State of fuel and energy resources and their rational use in the agro-industrial sector of the Republic of Uzbekistan

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Abstract. This article analyzes the status of the issue of rational use of fuel and energy resources of the Republic of Uzbekistan. Currently, the share of renewable energy sources in the fuel and energy balance of the country does not exceed one percent. At the same time, the potential of renewable energy sources of Uzbekistan is about 51 billion tons of oil equivalent, the technical potential of more - 179 00.0 million tons of oil equivalent.

1 Introduction

The shortage of hydrocarbon raw materials and the growth of prices for them have led to a trend of rapid growth in the use of alternative energy sources in developed and in many developing countries. In the developed strategies they set a goal of achieving the share of these sources to 18-20% by 2020. The main obstacle to the widespread use of alternative sources of energy is their lower economic efficiency compared to traditional sources. However, many experts rightly point to the trend of a rapidly decreasing cost gap between traditional and unconventional energy sources.

At the same time, Uzbekistan has a great potential for the use of alternative energy sources, which, according to experts, are three times higher than the resources of fossil fuels. At the same time, the government of Uzbekistan is extremely interested in its rapid implementation.

At this time, when Uzbekistan is an integral part of the international community and the global financial and economic market, in order to modernize the national economy, technical and technological re-equipment of industries and production of products that meet the requirements of world standards, one of the urgent tasks is to train personnel - specialists based on new requirements and methods, training them in modern knowledge.

With independence, the Republic of Uzbekistan has significantly changed the priorities in the directions and pace of development of the national economy.

Particularly noticeable positive changes occurred in the extraction and processing of mineral resources. Uzbekistan is the fourth largest producer of gold in the world, and oil and gas production has almost doubled. Significant changes have also occurred in industry.

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Uzbekistan has become a manufacturer of automobiles, which means that the machine-building industry of the Republic has acquired the most modern production technologies. At the same time, Uzbekistan has retained its leading position in the world in the production of cotton, but now it is no longer a monoculture, but one of the most important sources of foreign exchange earnings.

2 Methods

The agro-industrial complex has become a multi-sectoral sphere of providing the population with food and the processing industry with raw materials. Suffice it to say that for more than ten years the republic has been living in conditions of grain self-sufficiency [1].

With the use of new technologies (seeding of cotton under the film, sowing of grain crops in the cotton rows, etc.) the intensity of land use has increased significantly. At the same time, specific volumes of agricultural production and specific volumes of mechanized works per unit area of arable land have increased. Accordingly, the cost of fuel and lubricants (FCM) increased, the world prices for which are also sharply rising and, according to forecasts of experts, will rise in the future. The economic development of the country occurred at the expense of excessive growth of energy consumption, especially generated by thermal power plants, and all "multiplying" at a high rate internal combustion engines that use fossil fuels, which led to an increase in the negative impact of their emissions on the environment. Today the amount of fossil fuels burned worldwide each year is equivalent to 12 billion tons of oil, or 2 tons of oil equivalent for each person on the planet. Over the past 40 years, the amount of fossil fuels produced in the world has exceeded the amount of its production in the previous history of mankind, which has led to a sharp decline in its reserves. In recent years, a sharp increase in the price of hydrocarbons in many countries has forced people to think about new alternative energy sources, as a result, the total capacity of photovoltaic power plants installed in European countries, especially the production of these plants in the Middle East has doubled. The total area of solar collectors reached 15 million meters in the U.S.^{2}, in Japan 12 million meters^2. In Israel, there are about 1 million solar energy installations, providing 75% of the total volume of hot water supply of the country. The use of wind energy is developing rapidly, the annual growth of their use in European countries is 40-45%. Experience in the use of renewable energy installations shows that they generally pay for themselves, despite the high cost of their purchase and use in the initial period of operation. Today, a number of countries have adopted programs for the development of renewable energy sources. For example, in Germany it is planned to increase the share of renewable energy sources to 50% in the total energy balance of the country by 2050 [5, 7, 9].

During the operation of the machine and tractor fleet (MTP), the loss of TSM allowed by regulations exceeds 5%, which means that we accelerate the process of depletion from the subsurface of natural resources and do not care about the next generation.

The problem of providing energy resources is complicated by the mismatch between the structure of natural resources and the current trend of their use; it has grown from a regional problem to a global one, with many aspects covering virtually all areas of human activity, and therefore has no single solution.

The share of gasoline consumed by cars of individual owners is a significant part of its total amount produced in the country. The tendency of growth of car fleet of personal use testifies that this share already in the nearest future will increase in 2...3 times and will lead to additional tension in provision of national economy with fuel and energy resources.

Machine building is the leading branch of the whole industry, its "core". The products of mechanical engineering enterprises play a decisive role in the implementation of scientific and technological progress in all areas of the national economy. [1] The structure of the vehicle fleet of the Republic of Uzbekistan and industrialized countries differ significantly. The share of trucks and buses in the structure of our car fleet is several times greater compared to the structure in the United States. But the number of passenger cars in the structure of the US fleet is 5.2 times more than in our country. Therefore, improvement of fuel efficiency is primarily important for trucks, whose specific weight in the energy balance of the industry and the share of fuel consumed by them is significant [10].

Road transport is one of the most energy-intensive industries of the national economy. It accounts for 7.2% of the country's energy resources [5,12], or 24.6% of liquid fuel of oil origin, and in the near future the relative consumption of petroleum products in road transport will increase even more.

3 Results and Discussion

The most complete picture of fuel efficiency in road transport is given by specific fuel consumption per unit of transport work or transportation of one passenger. The average specific fuel consumption per unit of transport work for all types of freight transportation by cars with gasoline engines in public transport today is 85 g/ton km, and with diesel engines 44 g/ton km. Specific fuel consumption for passenger transport by buses with petrol engines reached 14.7 g/passenger-km, and by diesel engines - 10.8 g/passenger-km, for taxi services - 135 g/passenger-km. Reducing fuel consumption is a multidimensional task associated with further improvement of the design and production technology of our Republic. The figure below shows the dependence of fuel efficiency of vehicles on specific costs (Fig.1).

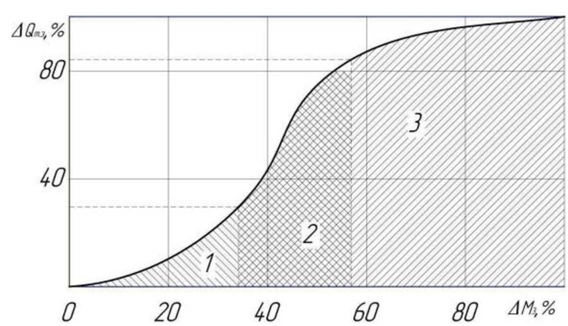

Fig. 1. Diagram of dependence of fuel efficiency of vehicles on specific costs ($\Delta Q \rightarrow_{T.E} \Delta Mz$):
1 - technological dependence; 2 - operational dependence; 3 - structural dependence.

Oil is a valuable, but non-renewable, fossil raw material for many industries, most importantly the fuel and energy industry. Oil and its derivatives are a commodity, i.e. the subject of international trade. This commodity has a unique property of influencing the economy of the world community. Any fluctuations in the price of "black gold" turn out to be an inflation of money supply, though real gold is a guarantor of economic stability.

Analysis of the dynamics of oil production over the last 50 years (Fig. 2) shows that the growth rate is characterized by three plots. The first plot covers the period 1940 ... 80, accompanied by a steady increase in its production. Oil production was especially intensive in the 60s when the annual growth rate reached 8.0...8.4 per cent. By 1980 the production growth rate dropped to 3.2 %, and then (at Block 2) there was a sharp decline in the volume of oil production which reached 2.59 billion tons by the end of 1983.

The third section, covering the last decade, is characterized by an exponential increase

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in oil production with an annual increase of 2.7% (Fig. 2).

In some Central Asian countries the cost of diesel is much higher than the cost of gasoline. In Kazakhstan it is higher, and in Tajikistan and Kyrgyzstan the cost of diesel and gasoline is almost the same.

Significant damage is caused not only by loss of fuel during storage, receiving, refueling, but also by overconsumption during transport operation. Most malfunctions, most often occur when machines are running, causing a drop in power, and this leads to overconsumption of fuel. If the spark plug alone is not working, fuel consumption increases by 15...20 %, if the air-cleaner is clogged, it increases by up to 6 %.

The least wear of parts and fuel consumption will be at coolant temperature of 85...90C^0. When the temperature decreases by 20C^0 as a result of deterioration of the combustion process, the gasoline consumption increases by 10 %, at low thermal mode (30...40C^0) the overconsumption reaches 40 %. In order to maintain the thermal mode it is necessary to monitor the engine cooling system, because the accumulation of scale increases the temperature of parts of the cylinder-piston group. At a scale thickness of 1 mm the fuel consumption increases by about 8 %.

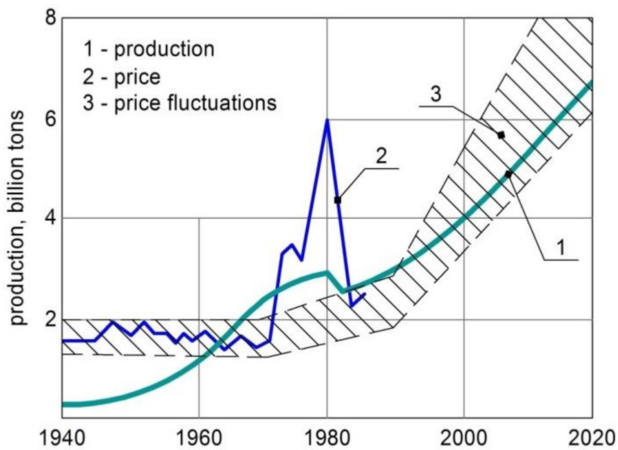

Fig. 2. World oil production and price

The economical operation is closely related to the level of gasoline in the float chamber, the tightness of the valves, and the correct setting of the ignition advance angle. The adjustment of the distributor mechanism is of great importance: too early or late opening of the valves causes a drop in power and an increase in consumption. In order to reduce it, it is necessary to carefully monitor the engine condition, using diagnostic tools and timely maintenance.

The gas economy is also influenced by the serviceability of the transmission and the chassis. The brakes should be adjusted in accordance with the factory instructions (good rolling of the vehicle). This also applies to the front wheels (convergence, tightening of bearings) and the tire pressure. Overdraft occurs also at badly adjusted clutch (doesn't switch on completely or slips). Fuel consumption can be reduced by about 10 % by adjusting the car units, which affect the ease of movement of the car

A significant source of fuel economy is possible fuller use of vehicle power, rational organization of road transport operation, which transports more than 80% of agricultural goods. Much depends on the experience of drivers. Under the same conditions, highly qualified drivers consume 20...30 % less fuel. It is necessary to move the car smoothly, with a low fuel supply, without lingering in intermediate gears. Do not use the air damper when the engine is warmed up. It is necessary to correctly use the rolling of the car under the condition of traffic safety.

The vehicle must work with the highest load without idling. Progressive use of trailers and road trains: gasoline consumption per 1 t-km is reduced by 25....30 %. The efficiency of use of machines in bulk transportation of cargo (flour, grain, fertilizers, pesticides, etc.) by specialized vehicles increases significantly. Of great importance are the selections of machines, their preparation for transportation of certain materials, drawing up a traffic scheme, ensuring coordinated work with harvesters, timely maintenance, and widespread experience of advanced drivers [4, 11, 15].

Losses of gasoline, as well as other petroleum products, can be divided into three groups: quantitative, qualitative and mixed. Gasoline is a easily movable liquid that leaks through even the smallest microcracks and pores in welds, pipeline joints with tanks, fuel tanks, couplings, etc. Drip leaks in cocks, glands, flanges lead to loss of tons of fuel per year. In order to eliminate losses it is necessary to timely maintain and repair the tank farm, use new materials, properly organize refueling (only by mechanized means) and drain and pour operations.

Gasoline quality deterioration - quality losses - can cause significant damage. Gasoline is often transported in the same automobile tanks in which diesel fuel is transported. In the tank there always remain 30 ... 40 kg, which are mixed with the new product during the next filling. Thus, diesel fuel gets into the gasoline, the amount of resins increases, the boiling point rises (the intensity of engine wear and fuel consumption increases). Fuel mixing can be eliminated by extensive use of centralized delivery of petroleum products, as vehicles here are used to transport products of the same name.

Qualitative losses include deterioration of fuel properties during oxidation as a result of its contact with air during transportation, storage and loading and unloading operations. Resinous substances, organic acids are formed, gasoline acquires yellow color, and in case of deep oxidation even light brown color. Using such a product will lead to increased tarring of parts, carbon monoxide formation, and increased corrosive wear. The rate of oxidation is mainly influenced by temperature, so the coloring in light colors, deepening of tanks contributes to the preservation of fuel quality. Under the same conditions, the oxidation is quicker, if the gasoline is stored in the insufficiently filled tanks, especially when there are scales, water, sediments at the bottom. Therefore, fuel should be stored in filled tanks, cleaned at least once every two years, and the sediment should be pumped out seasonally.

Significant deterioration of gasoline quality occurs when it is watered down and contaminated with mechanical impurities (pouring into dirty containers, dilapidated hoses, poorly closed tanks, pouring in an open jet). Using contaminated gasoline clogs fuel filters, carburetor jets, increases the amount of deposits in the intake system and the combustion chamber. Contamination can only be prevented by proper storage and refueling.

Especially typical for gasoline are mixed losses during evaporation, when along with the loss of light fractions the operational properties change (the octane number decreases, the fractional composition deteriorates, etc.). Evaporation of gasoline occurs during all operations (filling, storage, refueling), the value of losses depends on the organization of work, technical equipment and the state of equipment. [4]

Evaporation losses from small and large "breathing" tanks are significant. There is a mixture of air and gasoline vapor in the tank above the liquid. During the day the tank is heated, the mixture expands and escapes to the atmosphere through the breathing valves (small breathing). When it cools down (at night) air enters the tank and is saturated with vapors again. When the temperature changes from 15 to $40C^0$, about 2 kg of gasoline escapes into the air from the tank with a capacity of 25 $m.^3$

When the fuel is released, its amount in the tank decreases and the vapor volume increases. If the gasoline is completely drained, the tank will be filled only with vapor-air mixture. When a new batch of gasoline is poured, this mixture is displaced into the atmosphere (big breathing). When the filler is closed, 20 m of ^{3}fuel is immediately lost 15...20 kg.

To reduce losses from small and large breathing it is necessary to strive to fill the tanks as much as possible (96...97 % of full capacity), to reduce temperature fluctuations (irrigation, landscaping), to use gas piping (vapors go out not into the atmosphere, but into special containers), to maintain breathing valves in good condition. The most effective way to reduce evaporation is to store gasoline in underground tanks, when daily temperature fluctuations are absent or sharply reduced [2].

Table 1. Norms of natural losses of motor gasoline of the Republic of Uzbekistan

Operation	Northern Regions		Southern regions	
	Autumn Winter	Springtime Summer	Autumn Winter	Springtime Summer
Acceptance, accepted quantity, in tanks, kg/t:	0.32	0.53	0.35	0.59
above-ground, up to 400 m^3 capacity, same with pontoon	0.20	0.42	0.22	0.43
Storage, kg per 1 ton of stored product, in tanks: ground, with a capacity of up to 400 m^3				
upto 1 month.	0.50	1.49	0.51	1.69
more than 1 month.	0.29	0.86	0.30	0.90
Same with pontoon				
Up to 1 month	0.08	0.37	0.09	0.40
more than 1 month.	0.05	0.20	0.05	0.20
Release, kg per 1 ton of released quantity in tanks:				
railway	0.13	0.21	0.14	0.22
automotive	0.10	0.20	0.11	0.20
Natural loss, kg per 1 ton of accepted quantity at refueling stations and refueling points with tanks:				
byground	0.74	1.25	1.80	1.16
buried	0.49	0.68	0.56	0.70

The current norms of automobile gasoline losses at various operations are given in Table 1. Actual losses are often much higher (faulty tanks, non-working breathing valves). An effective way to reduce them is timely maintenance of the tank farm, using only mechanized refueling of machines [13,16].

If the actual tar content meets the requirements of the standard, the engines operate for a long time without increased tar and carbon buildup. Often, however, during the operation of equipment, the content of tar in the fuel is much higher. The Fig. 1 . shows the influence of the actual tar content on the intensity of sediment accumulation in the inlet piping. The pattern for the intake valve is similar. If the content of actual resins is 2...3 times higher than the norm, the carburetor engine service life is reduced by 20...25 %. Besides that, various malfunctions occur during operation: valves hang up, rings get caked.

The tar formation processes also depend on the technical condition and operating conditions of the engines. All impurities that enter the engine with the combustion air are in the oil and fuel, and in addition, wear products of parts can participate in the formation of deposits. The amount and purity of combustion air for gasoline combustion significantly affects the intensity of fouling. The formation of tar and carbon deposits also involves fine carbon products (soot) released during incomplete combustion, which are deposited on hot engine parts. The high-temperature deposits that accumulate on the valves and in the combustion chamber also contain lead oxides, which are part of the antiknockers.

According to the standard, the presence of mechanical impurities in gasoline is not allowed. However, during transportation, storage, receiving and dispensing operations, fuel is usually contaminated by dust from the ambient air. A certain amount of impurities is almost always contained even in a clean-looking fuel. Together with tar and carbonaceous substances, the impurities increase the intensity of high-temperature deposit accumulation. In addition, abrasive particles penetrating the engine increase the rate of wear [16,17,18].

If the fuel contains abrasive mechanical impurities, the gasoline consumption increases sharply, and the service life of the fuel-supplying equipment, depending on the contamination, is reduced by 2...3 times. Mechanical impurities penetrate into the gaps between the piston rings and the cylinder liner, causing their increased wear. Increase of wear intensity leads to loss of power, deterioration of economy and premature engine failure.

It should be noted that in the context of the globalization of the world economy, reducing the growth of non-renewable energy resources, the steady depletion of oil reserves and rising oil prices is one of the most important factors of inflationary phenomena, reducing living standards, increased competition in the world markets of liquid hydrocarbons and solid fuels to ensure sustainable economic development is becoming increasingly important search and wide involvement of new alternative energy sources.

4 Conclusions

Analysis of the status of the issue of rational use of fuel and energy resources allows us to make some generalizations and conclusions.

- The problem of mobile energy, despite the greater number of solution options, is more complex, as it entails a radical change in the almost billion-dollar fleet of energy resources. Consequently, the world economy will strive in every way to delay the inevitable process of energy conversion, and this means aggravation of the problem of rational use of fuel and energy resources.
- The problem of rational use of fuel and energy resources is multifaceted and includes aspects of production and technical operation of MTP, issues of transportation of TSM, their storage and refueling. At each stage of the life cycle of machines there are reserves of saving or reduction of losses of fuel and energy resources.
- The increase in the specific weight of foreign equipment leads to an expansion of the required range of FCM and an increase in different brands of ICC vehicles, and this, in turn, makes a significant adjustment in planning the volume and number of capacities of oil storage facilities.

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