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**ЭКОНОМИКА, ЭКОЛОГИЯ ЖӘНЕ ӨМІРТІРШІЛІК ҚАУІПСІЗДІГІ**  
**ЭКОНОМИКА, ЭКОЛОГИЯ И БЕЗОПАСНОСТЬ ЖИЗНЕДЕЯТЕЛЬНОСТИ**  
**ECONOMICS, ECOLOGY AND LIFE SAFETY**

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The Bulletin of Kazakh Academy of Transport and Communications named after M. Tynyshpayev, ISSN 1609-1817, DOI 10.52167/1609-1817, Vol. 119, No.4 (2021) pp.121-126

UDC 542.941.7:547.36:547.3

DOI 10.52167/1609-1817-2021-119-4-121-126

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**ALTERNATIVE ENERGY SOURCES IN THE AVIATION INDUSTRY**

**Annotation.** Consider the solution of environmental problems that arise in nature. Briefly describe the main alternative energy sources. Said alternative energy sources in the aviation industry. In this connection, we considered environmentally friendly, cost-effective energy sources for jet engines.

**Airbus Launches World's First Air Emissions Study Using 100% Eco-Friendly Aviation Fuel**

The German Aerospace Research Center (DLR), Rolls-Royce and the green aviation fuel manufacturer Neste have launched a joint project on Emissions and Climate Impact of Alternative Fuels (ECLIF3). It will investigate the impact of 100% green aviation fuel on air emissions and aircraft performance when using this fuel.

The research findings, to be carried out on the ground and in the air aboard an Airbus A350-900 powered by Rolls-Royce Trent XWB engines, will contribute to the aviation industry's transition to the full implementation of sustainable aviation fuels as part of the Airbus and Roll-Royce global industry decarbonisation initiative. ...

Engine tests using 100% sustainable aviation fuel and testing for compatibility with aircraft systems have begun at the Airbus plant in Toulouse, France and will undergo groundbreaking in-flight emissions studies, and the program will continue in the fall with the DLR Falcon 20-E escort aircraft for evaluation emissions when using ecofuel. Ground tests will assess the impact of the new fuel on the operation of airports.

The air and ground tests will compare emissions when using 100% environmentally friendly aviation fuel, produced using hydroprocessed esters and fatty acids (HEFA) technology, and when using fuels from hydrocarbon feedstocks - kerosene and low-sulfur kerosene.

DLR has already carried out extensive analytical research and simulations, as well as ground and flight tests using alternative fuels on a special aircraft Airbus A320 (Advanced Technology Research Aircraft, ATRA) in 2015 and 2018 in collaboration with NASA.

**Keywords:** aviation, battery, energy, aviation fuel, engine.

**Introduction**

The most widely used sources of natural energy from oil in the world are cars, most of which belong to cars. When using hydrocarbons, which are crude oil, cars emit many harmful substances into the atmosphere. As a result, cars pollute 39-63% of the environment, ie all air, land and water.

To solve the current energy and environmental problems of cars is to improve the design of existing internal combustion engines and the construction of more advanced power plants using new types of hydrocarbon fuels. First, a comprehensive adjustment to increase focus

efficiency and maximize combustion efficiency in all operating modes is to reduce vehicle toxicity as the engine of the workflow. In the first case, in order to ensure the most complete combustion of fuel in all operating modes, it is necessary to increase the efficiency of the engine and reduce emissions.

New vehicle engines developed to date include internal and external combustion heat engines of non-traditional operating processes and electric power units. The first mainly includes piston, gas turbine, steam and rotor engines [1].

Electric power plants using rechargeable batteries and fuel cells are of great interest. Recently, many types of prototypes of electric vehicles have been developed. Electric vehicles use fuel cells to convert non-intermediate fuels into electricity. In recent years, its level of service has increased due to the increase in the actual capacity of hydrogen-oxygen fuels during daily use. However, the biggest problem in the use of such fuels is the storage of hydrogen in cars [2].

Alternative drives and energy sources that do not harm the environment are considered to be the bright future. The optimal solution to energy problems is fuel cells, ie electricity from hydrogen and oxygen used to drive the engine. Along with electricity, heat and water vapor are formed as a result of electrochemical processes.

Now we hear about the energy crisis everywhere. There are concerns in this regard. This, of course, will happen, and then we all need to understand. We brought it ourselves. Although we have a lot of rich natural resources, they will run out one day, and then we need to figure out what to do.

According to statistics, oil and gas in Kazakhstan will last for 70-80 years, and in Saudi Arabia - for 50 years. What do we do next?

The only answer is to look for new energy sources or alternatives. Basically, work is being done in this direction. For example, 70-80% of cars in Brazil will be powered by ethanol, in Iceland by 2050 renewable energy sources, and in Germany and Spain the use of wind energy is growing every year. The United States uses nuclear energy, while the United Kingdom uses wind energy as well as ocean wave energy. And what about Kazakhstan, what energy can it be proud of? Such information is almost non-existent. EXPO-2017 is coming soon, then we can get some information. But as the world moves to new sources of energy, we must not lag behind. Much work needs to be done in this direction to join the top 20 developed countries. We need to use the technologies we already have.

On March 19, 2021, a team of leading aerospace companies launched the world's first air emissions study using 100% sustainable aviation fuel. The tests will take place on board an Airbus wide-body passenger aircraft.

At this time it is necessary to use natural resources that do not pollute the environment. There are many such energy sources. One of them is solar energy, which is equal to 1 hour of energy given to the Earth's surface in summer during 1 year on Earth. If we get 1 day's worth of solar energy, we would not be able to fully use fuels such as oil and gas, coal, which are land resources. However, despite the fact that so much energy is available, it is not used due to the lack of processing technologies.

We must not forget about wind energy. This energy has long been one of the least developed technologies, as it is considered inefficient to use only in areas with special nature. But U.S. scientists say that if only 3 out of 50 states used wind energy in full, the energy from it would reach all states in full.

Through such energy sources, we get rid of oil, gas and coal from nature and reduce environmental pollution. We call this the energy of the future, but we forget that the future begins with us.

In general, today we consider cars, trains and planes as vehicles. There are already electric cars with special batteries designed to travel up to 320 km at a speed of 160 km / h. But oil, gas and coal production

The Trent 1000 is the fifth engine of the Trent family of engines, the first of which was put into operation in 1995. By that time, when the Trent 1000 will be put into commercial operation, all the engines of the Trent family will be in order for 35 million flight hours.



Figure 1 - Trent 1000 engine

The volume of hydrocarbons on Earth is declining, and as a result, prices are rising. Therefore, it is difficult to determine the annual budgets of airlines.

Another disadvantage of turbojet engines is environmental pollution. Environmental protection began only in the last 30-35 years, and when turbojet engines were invented, they did not consider the impact on the environment. Fuel residues or impurities began to spread into the environment, including toxic gases, unburned hydrocarbons, nitrogen oxides, sulfur oxides, and carbon monoxide, which have a direct effect on global warming [3].

These planes provide only 2% of the total carbon monoxide, but this can be exacerbated if not treated properly. This percentage releases 650 million tons of carbon monoxide into the environment, and they quickly pollute not only the Earth's surface, but also between the troposphere and stratosphere, which is a very sensitive part of nature protection [4].

Due to these problems, special measures are taken on the aircraft of many countries. Special high-powered equipment for planes and helicopters is being improved. Airports, landing sites and air traffic control systems are also being improved.



Figure 2 - Airbus Launches World's First Air Emissions Study Using 100% Eco-Friendly Aviation Fuel

The use of sustainable fuels is an important part of Airbus commitment to decarbonize the aviation industry.

Today, planes can fly a 50% mixture of environmentally friendly aviation fuel and kerosene. Through this project, we will not only understand how gas turbine engines run entirely on sustainable aviation fuel and prepare for certification of the respective engines, but also find out how much emissions will be reduced and determine the environmental benefits of using eco-fuels on commercial aircraft.

Using 100% ecofuel takes our research on various fuels and their environmental impact to a whole new level. In previous studies, we have seen that using blends containing between 30 and 50% alternative fuels reduces soot formation. We hope that the new project will unlock even greater potential for reducing emissions.

After the COVI-19 pandemic, people will want to travel again, but they will start to think more about the impact of their movements on the environment. Gas turbine engines will continue to be used for long-distance travel for decades to come. Sustainable aviation fuel will become an integral part of the decarbonization of the industry, and we are actively working to make it available to the aviation industry. This research is critical to understanding the nature of 100% green jet fuel and its implementation to reduce emissions.

The advantages of environmentally friendly aviation fuel over hydrocarbon fuels. The data obtained will make it possible to use environmentally friendly fuel in higher concentrations than 50% of the mixture.

Independent analysis has shown that using 100% Neste MY Sustainable Aviation Fuel, greenhouse gas emissions can be reduced by 80% throughout the life cycle compared to fuels from hydrocarbons. Through this study, we will identify additional benefits from sustainable jet fuel.

### **Conclusion**

We see that the introduction of new fuels in the world has long existed, and some countries are working on the world market by introducing their own technologies. Currently, new biofuels are used. It is clear that oil, coal and gas resources are ready to run out and will not be replaced. Therefore, we need to switch to other energy sources from now on. If we lag behind in this area, we will get these technologies from other countries, and we will run out of resources for the general budget.

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## **ҰШУ САЛАСЫНДАҒЫ АЛТЕРНАТИВТІ ЭНЕРГИЯ КӨЗДЕРІ**

**Аңдатпа:** Мақалада табиғатта кездесетін экологиялық проблемаларды шешу мәселесі қарастырылған. Жалпы баламалы энергетика көздері туралы қысқаша түсініктеме берілген. Авиацияда кездесетін баламалы энергия көздері көрсетілген. Осыған байланысты ұшақ қозғалтқыштарына экологиялық таза, экономикалық тиімді энергия көздері қарастылыған.

Германияның аэроғарыштық зерттеулер орталығы (DLR), Rolls-Royce және Neste, экологиялық таза отын өндірушісі, балама отындардың шығарындылары мен климатқа әсері туралы бірлескен жобаны бастады (ECLIF3). Ол 100% жасыл авиациялық отынның

бұл отынды пайдалану кезіндегі ауа шығарындылары мен ұшақтардың жұмысына әсерін зерттейді.

Rolls-Royce Trent XWB қозғалтқыштарымен жұмыс істейтін Airbus A350-900 бортында және жер үстінде жүргізілетін зерттеулердің нәтижелері авиация саласына Airbus жобасы аясында экологиялық таза отын түрлерін толық қолдануға көшуге көмектеседі. және Roll-Royce-тың ғаламдық өнеркәсіпті декарбонизациялау бастамасы қарастырылады.

Францияның Тулуза қаласындағы Airbus зауыты 100% таза авиациялық отынмен қозғалтқыштарды сынауды бастады және ұшу кезінде шығарындыларды жаңарту бойынша зерттеулер жүргізетін ұшақтар жүйесімен үйлесімділігін тексеруді бастады және бағдарламаны DLR Falcon 20-E-мен жалғастырады. Экологиялық отынды пайдалану кезінде шығарындыларды бағалау үшін ұшақпен бірге жүру. Жердегі сынақтар жаңа отынның әуежай жұмысына әсерін бағалайды.

Әуе мен жердегі сынақтар гидротазаланған майлы эфир мен май қышқылының (HEFA) технологиясы арқылы шығарылатын 100% таза авиациялық отын шығарындыларын күкіртсіз керосин мен керосинді көмірсутекті отынмен салыстырады.

DLR NASA -мен бірлесіп 2015 және 2018 жылдары арнайы Airbus A320 (Advanced Technology Research Aircraft, ATRA) арнайы ұшақтарында баламалы отынды қолдану арқылы ауқымды аналитикалық зерттеулер мен модельдеуді, сондай -ақ жердегі және ұшу сынақтарын жүргізді.

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**Түйінді сөздер:** авиация, аккумулятор, энергетика, авиажанармай, қозғалтқыш.

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## **АЛЬТЕРНАТИВНЫЕ ИСТОЧНИКИ ЭНЕРГИИ В АВИАЦИОННОЙ ОТРАСЛИ**

**Аннотация.** Рассмотрены решения экологических проблем, возникающих в природе. Кратко описано основные альтернативные источники энергии. Указаны альтернативные источники энергии в авиационной промышленности. В связи с этим, рассмотрены экологически чистые, экономически эффективные источники энергии для реактивных двигателей.

Airbus запускает первое в мире исследование выбросов в атмосферу с использованием 100% экологически чистого авиационного топлива

Немецкий центр аэрокосмических исследований (DLR), Rolls-Royce и производитель экологически чистого авиационного топлива Neste начали совместный проект по выбросам и влиянию альтернативных видов топлива на климат (ECLIF3). Он будет исследовать влияние 100% экологичного авиационного топлива на выбросы в атмосферу и летно-технические характеристики самолетов при использовании этого топлива.

Результаты исследований, которые будут проводиться на земле и в воздухе на борту самолета Airbus A350-900 с двигателями Rolls-Royce Trent XWB, будут способствовать переходу авиационной отрасли к полному внедрению экологически безопасного авиационного топлива в рамках проекта Airbus. и глобальной инициативы Roll-Royce по декарбонизации отрасли. ...

На заводе Airbus в Тулузе, Франция, начались испытания двигателей с использованием 100% экологически чистого авиационного топлива и испытания на совместимость с авиационными системами, в ходе которых будут проведены новаторские исследования выбросов в полете, а осенью программа будет продолжена с DLR Falcon 20-E. сопровождать самолет для оценки выбросов при использовании экологического топлива. Наземные испытания позволят оценить влияние нового топлива на работу аэропортов.

В ходе воздушных и наземных испытаний будут сравниваться выбросы при использовании 100% экологически чистого авиационного топлива, произведенного с использованием технологии гидрообработанных сложных эфиров и жирных кислот (HEFA), и при использовании топлива из углеводородного сырья - керосина и керосина с низким содержанием серы.

DLR уже провела обширные аналитические исследования и моделирование, а также наземные и летные испытания с использованием альтернативных видов топлива на специальном самолете Airbus A320 (Advanced Technology Research Aircraft, ATRA) в 2015 и 2018 годах в сотрудничестве с NASA.

**Ключевые слова:** авиация, аккумулятор, энергетика, авиатопливо, двигатель.

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The Bulletin of Kazakh Academy of Transport and Communications named after M. Tynyshpayev, ISSN 1609-1817, DOI 10.52167/1609-1817, Vol.119. No.4 (2021) pp. 126-132

УДК 656.2

DOI 10.52167/1609-1817-2021-119-4-126-132

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## КУЛЬТУРА БЕЗОПАСНОСТИ – СОВРЕМЕННЫЙ ПОДХОД В РАЗВИТИИ СИСТЕМЫ УПРАВЛЕНИЯ БЕЗОПАСНОСТЬЮ ДВИЖЕНИЯ ПОЕЗДОВ

**Аннотация.** В настоящее время передовым направлением совершенствования системы управления безопасностью движения поездов (далее - СУБД) является развитие культуры безопасности движения, основанной на осознании важности и социальной ответственности каждого участника перевозочного процесса. В статье освещен опыт развития культуры безопасности зарубежных железнодорожных администраций и АО