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SYSTEM USAGE OF LIFE
In technology for biofuels

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In the paper the methodology of system use of biological resources in technology for biofuels.

Biofuels, Bioresources, system, technology.

Problem. In a sharp depletion non-renewable fuels, biomass accumulation efficiency of solar energy which is 0.8% (in the field) to a projected 5% (in terms of providing a high level ahrobiotehnolohiy) for the production of solid, liquid and gaseous fuels becomes very important. Since each field can be harvested annually two crops, namely food and energy from biomass in an amount not exceeding 30%. With mechanical, chemical, thermal, biological or complex processes biomass in modern conditions transform into gas (biogas), liquid (diesel biofuel and ethanol) or solid (briquettes, pellets straw, etc.) biofuels. According to EU requirements (Directive 2003/30 / EC of 8 May 2003). Share of biofuels in the EU energy structure should by the end of 2010 up

5.7%. In our country the relevance this direction outlined Cabinet of Ministers of Ukraine № 1774 of December 22, 2006

The purpose of research. In order to implement scientific and technical potential of bioenergy direction authors conducted a series of deep fundamental research and made a number of scientific and

technological developments, the results of which set the stage widespread use of highly advanced biotechnology enerhokonversiyi in agricultural production and the energy sector of Ukraine.

The effectiveness of biomass in energy production is achieved only rational parameters of processes and machines for agriculture, which converts biosyrovyny. Each type of biomass can give a wide variety of products. For example, the production of biodiesel from waste processing oilseeds (straw, husk and cake) you can get a number of products that have commercial value. Even a simple straw in solid fuel fired boilers provides a warmth and ashes returned to the soil as fertilizer. Production and use of biogas and accompanying him Manure quality produced from secondary energy resources agricultural biosyrovyny create conditions for disposal at the present level of biological waste agricultural production. The newest model of agriculture, including bioenergy on an equal footing as one of its main components sectors are shown in Fig. 1.

Biological resources enerhokonversiyi

The National Botanical Garden (NBG) them. MM Grishko National Academy of Sciences of Ukraine established one of the largest in Ukraine gene pools of energy plants, which includes 365 species, varieties and forms of plants (76 - tsukronosnyh 145 - oil, 144 - commodity crops for solid biofuels and biogas). Along with exotic species of rare and important cultures in this list belongs created their own efforts forms, hybrids and varieties of power plants that are not targeted food crops. Alternative energy crops represent different botanical families and their use in crop rotations or beyond is not a threat to the environment. They are not targeted food crops. These plants prevent erosion, improve agronomic and biological indicators of soil. Most of the proposed crops include exceptional drought and winter hardiness, adaptability, resistance to diseases, pests and weeds. Preference is given perennials with a period of 10-20 years of productive longevity that can grow not only in the fertile fields of crop rotation, and on land not suitable for growing traditional crops.

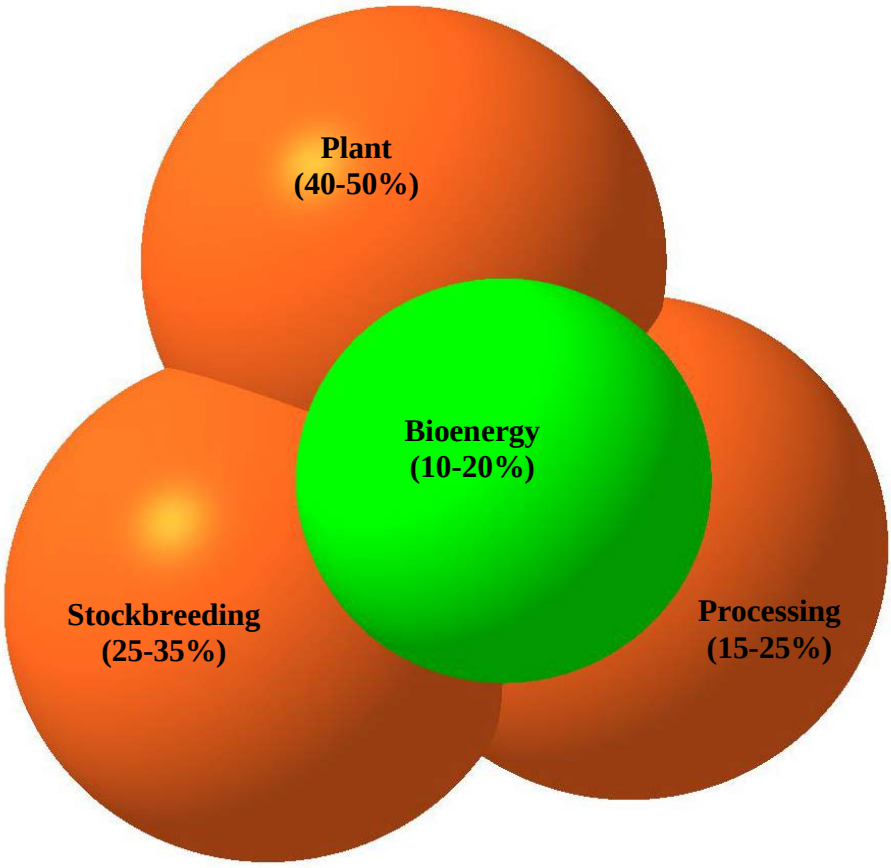

Fig. 1. Model of modern agricultural production.

From among the most promising new crops tsukronosnyh NBS National Academy of Sciences of Ukraine created a valuable gene pool palmate millet (10 samples), sugar sorghum (15), Miscanthus (7) and drotopodibnoho millet (5 samples), characterized ripening, drought resistance, high yield seeds or phytomass, high in carbohydrates in grain or overground mass and ethanol yield. Tsukronosni These plants can fully ensure a high productive potential of Ukraine and ethanol yield per unit area than traditional crops (sugar beet, potatoes, wheat, etc.).

The Institute of Food Biotechnology and Genomics (IHBH) NAS Ukraine received a number of options somaklonalnyh palmate asking for further use in the selection process in NBS National Academy of Sciences of Ukraine. In particular, at their base high-yield varieties Yaroslav-8 and Eugene. During clarify the genetic basis of acquired Jaroslav grade-8 signs it was suggested that the key role they can play an active tsytokininoksydazy / dehydrogenase - a key enzyme of cytokinin degradation. It analyzed the samples for gene expression

tsytokininoksydazy example transcript meristem palmate millet at different stages of development resulting class (using 12K macroarray filters barley). Revealed the presence of four genes in the genome tsytokininoksydazy whole palmate millet. The analysis of gene expression tsytokininoksydazy using cloned cDNA fragment as a probe tsytokininoksydazy revealed altered expression level of one of the genes related class "Yaroslav-8 " compared to the starting material. Also found that gene expression in inflorescences tsytokininoksydazy class "Yaroslav-8 " At the stage of development (inflorescence size 23 cm) Is almost 2.5 times lower in comparison with the original line.

In parallel, it was determined the content of cytokinins in plants investigated class - only 25 different cytokinin derivatives, since their predecessors, active cytokinins, spare conjugates and ending decomposition products of cytokinin in various stages of development. The results showed that the amount of cytokinin in the leaves of plants obtained grade was significantly higher compared with controls and, most importantly, is higher in inflorescences in the earliest stages of development, but not different from control at later stages of development. Thus, these data together with the results of an expression analysis can explain the morphological and physiological characteristics of the studied phenotype, including laying more ears and the presence of a larger number of seeds in each ear. Accordingly, the above data generally argue in favor of a decisive role in shaping tsytokininoksydazy signs new variety. Based on these results we can talk about the development of an effective strategy for increasing the yield of crops in general and millet in particular palmate using genetic engineering approaches that are based on the use of plants for the transformation of genes involved in the regulation of cytokinin biosynthesis and degradation.

Using methods of molecular breeding NBS scientists NAS of Ukraine together with partners from NAS Ukraine IHBH well established high-grade sugar sorghum - Botanical. Raw materials obtained new hybrids and varieties of sorghum and sugar palmate millet contains 15-30% of total sugars. They are characterized by high plasticity and provide guaranteed performance and yield of 5-8 t / ha seed and 50-80 t / ha (130 tons / hectare) green mass. Ethanol yield per unit area, depending on the conditions of vegetation and materials processing technology is 350-800 dal / ha. The heating value of the mass reaches the combustion of 3731-4363 cal / g.

In NBS National Academy of Sciences of Ukraine also created 16 varieties vysokomaslichnyh crops, most of which are included in the State Register of varieties of Ukraine. Most of these varieties has valuable productive properties and is suitable for the production of

biodiesel. In particular, valuable gene pool created false flax, which has about 20 forms and hybrids sortoobraztsov. Most promising forms and hybrids provide false flax 3-4 t / ha of seed oil content and yield 45-50% 1-1.4 t / ha of biodiesel. This yield is 30-40 t / ha of biomass 5-8 t / ha of dry matter, 0.8-1.0 t / ha feed protein. Unlike rape as a result of mineralization of organic matter in the soil false flax leaves more than 70 kg / ha of nitrogen, 30 - phosphorus, 85 - Potassium 35 kg / ha - calcium. Developed biotechnological principles improve the fatty acid composition and lipid accumulation in the seeds of false flax.

In recent years, a number of other modern varieties of cabbage crops (including winter oilseed rape and wild turnip), containing the seeds of 40 to 52% oil (lipids). They are characterized by high plasticity and provide guaranteed performance and seed yield at 2.5-3.0 t / ha yield of oil per hectare depending on the type of 8001000 kg (As opposed to imported varieties). Defined lipid and caloric energy potential spring (oil radish, wild turnip spring, blue-gray and white mustard, Nigella damascena and crop, flax oil) and winter (winter rape, Typhon, wild turnip winter) oilseeds collection NBS National Academy of Sciences of Ukraine. Among winter crops yield the highest seed yield and content of lipids characterized varieties of winter rape, Typhon and wild turnip, among spring - oil radish, white mustard and linseed providing 2,8-3 t / ha and seed to 1100-1400 kg / ha yield lipids. Following the completion of the fatty acid composition of seed oil grades wild turnip spring, winter rape, Typhon and sowing eruky found that rape and wild turnip oil oleic acid is respectively 62.4 and 48.1% of the total fatty acid composition. Among the studied crops high in erucic acid oil is characterized by Typhon (48.7%) and eruky sowing (47.5%). Oil wild turnip spring and winter rape differs significantly low in erucic acid (1.9 and 0.7%) and high in linoleic acid (19%) of the total fatty acids. Calorie oil in different cultures ranged from 37.5 to 41.4 MJ / kg. The output energy from lipids spring rape and false flax equivalent calorific 1312 and 1215 liters of diesel fuel. In addition, a 19 plant varieties with high yield biomass for use in solid biofuels (for logs, briquettes, pellets) and biogas. Deserves special attention commodity conveyor grades based on their own power plants: schavnatu (varieties Biekor-1 Rumeks OK-2, Mentor) multi sidy (varieties of Virginia and Fitoenerhiya) sylfiyu pronyzanolystoho (Kanadchanka varieties, Winner, Hercules), multi sorghum (sort Columbus) kozlyatnyku (sort of NBS-75), Giant Knotweed, etc.). These varieties can be efficiently used for 10-20 years, annually providing up to 30 t / ha of dry matter entirely. Developed energy-saving technology of cultivation of bioenergy plants provide a high yield of conventional biofuels (10-21 t / ha) and energy (70-90 Gcal / ha) with the harvest. The

total output of biogas1 ha new energy plantations of exotic species is from 9000 to 37,000 m3.

Created varieties and production biosyrovyny are implemented in Ukraine (in farms in 17 regions) and CIS (Russia, Belarus, Kazakhstan) and European Union (the Czech Republic and Poland, the number of registered design 2005/0758) in China, North Korea , Republic of Korea, as evidenced by a bilateral agreement. The total area of crops schavnatu is about 30 thousand. Ha.

Technological aspects of biological transformation of energy resources

The use of ethanol as a fuel was by far one of the most important areas of the world economy. This trend started much earlier than global warming, because of the shortage of fuel oil in some countries and the presence of significant biological resources for ethanol production. It is primarily about Brazil, where the government began to encourage the use of ethanol as a component of fuel for spark ignition engines. Then the process of partial replacement of bioethanol fuel oil began to join the United States and Canada, Europe. Began production of "flexible" spark ignition engines adapted to use fuels containing up to 95% ethanol, and diesel engines operating at 90% of th fuel. In 2009 fuel bioethanol produced 73.9 million. M3, non-fuel purposes - 10 mln. M3. Used raw corn - 55% sugar cane - 34% molasses - 6%, wheat - 3.5%. The leaders in the production of fuel ethanol is the United States (40.6 mln. M3) and Brazil (24.9 mln. M3). World consumption of gasoline is approximately 1 billion. Tons. Theoretically, without prejudice to the provision of the world's population with food at current levels of productivity on the planet can be grown raw materials for the production of about 500 million. Tons of bioethanol per year. This amount of energy equivalent to 360 million. Tons of gasoline.

Scientific research in the world is currently going on both in the direction of improving technologies for first-generation bioethanol and development of scientific and technical bases receiving second-generation bioethanol (biomass). Therefore, the Institute of Cell Biology (CSI) NAS Ukraine was carried out aimed at improving ethanol fermentation parameters of traditional raw materials - glucose - involving alcohol yeast Saccharomyces cerevisiae. To do this, first used the possibility of modifying energy metabolism of yeast by overexpression of enzymes that break down the main cell energy source, ATP. The resulting strains convert a higher percentage of glucose to ethanol by smaller biomass accumulation of cells. In this context, biomass is a by-product, so that instead of converting components in ethanol nutrient medium, the cell uses this resource to build daughter cells. By manipulating the energy balance of the yeast cells at the gene level

could reduce the growth of biomass and increase the yield of ethanol during fermentation of glucose by 20% compared to the original strain.

Global production of plant biomass is 200 × 109 tons per year, with 90% of the biomass is lignocellulose - heterobiopolimer composed of cellulose, hemicellulose and lignin different. One of the main sugars hydrolysates lihnotselyuloznyh waste is tselobioza and xylose, are not fermented baker's yeast. Therefore, the work carried out to detect other types of microorganisms that are potential producers of ethanol from waste lihnotselyuloznyh hydrolysates. One of the best candidates appeared unconventional yeast Pichia stipitis, however, the efficiency of xylose fermentation and tselobiozy natural strains is insufficient to provide cost-effective industrial process. In ICC NAS of Ukraine conducted the metabolic engineering of this type of yeast. It was heavily modified version of the first expression of the gene xylose catabolism encodingksylozoreduktazu. Performance ethanol fermentation of xylose constructed strains exceeded productivity original strain of 1.3 times.

It is known that glucose is the best fermenters Saccharomyces. However, these organisms are unable to ferment xylose, as was done kofermentatsiyu using two bacteria, recombinant strain *P. stipitis* and wild-type strain *S. cerevisiae* cells in the optimal ratio of 1: 1. These results allowed the development of laboratory and semi regulations ethanol from plant biomass hydrolysates based PE "Express" (m. Romney, Sumy region.), Which makes it possible to scale the process and begin setting up production of ethanol from the aforementioned materials.

Enzymatic hydrolysis (saharyfikatsiyu) lihnotselyuloznoyi biomass can be done simultaneously with microorganisms that ferment sugars to ethanol released (simultaneous saharyfikatsiya and fermentation). In ICC NAS Ukraine were found termotolerantni yeast Hansenula polymorpha, are able to ferment xylose active at elevated temperature 48oS. It made additional increase termotolerantnosti this type of yeast to 50oS.Exit ethanol derived recombinant strains *H. polymorpha* generally increased 25-fold compared to wild-type strain, the maximum concentration of ethanol during fermentation of xylose in 48 ° C was about 15 g / l.

New technologies of production and use of biofuels

New technologies bioenerhokonversiyi for biofuels based on spent in the last 10-15 years, fundamental and applied research processes of transformation of organic matter. In Ukraine, the program bioethanol fuel purposes was launched with late - the beginning of the new century. They started with conversion distilleries who lost markets food alcohol. These studies were carried out in particular for scientific development IHBH NAS of Ukraine:

- Development of technologies biosynthetic fuel components based ethanol from renewable plant materials.
- Development of conceptual solutions to create agro-industrial complexes processing plant material into liquid biofuels and the use of by-products for energy production.
- Biosynthetic production of liquid biofuels component "alternative biosynthetic Oksyhennyy Komponent-1 ' (ABOK-1), "Alternative Motor Fuel oxygenates" (SMR-A) of the primary ethanol pilot plant at Budylskomu State Committee of Ukraine and the company for "Eco-Energy" Sumy region.
- Production of complex fuel komponetiv based ethanol and its derivatives in the company for "Eco-Energy";
- Biofuel production of "bio-100 ' for engines with spark ignition at the company LLC "Biochem Group", Donetsk, capacity of 10 thousand. tons per year.
- Development of technologies esterification of vegetable oils using ethanol and ethyl esters of fatty acids for fuel composition for diesel engines for bioethanol and hydrocarbon components.
- Development compositions of liquid biofuels for internal combustion engines based ethanol and vegetable oils.

Scientists IHBH and ICC NAS Ukraine received a number of fundamental results that allow us to understand the mechanism of enzymatic transformations of biopolymers plant material (cellulose and hemicellulose). These polymers are transformed into simple sugars that are substrates for microorganisms-producers monofunctional. A further selection and concentration of these alcohols can receive components of liquid biofuels. The mechanism of resistance and limits cell producers to high concentrations of ethanol and butanol. Features of consumption of components of complex substrates at their microbiological transformation of target products.

The study also focused on the development of biotechnology ethanol production from raw materials such as sugar sorghum and millet palchaste that combines raw as the first (mono- and oligosaccharides) and second (lignocellulose) generations. Sugar sorghum is not a traditional crop edible products because of its processing in biofuels does not cause such severe criticism as the use of maize and wheat. In addition, sorghum stalks can be utilized in the production, especially sugars - the production of bioethanol and sorhova Bagas, Gironde (zhmyh) as a solid fuel for heneratsiyiyi process steam and then - as raw 2nd generation. To go to raw 2nd generation will not have to create a new company - just doosnastyty several existing positions of specialized equipment.

The above does not exhaust all the advantages of sugar sorghum. Lignocellulose stems in the extraction of sugar it undergoes hydrothermal influence that facilitates subsequent enzymatic hydrolysis of polysaccharides. Thus, it becomes possible to obtain partially prepared for further processing of raw second generation. The plant that recycled sugar sorghum as bioethanol, now may be the base for the introduction of innovative technologies, processing lihnotselyuloznoyi excess biomass sorghum, not only, but also such promising crops as millet palchaste. The company "Shepetivsky sugar factory" in industrial environments proven technology of complex processing of juice and stems of sugar sorghum, millet straw palmate to obtain a solution of simple sugars for subsequent fermentation to ethanol. In industrial fermentation conditions was performed on Budylskomu experimental plant JSC "Eco Energy" and fermentation products obtained pilot batch of fuel oxygenates ethanol and higher alcohols. The results of the current patented and preparing for industrial application.

Based on the theory of fuzzy sets and fuzzy logic in NUBiP Ukraine a model of adaptive process of esterification of vegetable oil solution of an alkaline catalyst in methanol, which allows to determine the expected performance of the industrial production of methyl esters of fatty acids, depending on the characteristics of raw materials and technological modes reactors periodic and continuous.

Significantly extended and detailed scientific basis fermentation of organic materials, based on the provisions of the theory of decomposition of organic matter under anaerobic conditions created artificially or existing in the environment (landfills). The mechanism of decomposition of organic matter in anaerobic reactors implement flow through four interconnected, steps. The effectiveness of anaerobic digestion is measured by the degree of decomposition of organic matter, yield and composition of biogas determined the chemical composition of the original organic substances supplied to the reaction medium and basic technological process parameters such as loading dose bioreactor temperature in the reaction medium, the concentration of organic matter and so on. The green mass of plants in the structure has a relatively higher content of organic carbon is one of the most promising organic substances, which allows adding intensify the process of anaerobic digestion of manure hnoyivky, litter etc.

In the last 6 years, experts institutions prepared a monograph, in different modes and nutrient substrates agriculture and municipal origin processed biogas technologies and Liquid Manure quality. The processes metanoutvorennya monosubstrativ and the processing of multicomponent organic mixtures. A series of experimental studies to determine the effectiveness of anaerobic digestion hnoyivky compatible with corn silage, haylage, waste vegetables and fruits at temperature

conditions of 22 ± 1 ° C, 35 ± 1 ° C and 53 ± 1 ° C. Reviewed biogas yield, biogas (CH4, CO2, O2, H2S), the degree of decay of organic matter for each substrate and mixtures thereof. An important factor is the quality of solid biofuels technology to prepare biomass burning. It causes structural and technological performance of heating equipment, significantly affects economic performance. The scientists of the National University of Life and Environmental Sciences (NUBiP Ukraine) technology developed collection and processing of biomass as a major biological resource bioenergy. They used specialized installation of granulation and briquetting biomass. Results of the development problems of power and heating plant matter embodied in the new generation of technology and heating devices with the optimal mode efficiency ranging from 80 to 90%.

Means bioenerhokonversiyi

The above work allowed to determine the direction of technological developments and implement them in practice. Scientific results obtained allowed to begin implementation of technological and conceptual solutions to a much more powerful objects - processing plant corn in ethanol of "Crown-Agro" capacity of 100 thousand. Tons of bioethanol per year in. Zolotonosha Cherkasy region., Plant to produce bioethanol Ltd.

Developed dimension-type series of technological equipment for the production of biodiesel capacity from 1 st to 10 tons per day. With modular assembly lines, technology with the "cold" method of oil extraction is recommended when production volumes to 30,000 tons / year biodiesel. Commissioned the first pilot plant for the production of biodiesel educational and scientific purposes.

Hardware Factory has successfully passed the state acceptance trials in UkrNDIPVT named Leonid Pogorelogo and put on production at domestic enterprises. Quality biodiesel meets ISO 6081: 2009. National University of Life and Environmental Sciences of Ukraine and several domestic engineering plants developed a series of equipment for regional plant capacity from 1 st to 10 tons of fuel per day.

However, along with the traditional narrowly focused alternative industries of various types of biofuels, the authors implemented a pilot project with UNIDO Cleaner Production in the field of bioenergy. Developed Project of biodiesel production from 300 to 10,000 tons / year. With modular assembly lines of technology with the "cold" method of oil extraction can be effectively used in the production of 30,000 tons / year biodiesel. On a more powerful (industrial) oil-producing plants for production schedules oil-extraction plants. Together with domestic engineering plants, in particular of "TAN" from Chernigov proposed

appropriate equipment production lines (with cleaning biodiesel according to European standards).

Put into operation a plant for the production of biodiesel educational and scientific purposes. This company has three production lines, namely oil production lines LVRO-ECO-BIO, preparing to oil esterification LPRO-ECO-BIO and biodiesel production LVDB-ECO-BIO. Quality biodiesel output line LVDB-ECO-BIO meets current SOU 24.14-37-561: 2007 and ISO 6081, which entered into force on 1.03.2010 p.

Depending on the technology, equipment, additional end-products (feed, heating oil, etc.), as well as production capacity production lines vegetable oil (profitability - 80%), biodiesel (15-25%), as well as animal feed and solid biofuel (30- 60%) and agro bio-energy companies can get a stable income and recoup the costs for 1.5-2 years. Biogas production is traditionally performed at waste fermentation animals such as manure or hnoyivka. This selection can mix with other commercial waste or waste materials the food industry. The authors created a specialized laboratory for production of royal culture metanoutvoryuyuchyh bacteria. Through the use of research and production base in different modes with different nutrient substrates processed biogas technologies and liquid organic fertilizer quality.

Completed design work on creating a new generation of biogas plant to produce biogas and organic fertilizer in the multi-substrate fermentation, which develops by cooperation with Austrian colleagues BOKU University and companies BauerTech and Heat Bioenergy. Installing recycled annually about 17-18 thousand. T multicomponent substrate and produce daily to 3500 m3 biogas containing methane 50-60%. The CHP is designed to produce 330 kW of electricity and 380 kW of thermal energy. In addition, a pilot biogas plant annually issue for the purposes of teaching and research facilities NUBiP Ukraine, located in the Kiev region, about 3.3 solid and 14.5 thousand. T Liquid Manure quality.

Conclusion. Through the efforts of scientists, engineers and machine builders in Ukraine developed and mastered the production of complex technical means enerhokonversiyi Life. Designed with the direct participation of the authors domestic equipment for technological parameters and characteristics corresponds to the world's best, and at a price of 2.5-3 times cheaper. The introduction of new technologies bioenerhokonversiyi promotes job creation (especially in rural areas), the local economy, resulting in a significant environmental impact (by reducing greenhouse gas emissions and sulfur). Estimated annual savings through substitution of natural gas for biomass 10.2 billion, which is 1.8 times greater than the value of direct investment costs necessary to introduce new technologies and biofuels respective park equipment, manufacturing domestic engineering plants.

In this article Methodology Using the system is set out in byoresursov obtain byotoplyva technology.
Byotoplyvo, Byoresurs, system, technology.

In paper the methodology of system use of biological resources in technology for biofuels.
Biofuels, Bioresources, system, technology.