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RATIONALE FOR THE USE OF SYNTHETIC LIQUID FUELS AIRENTERPISE

The article outlines the need for alternative fuels for air transport companies. The features of the use of traditional jet fuel and found economic benefits of using synthetic liquid fuel from brown coal that are associated with the ability to reduce energy costs.

Keywords: fuel, jet fuel, synthetic liquid fuels, coal, air transport enterprise.

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PROBLEM. One of the major problems of development of air transport companies serving the lack of energy resources and high energy. According to statistics of the International Civil Aviation Organization (ICAO - The International Civil Aviation Organization) airline fuel costs,in the last decade,varied from 12 to 25% of total operating costs. It should be noted significant fluctuations in fuel prices through their market instability. The cost of fuel and oil in the last decade ranged from 10 to 15% of total operating costs of regular airlines.

According to a survey of 197 executives from 101 airlines in the world, which was carried out by the company Sabre Airline Solutions, Factors affecting the sector and identifies current problems of the industry. Airlines are three regions with the most intense air traffic. The first region included North America (62 per., 32% of respondents), the second region were united Europe, Middle East and Africa (72 per., 36%), the third - Asia and Latin America (63 people. 32%). The study showed that the cost of fuel worries almost all respondents (94%). Among the factors that most hinder growth of profitability of airlines in the first place, according to polls, were fuel costs (91%).

The above makes it necessary to search and use of alternative energy sources.

Analysis of recent research and publications. The issue of energy supply of business entities devoted their labor S.V. Boychenko R.V. Sherstiuk G.G. Burlaka and others. These authors define technical schemes and conditions of use of alternative fuels.

Unsolved part of the PROBLEM. However,there is unresolved the task of description of economic feasibility of using synthetic liquid fuel in aviation industry.

The purpose of the article and the main MATERIAL. The purpose of this paper stands proof of economic feasibility of production of synthetic liquid fuel from brown coal for the needs of aviation companies.

Modern aircraft are mainly equipped with air-jet engines (PRD). These engines fuel to the combustion chamber is fed continuously and, therefore, the combustion process takes place continuously. Only start the engine using a third-party plug. Also, continuously fed to the combustion chamber and air PRD (necessary for combustion), pre-heated and compressed in the compressor. The gaseous products of combustion from entering the combustion chamber to the turbine, where some heat is converted into mechanical work rotation of the turbine wheel, the shaft of which is driven compressor rotor, and fuel and oil pumps. After the turbine combustion *products in the form of a gas stream passing jet nozzle and expanding it, creating reactive traction, with which also carried flight.*

In PRD fuel tanks of the aircraft at low pressure (0,02-0,03Mpa) is pumped that swaps , through fine filter to the main fuel pump regulator high pressure (0.8-1.0 MPa)

The latter fuel passing through the nozzle sprayed into the combustion chamber and heated to much turbulence flow, providing increased surface evaporation of fuel and its vapors uniform distribution throughout the volume of the combustion chamber of the engine. In turbojet engines fuel passing through the fuel and oil cooler reduces the temperature of the lubricating oil, means acts as a cooling environment. In addition, the fuel is also used for lubrication (grease) friction parts of fuel pumps. Also, changing the fuel supply apparatus using fuel regulating equipment regulates the speed of the aircraft.

Basic properties of jet fuels:

- Good volatility to ensure the completeness of combustion;

- Completeness and high calorific value, which will provide a range of flight;

- Good pump ability and low temperature properties to ensure fuel supply to the combustion chamber;

- Low tendency to form deposits characterized by high chemical and thermal stability;

- Good compatibility with materials of low anticorrosive properties with respect to metals and no effect on rubber technical products;

- Good anti-wear properties, which cause little wear of fuel system;

- Anti-static properties that prevent the accumulation of static electricity, which provides fire safety during refueling.

The main electrification is in fine filter. Electrification fuel filtering can grow 200 times. Therefore, with increasing requirements for fuel purity, ie with increasing subtlety filtration danger of ignition of the fuel air mixture from discharges of static electricity will increase significantly.

There are various technical means of protection against static electricity, static eliminators, air cushions nitriding of fuel antielectron filters. However, they only solve the problem locally.

The only way that ensures and guarantees the safety of pumping fuel and refueling aircraft and tankers, is the use of antistatic additives.

Jet fuel produced for subsonic aircraft aviation GOST 10227-86 and for supersonic aircraft GOST 12308-09. According to GOST 10227-86 provides five brands of fuel production: TS-1, T-1, T-1C, T-2 and RT. GOST 12308-89 produce two brands Fuel: T-6, T-8B. Bulk fuels at present is almost two grades of fuel: TS-1 (higher and first grades), RT (the highest category of quality). The main raw material for the production of massive jet fuels - oil fraction that boils within the temperature 140-2800S. Fuel TS-1. Depending on the quality of oil processed (mercaptans content and total sulfur distillates) fuel obtained by distillation or straight or mixed with hydro treated component.

Content demerkaptanation component in the mixture does not exceed 70% to avoid a significant reduction in anti-wear properties. Hydro treating used when kerosene oil distillates of total and mercaptan sulfur does not meet the standard, demerkaptanation - whenever mercaptan sulfur content does not meet the standard. Since processes demerkaptanisation practical application in our country and abroad have found the process "Meroks" and its modifications. During "Meroks" *total number of sulfur decreases with mercaptans that fit in distillates, oxidized disulfide in the presence of oxygen in a special catalyst. The process takes place in an alkaline environment.*

Fuel T-1.Product direct distillation of low-sulfur oil naphthenic base to beyond boiling 130-2800S. Contains a large number of naphthenic acids and has a high density because it subjected alkalized followed by washing with water (to remove sodium soaps of naphthenic acids resulting process alkalized).

The presence of a significant number of alkalized compounds, mainly oxygen, leads, on the one hand, relatively good anti-wear properties and chemical stability affordable enough fuel, on the other - a low thermal-oxidative stability.

Significant experience with T-1 fuel in aircraft showed that due to its low thermooxidative stability there are higher tar deposits in the engine NK-8 mounted on the main types of civil aviation (U-154, IL-62, IL-76) in resulting in dramatically (almost 2 times) reduced service life of the engine. Production of Fuel T-1 is very limited, it is produced only by the quality of the first category.

Fuel T-2 (first class quality) - the product of direct distillation wide cut that boils at a temperature between 60 and 2800S; accommodates up to 40% of gasoline fraction, which makes it a high pressure vapor and low viscosity and density. High pressure vapor fuel T-2 insecure formation of vapor lock in the fuel system of the aircraft, which limits the height of its flight. Low viscosity causes decrease durability of fuel, which limits the lifetime of the fuel assemblies, and low density limits the range flights. Fuel T-2 is redundant with respect to fuel TS-1 and RT.

Fuel PT are usually rectangular distillate hydro treating outside of boiling 135-2800S. The raw materials used for hydro treating of distillates, which can not get fuel TS-1 because of an increased excess of the total content and mercaptan sulfur.

In the hydrotreating of petroleum distillate removed aggressive and unstable compounds that contain sulfur, nitrogen and oxygen, it increases the thermal stability, as previously indicated, and reduces the corrosivity of fuel. To improve low as a result of hydrogenation processes of chemical stability and wear resistance properties of the fuel injected antioxidant additives that increase durability. During the processing of low-sulfur Western Siberian oil fuel RT can be obtained by direct distillation of the introduction of antioxidant additives and additives to prevent wear to store high-level performance indicators. RT fuel is fully compliant with the requirements for jet fuels highest quality category, and is internationally, surpassing its performance on individual properties.

It has high level of wear resistance, chemical and thermal oxidative stability, not aggressively against structural materials, hardly contains mercaptans and contains less than 0.02% of sulfur can be stored up to 10 years without changing the quality and fully guarantee the life of the engine.

Fuel T-6 obtained using hydrogenation processes slab.

Fuel T-8B are distillates from direct distillation of crude oil using hydrotreating process. During the processing of low-sulfur fuel oils can be obtained by direct distillation of petroleum. In fuel T-6 and T-8B to improve chemical stability and durability performance improvement introduced additives: antioxidant Ahidol 1% 0,003-0,004 (mas.point) and to improve durability "K" - 0,002-0,004% (mas. point)

Synthetic liquid fuels, flammable liquid derived synthetically and those used in internal combustion engines. Synthetic liquid fuel synthesized from a mixture of CO and H_2 produced from natural gas and coal, the process is carried out at elevated temperatures and in the presence of catalysts - Ni, Co, Fe (method of Fischer - Tropsch). Depending on the process conditions, the resulting synthetic liquid fuels containing different amounts of paraffin and olefin hydrocarbons, mostly normal structure.

First synthetic liquid fuel in a huge quantity produced in Germany during the Second World War 1939-1945 GG, which was associated with a lack of oil. The synthesis was carried out at 170-2000S, pressure 0.1-1 MN / m2 (1.10 Am) with a catalyst based on CO; received as a result of gasoline (korazyn 1 or syntyn) with 40-55 octane, high-quality diesel fuel (kohazyn II) with cetane number 80-100 and paraffin wax. 0.8 by adding tetraethyl lead to 1 liter of petrol increased its octane number from 55 to 74. Synthesis using catalysts based on Fe held at 2200S and higher pressure 1-3 MN / m2 (10-30 Am). Petrol, which was obtained under these conditions, could accommodate 60-70% olefin hydrocarbons normal and branched structure; its octane number 75-78. Later production of synthetic liquid fuels from CO and H_2 are not widely because of its high cost and low efficiency of the used catalysts.

Solving the problem of providing efficient internal combustion engines kinds of alternative fuels made from crude oil, have greater relevance to Ukraine.

In order to create the modern technology of synthetic liquid fuels from lignite team of scientists made a series of fundamental research content and structure of brown coal and patterns of change, depending on age. As a result of studies have established physical and chemical conditions of creation and decay of various bonds, which are connected by aromatic, hydro aromatic, heterocyclic and aliphatic fragments that are part of high natural polymers coal. It was found that for younger lignite characteristic is a high content of heteroatoms and macromolecules in the structure of the coal interconnected, preferably by means of electron donor-acceptor mechanisms.

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Ongoing study has found a new phenomenon - under certain conditions of interaction with the reactionary lignite environment with solid physical state enters the liquid physical state at room temperature and atmospheric pressure, and set the boundary conditions of phase transitions.

This discovery allowed based on it to create a modern technology of synthetic liquid fuels from lignite. This technology includes the following stages: liquefaction, purification of plasma-chemical and catalytic cracking.

In the first stage liquefaction process is carried lignite. In Grindability-mixing apparatus, which is a continuous mixer is loaded lignite and modifying additives. During fault mixing and homogenization of high-molecular structure changes, the composition of the fragments, broken electron donor-acceptor bonds, leading to depolymerization of brown coal and its conversion into liquid hydrocarbon mixture.

Physico-chemical properties of the liquid hydrocarbon mixture is close to the oil.

Further processing of liquid brown coal is carried out under conditions similar refining processes.

Mineral content in brown coal exceeds their content in crude oil. During the processing of brown coal into synthetic liquid fuel necessary to use advanced fractionation and separation processes of hydrocarbon and mineral components.

In a second step is performed cleaning liquid brown coal from solids, suspended particles, salts, sulfur and other components that are subject to removal. Cleaning is carried out original, which is unique, way - thermo-gravitational cleaning.

Installation of thermo-gravitational cleaning liquid brown coal has rotating parts and wear and filters, a low energy costs and operating costs.

The third stage is carried out deep processing of brown coal in a liquid synthetic liquid fuel.

A team of scientists working in the field of physics phenomena bit, created a brand new technology of plasma chemical processing liquid brown coal. The basis of the new technology incorporated the results of basic research properties of dense plasma, allowing for maximum concentration electro-physical influence the processing facility. With the new technology, *hydrocarbons, as opposed to traditional multi-step process is processed in a single step. The output of low-get gasoline, high-octane gasoline, diesel and fuel oil for power plants. Hydrocarbon processing carried out in plasma-chemical reactor which is a vertical steel column-type apparatus.*

In reactor is fixed catalyst bed height required. Purified and produced hydrocarbons at room temperature evenly fed to the column below. In the column top is filed powerful stream of microwave radiation. In the bulk catalyst generated microwave dense plasma, catalyst and reactant are heated to operating temperature in the catalyst layer is made catalytic cracking of hydrocarbons and other reactionary transformation.

In the upper zone of the column comes catalyst in gaseous form, which is derived from the column and fed to further stages of cooking fuel.

For plasma chemical processing technologies hydrocarbons, a special multifunctional catalyst that allows one stage in one pass hydrocarbon hold up to 4 responses simultaneously. In carrying out the process does not require the use of hydrogen.

Currently developing more efficient technologies for such processes, which can be called "burning" coal. The most relevant for primary production of liquid fuels from coal are as follows:

1. liquid fuels from coal directly:

a) pyrolysis (carbonization)

b) Liquefaction solvents (extraction)

c) Hydrogenation (interaction with hydrogen)

2. Prior gasification and subsequent obtaining fuels from synthesis gas:

a) Fischer-Tropsch synthesis (receiving liquid hydrocarbons)

b) Synthesis of alcohols (methanol).

The contents of total sulfur in hydrocarbons is not limited, and the content in products is less than 0.01%.

The optimum parameters of electro-physical activation of the catalyst-reactant for a significant increase in the efficiency of conversion of hydrocarbons.

Temperature catalytic transformations reduced on average 2 times. Catalytic cracking of hydrocarbons processes are carried out in the temperature range from room to 3000S and atmospheric pressure. The rate of reaction processes increases on average 200 times.

An important advantage of plasma chemical processing technology is a significant hydrocarbon simplify and reduce the cost of treatment processes while increasing yield of gasoline, diesel fuel, jet fuel and other targeted products and increase their quality.

The new technology eliminates the costs of a number of complex processes. In this way, capital and operating costs compared with conventional technology, reduced by an average of 10 times.

Plasma-chemical processing technology reduces power consumption of hydrocarbon production processes. The cost of synthetic liquid fuels derived from brown coal to be lower than the cost of liquid fuels derived from crude oil.

The main advantage of plasma chemical processing technologies hydrocarbons, of course, it is provided possibility of alternative motor fuels from oil solid organic materials - brown coal in economically viable conditions.

Fuel for aircraft engines (kerosene) derived from brown coal, the physical and chemical properties similar fuel, derived from crude oil. Burning these fuels in internal combustion engines requires no engine modifications.

Plasma-chemical raw materials processing technology on set parameters world has no analogues.

The main processes of new technology researched and tested in pilot plants.
According to experts working in Odessa branch of Academy of Engineering, deposits of brown coal in Ukraine, power coal producing mines, pits and enterprises for primary processing of lignite allow for this raw material and production base to organize the production of synthetic liquid fuels in the amount of 5.0 million. Tons year.

The presence in the energy balance of the country is so significant amounts of fuel made from its own energy resources, will reduce oil imports and stabilize the energy sector of Ukraine.

A powerful resource base allows gradually increase production of lignite and production of synthetic liquid fuels.

To meet the needs of Ukraine for energy, from the perspective of their continued growth, Ukraine will annually produce 50 million. Tons of liquid fuel.

Achieving this level of production of liquid fuels from its own sources of energy resources through the application of plasma chemical technology production of synthetic liquid fuel from brown coal is a real challenge. Even in this case reserves of brown coal in Ukraine will not be exhausted in 150 years.

Conclusions. *Thus, the production of synthetic liquid fuel from brown coal - is not only a condition, the path to energy independence of Ukraine, but also to the functioning of the aviation industry.*

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