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# Renewable energy in UKRAINE

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*The assessment states use of renewable energy sources (rivers, wind, solar, biomass) in Ukraine. The analysis of means of production receptions for renewable energy in Ukrainian enterprises.*

***Biomass, biogas, bioethanol, pellets, biodiesel, wind generator, solar power, small hydro power plants, green tariff.***

**Problem.** One of the major problems of mankind is the energy problem. Intensive exploitation of mineral resources has led to the depletion of their deposits. Are these liquid petroleum reserves on the planet last for 45 years, natural gas - for 60 years. The level of uranium mining are insufficient to ensure the functioning of all fuel nuclear power plants. World coal reserves somewhat greater, would last more than 200 years of use, but burning associated with a significant pollution [1]. In Ukraine's oil reserves are only sufficient domestic production by 18% [2]. Natural gas Ukraine annually consumes 50 billion. M3, of which 20.1 billion. M3 domestic production [3], that is about 35%. Fuel for nuclear reactors in Ukraine about 100 years of use, but after the Chernobyl accident, nuclear energy are cautious. Only coal reserves in Ukraine are quite significant (they will last for 600 years of production), as thermal power is transferred from gas to coal. However, coal is considered the dirtiest of all fossil fuels. Wanted carcinogenic isotope of carbon in larger quantities produced by burning coal.

**Analysis of recent research.** Due to the maturing of the energy problem in recent years, the use of renewable energy sources rise in the literature. Recognized leaders in Ukraine in the field of renewable energy are scientists Scientific and Technical Centre "Biomass": G. Geletukha [4; 5] T. Iron [4, 5, 6], Matveev et al. The National University of Life and Environmental Sciences



Ukraine issues involved in biofuels B. Dubrovin [7, 8, 9, 10, 11] G. Golub [12] V. Targon [11, 13] V. Sukhenko [14], the NSC "Institute of Mechanization and elektrifikatsii Agriculture "V. Mironenko in SI" Institute of Food Biotechnology and Genomics National Academy of Sciences of Ukraine "P. Tsygankov [10, 15].

**The purpose of research** is to analyze the current state of renewable energy in Ukraine.

**Results.** To improve the situation FEC Ukraine conducted the search for new renewable energy sources. At this time on an industrial scale for power generation using river, sun, wind, biomass.

In Ukraine among renewable hydropower is now the most advanced. Electricity generation in large hydroelectric technology worked, and hydropower generated by these today is the cheapest source of the wholesale market. In the energy sector hydropower Ukraine ranks third after thermal and nuclear power plants. Total installed capacity of hydroelectric Ukraine currently accounts for 8% of the total power of the united energy system. Economic and technical possibilities of hydropower Ukraine is about 21.5 GWh / year, now used less than 50% (10.8 GWh / year). The main focus on the hydroelectric potential of the Dnieper cascade, the total capacity of 3.83 GW, annual power generation - 9.9 GWh (Dnieper HPP first stage has a capacity of 648 MW, the second stage - 825 MW hydroelectric Kakhovska - 351 MW, Kremenchug HPP - 625 MW hydroelectric Dniprodzerzhyns'k - 325 MW hydroelectric Kanev - 444 MW Kyiv HPP - 389 MW, Kiev PSP - 225 MW) hydroelectric Dniester (capacity 702 MW), the Dniester PSP (capacity 430 MW) and Tashlyk PSP (power 302 MW) [7].

In the Dnieper, Danube and Dniester, Ukraine has more than 63 thousand. Small rivers and streams with a total length of 135.8 thousand. Km, of which about 60 thousand. (95%) - very small (length less 10 miles). Their total length is 112 thousand km., Is the average length of the watercourse - 1.9 km. Technical annual hydropower potential of small rivers 0.7 GWh (6.4 GWh), or 30% of the total technical potential of rivers Ukraine. Economic potential of small rivers of Ukraine may be assessed at a rate of 1,3-1,6 GWh / year [7].

Today in Ukraine operates 73 small hydro power plants [16] a total capacity of 111 MW, representing 5% of the technically feasible hydropower potential [17]. Every year they produce about 203.5 million. KW · h of electricity. This is about 0.13% of the total annual electricity production in Ukraine [16]. Small hydropower plants operating in the country, with 0,1-7 MW power [17].

Under the new project enerhostratehiyi 2020, plans to complete the reconstruction and rehabilitation of small hydropower plants with total capacity of 135 MW (0.44 billion. KW · h) and start building new ones. Envisaged the construction of new small hydropower plants on the river. Dniester and its tributaries (capacity of 560 MW, producing 1.78 billion. KW · h per year) and on p. Tisza and its tributaries (400 MW 1.41 billion. KW · h ). In addition, the planned introduction of micro hydropower plants

on small inflow (total capacity of 45 MW and annual electricity production of 120 million. KW · d) [18].

Investments in reconstruction and modernization of existing small hydropower bring up $ 800 / kW, and the restoration of decommissioned GES - 1-1.5 thousand. $ / KW, which will determine the duration of their payback within 5-8 years. During the construction of the new plant unit investments per 1 kW can reach $ 2,5-4 thousand., Which can increase the payback period of 12 years or more. The restoration of defunct small hydropower plants will need up to three years, and the construction of new hydroelectric, considering obtaining all permits and exemptions expert may take up to six years. Despite the long payback period and a fairly large investment, the cost of administration of 1 MW for small hydroelectric restored remains one of the lowest among the available alternative energy sources. In small hydropower plants compared with around $ 0,8-2,5 / W (for comparison, the cost of wind power input is 1,5-2,1 $ / watt, solar power 3-3.5 $ / W) [17] .

Unlike solar power, basic equipment for small hydropower produced in Ukraine. Its quality is not inferior to Western products, but the price is several times cheaper. Domestic manufacturers have extensive experience in this area and technological developments that are important for building new power stations. The main manufacturers of equipment for hydroelectric power in Ukraine is Sumy NPO. Frunze "Turboatom", "Yuzhelektromash" Poltava Turbomehanichesky plant, Nijinsky repair and engineering works, etc. [18].

Since 2011, when Ukraine Austrian company "Activ Solar" enacted three photovoltaic solar power plants with total capacity of 187.5 MW solar power has become the second most important alternative energy source (if there is such a large hydro energy and PSP). In January 2011 in Simferopol region Crimea was launched SES "Spring" power of 7.5 MW, where areas 15 ha 32600 available photovoltaic modules. In October Saki region Crimea on the square 160 ha SES launched "Hunters" capacity of 80 MW, consisting of 347 800 fotoelektrichnyh modules. In December, in an area near Simferopol 200 ha enacted SES "Perovo" 100 MW, which consists of 440,000 PV modules and is currently the most powerful solar photovoltaic power plant type in the world. In 2012 in the Odessa region launched two solar power plants "Starokozache" and "Danube" capacity of 43 MW each, consisting of 185 952 units and located on 80 hectares, and in Crimea - SES "Mytyayeve" capacity of 31 MW, consisting with 134,760 units and occupies an area 59 ha [7].

In 2012 the company "Solarenerho" solar station opened in Skadovsk district, Kherson region. Its capacity is 10 MW. It is located on the shores of the salt lake near the village oyster. Azure on land

unsuitable for agricultural use. Number of PV modules installation is 40 thousand. In the future we plan to increase the capacity of the plant to 27 MW [19].

In 2012 there were also commissioned SES "Oul Solar" power of 31.55 MW, Danube SES (21.52 MW), Danube SES-2 (21.62 MW), SES 'Franco Solar "(21, 18 MW ), SES 'French Pivi "(21.77 MW), SES" SE- 1 "(5.4 MW) and suburb-Bushanska Halzhbiyivska SES (1.875 MW and 1.264 MW), SES' Tokmak Solar Energy" (1, 5 MW) Tsekinovskie SES number 1, 2 (1.43 MW and 0.634 MW) and Hordashevska SES (0.103 MW), SES 'Altena - Invest "(0.309 MW), SES" Grill "(0,075 MW), SES' Vinnitsa - Energoservice "(0,035 MW), SES" Clean Energy 2011 "(0.03 MW) and photovoltaic station" Dawn 2003 "(0.03 MW) [20].

At the end of 2012 the total capacity of the existing Ukrainian solar power 422.3 MW, which is almost three times the capacity of existing small hydropower plants. In the future, examines the construction of solar power plants in the Crimea with a total capacity of 600 MW, in the Odessa area capacity of 420 MW. [7]

Wind Energy in Ukraine is now the third largest source of energy. In 2008 worked eleven wind farms: Donuz - Lavska capacity of 10.9 MW, 6.3 MW Sudak, Black Sea 1.2 MW combined into one enterprise SE "Donuzlavskaya WEIGHT" Saki (Myronivska) and 21 MW Pryesnovodnyenska 6 MW combined into one enterprise THIS "Vodenerhoremna-adjustment" Tarhankout 16.7 MW and 20.4 MW Novoazovska, Sivashskoe 1.7 MW and 0.75 MW Truskavetska, Aktashskoye (Eastern Crimea) 0 5 MW, 0.3 MW Adzhihilskaya total capacity of 85.75 MW, which were composed of 693 wind turbines USW 56-100 unit capacity of 100 kW wind turbines and 13 T 600-48 600 kW unit [7]. All the above domestic wind power mainly equipped with wind turbines manufactured in the Ukraine under license, but some of them still was purchased abroad. Ltd. Windenergo Ltd, a joint venture with US company "Wind Power", produced USW 56-100 wind generators under license "Wind Power". However, this type of turbine has a low efficiency (10-18%) and small individual capacity so it is cost-effective. In SE "stvennoe Production Association" Southern Machine-Building Plant. OM Makarov "installation produced T 600-48 (under license from the Belgian company" Turbowinds "). There were also efforts to develop wind power Ukraine from its own development. Ukrainian experts KB" South "at the time suggested alternative licensing projects, but their wind turbine model AVE -250 (200 kW) and vetroahrehat with vertical blades capacity of 420 kW were unsuccessful. [7] Also in Ukraine turbines produced low-power type WE nominal capacity of 1.5 to 12 kW and EuroWind nominal capacity of 0.5 to 10 kW [11 ].

In 2010-2011. Total domestic wind power capacity was increased to 151.25 MW by commissioning three new wind farm, wind park "Novoazovsky" in the Donetsk region. (Territory Novoazovsk WPS) with a total capacity of 37.5 MW consisting of 23 wind turbines produced by German company «Fuhrlander AG» unit capacity of 2.5 MW [21] (adjusted their collection at the facilities of "Furlender VindTehnolodzhy" in Kramatorsk (Donetsk region. ) [22]); wind park "Ochakiv" in the Mykolaiv region. total capacity of 25 MW consisting of 10 wind turbines «Fuhrlander FL - 2500"; vetroahrehat Novorossiysk first wind farm in the Kherson region. V -112 capacity of 3 MW Danish company VESTAS [23].

In 2012, in Zaporizhia region put into operation the first stage Botiyevskoyi wind farm consisting of 30 wind turbines with a total capacity of 90 MW [24]. Due to the commissioning of new wind turbines total capacity wind farm "Novoazovsky" reached 57.5 MW wind farm "Ochakiv" 37.5 MW (consisting Ochakiv and Tuzlovskomu wind farm of 25 MW and 12.5 MW respectively). In early February 2013 commissioned wind farms in the Crimea Ostaninska consisting of 10 wind turbines with a total capacity of 25 MW [19]. The total capacity of Ukrainian WEC has reached 299 MW.

By the end of 2013 it is planned to launch the second stage Botiyevskoyi wind farm with the capacity of 110 MW will be [24]. Power wind farm "Ochakiv" is planned to increase to 125 MW wind farm Novorossiysk - up to 24 MW [25]. Planned construction of wind farms Bakhchisaray (200 MW) in Crimea.

As part of a wind park "Saki" will work Zolninska 12 MW wind power plant, which is planned to install turbines type 5 FL- 2500. Wind Park "Kerch" plans to build East (Kazantipskaya) wind farm of 100 MW (it also includes Ostaninskaya WPS). Wind farm "Steppe" yet will consist of a single wind farm "Steppe" 100 MW [26].

Wind farm "prysyvashskyh" (Prysivashska WPS) 25 MW consisting of 10 turbines of type FL -2500 -100 be built in the Soviet Crimea region (p. Chapaevka). In 2013, the planned construction of East Wind (wind farms "Kerch"), which will be located in the Leninsky district of Crimea, near the village Marfivka. Planned construction of 40 wind turbines of type FL 2500, the total installed capacity of 100 MW wind farm will be. Also, in 2013, planned to build the first stage of Krasnodon Wind (wind farms "Krasnodonsky"), 25 MW. Location Lugansk region, Krasnodon district, near the village Verhnoshevyrivka. At WEC 10 planned wind turbines of type FL -2500. This year in the Donetsk region planned to build the first stage of Kramatorsk Wind (LLC "AtomVind - Kramators'k") capacity of 8 MW, with the installation of two wind turbines of type FL-2500 for towers 141 m in height, and one wind turbine FL -3000 capacity

of 3 MW hybrid tower height of 140 meters. Further development of the project involves bringing installed capacity to 150 MW wind farm. Also in 2013 planned to install two wind turbines of type FL -2500 capacity of 2.5 MW wind farm Novoazovsk.

In the Kherson region underway are projects to build wind farms 7 (WPS) with total capacity of 1.371 GW. In the 2014-2015 biennium. Mykolayiv region. plans to build wind farms Zorynsk (32.5 MW) wind farm Matiyasivskoyi (35 MW) Tuzlovskomu - Limanskaya wind farm (37.5 MW); in the Odessa region. Tatarbunar wind farm (150 MW) wind farm Ovidiopil -1 and -2 wind farms with a total capacity of 200 MW, sharing Wind (50 MW) wind farm Bilyaivka (150 MW); Luhansk region. wind farm "Lutuginsky" (1 part 25 MW, 200 MW of turn 2) wind farm "Anthracite" (1 part 25 MW, 200 MW of turn 2) wind farm "Krasnodonsky" (400 MW); in Crimea Steppe Wind (installed capacity of 100 MW) [27].

Ukraine has considerable potential of biomass available for energy to 24.2 million tons. / Year, the main components of which are straw (5.6 million tons. / Year) and other agricultural waste (stalks, straw, cobs, husks, etc.) 4.7 million tons. / Year [5]. Annual agricultural waste are 49 mln. Tons, of which own agricultural needs, approximately 34 million. T, the residue can potentially be used for energy production [4]. According to incomplete information, new boilers burning straw and other solid biofuels -s already installed in 17 villages Vinnytsia, Kyiv, Sumy, Rivne, Volyn and Cherkasy regions where providing warmth of production facilities (stomach - novodcheskie farms, poultry) social facilities and schools, hospitals, kindergartens [10].

Main oil crops in Ukraine sunflower seeds gross yield in excess of 5 million. V. Ukraine has a powerful set of companies with oilseeds in vegetable oil, which includes 18 oil extraction plants, 50 maslopresovyh factories and about 1,000 small maslorobok where the seeds processed. However, since sunflower husk contains about 1% of waxes that affect commodity quality oil before we collect it from seed husks are cleared, the output of which is 11-20% by weight of the seed, ie 580-1100 thousand. T, and fiber content ( cellulose and lignin) it is 56-59% [7].

**Conclusion.** Renewable Energy in Ukraine intensively. Particularly active is building wind and solar power. A technology implementation of waste agriculture and forestry for energy. Put into effect small hydropower plants shut down after the collapse of the Soviet Union. To stimulate the production of renewable energy on equipment produced in Ukraine, the electricity generated from renewable sources introduced "green tariffs".

## References

1. *V. Polishchuk* The current state of the world and domestic energy sector / *VM*

*Polishchuk, TA Bilko* // Scientific Bulletin of National University of Life and Environmental Sciences. – K., 2012. – Vol. 170, p. 1 – S. 209–219.
2. *Berezovskaja Y.* Chernaya fever / *Yulia Berezovskaja* // Contracts. – 2005. – Number 27. – S. 7-8.
3. *Alternative* Energy: [teach. guide for students. HI. teach. bookmark.] / *MD Melnychuk, VA Dubrovin, V. Mironenko, I. Hryhoryuk, VM Polishchuk, GA Golub, VS Targon, SV Dragnev, IV Svistunova, SM Kuharets*. - K: "Agrar Media Group», 2012. - 244 p.
4. *Review* Renewable Energy in Agriculture and Forestry in Ukraine / [*Geletukha GG, Zhelyezna TA, Golubovska-Onisimova TN, Konechenkov AE*]– K .: Institute for Economic Research and Policy Consulting, 2006. – 58 sec. – (Visual work).
5. *Geletukha GG* Modern technology anaerobnogo sbrazhyvanyya byomassы (Review) / *GG Geletukha, SG Kobzar* // Эkotehnolohyy and resursosberezhenye. - 2002. - № 4. – P. 3-8.
6. *Zhelyezna T.* Husk sunflower requirements for thermal / *Tatiana Zhelyezna, Alexander Morozov* // Green Energy. – 2007. – Number 4. – S. 24-25.
7. *Alternative* Energy: [teach. guide for students. HI. teach. bookmark.] / *MD Melnychuk, VA Dubrovin, V. Mironenko, I. Hryhoryuk, VM Polishchuk, GA Golub, VS Targon, SV Dragnev, IV Svistunova, SM Kuharets*. - K: "Agrar Media Group», 2011. - 612 p.
8. Bioenergy in Ukraine - the development of rural areas and for specific communities: Research guidelines for the implementation of best practice farms Poland, Lithuania and Ukraine on the creation of new bioenergy facilities, efficient production and use of biofuels: [Scientific and method. recommendations.] / [*VA Dubrovin, MD Melnychuk, YF Miller, VG Myronenko etc.*.]. – K .: National University of Life and Environmental Sciences of Ukraine; Institute of Building, Mechanization and Electrification of Agriculture, Poland, Institute of Agricultural Engineering, Lithuania. 2009. – 122 pp.
9. *Technology* biogas: [lectures for students. agricultural. universities] / *VG Myronenko, VA Dubrovin, V. Polishchuk, S. Dragnev, IV Svistunova*.– K .: Holteh, 2010. – 84 sec.
10. *Biological* resources and technologies biofuels: Monograph / *YB Blum, G. Geletukha, IP Hryhoryuk, KV Dmitruk, VA Dubrovin, AI Yemets, GM Slow, GM Kaletnik, MD Melnychuk, V. Myronenko, DB Rakhmetov, AA Sabirnyy, SP Tsygankov.* - K: "Agrar Media Group", 2010. - 408 p.
11. *Technology* and equipment for renewable energy in agriculture / edited. *VI Kravchuk, VA Dubrovin*. - Research .: UkrNDIPVT them. Pogorelogo L., 2010. - 184 p.
12. *Golub, GA* The use of bagasse and molasses mixed with straw for biogas production / *GA Golub, V. Goh* // Scientific Bulletin of National University of Life and Environmental Sciences. – K., 2012. – Vol. 170. Part 2 – S. 74-80.
13. *Targon Basil*. Definition depending biogas output and degree of bioconversion of organic matter on the type and time of fermentation in biotechnological processes methane fermentation of animal waste / *Basil Targon* // MOTROL. Motoryzacja i energetyka rolnictwa. – Lublin, 2010. – Tom. 12B. – R. 86-91.
14. *Mikhail Mushtruk*. Yntensyfokatsyya process converting fats into diesel byotoplyvo / *Mikhail Mushtruk, Yuri Sukhenko, Vladimir Sukhenko* // MOTROL. Motoryzacja i energetyka rolnictwa. – Lublin, 2012. – Tom. 14, No 3. – R. 96-104.
15. *Tsыhankov SP* Bioethanol / *SP Tsыhankov*. - K .: profile "Interservis", 2010 - 160 p.
16. "*Green* umbrella "for malyh GES / Scientific and Technical Union эnerhetykov эlektrotehnykov and Ukraine [electronic resource] / 2013. Access to the journal .:

http://ntseu.net.ua/ru/work/pr/268-2012-03-14. Access Date: 03.11.2013.
17. *E. Burkov* "Zastыvshyy BUILDING" Or Malые da udalые GES / *Egor Burkov* // CEO. – 2012. – № 8-9. – S. 9-10.
18. *A. downpour* GES Malые – BOL'SHAIa USER / *Oksana downpour* // Эnerhobyznes. – 2010. – Number 36 (671). – P. 21.
19. *Pyaterka* krupneyshyh deystvuyuschyh "zelenыh" projects / Dominic.net [electronic resource] / 2013. Access to the journal .: http://www.domik.net/novosti/pyaterka-krupnejshix-dejstvuyushhix-zelenyx-proektov-n188737.html. Access Date: 12.03.2013.
20. *Ustanovlennaya* -power at power plants in Ukraine in VYЭ 2012 g. vozrosla doubled and prevыsyla 580 MW / RBC Ukraine [electronic resource] / 2013. Access to the journal .: http://www.rbc.ua/rus/newsline/show/ustanovlennaya-moshchnost-elektrostantsiy-na-vie-v-ukraine-22022013130700. Access Date: 12.03.2013.
21. *Vetroэnerhetyka* Ukraine 2011. - By: Ukrainskaia vetroэnerhetycheskaya Association, 2012. - 16 pp.
22. "*Wind farm* Kerch "uvelychyl-power 10 MW / Informational agency" Interfax-Ukraine "[electronic resource] / 2013. Access to the journal .: http://interfax.com.ua/news/economic/129619.html#.UT-JnEeAlEg . Access Date: 12.03.2013.
23. *Konechenkov AE* Trends and barerы to the development vozobnovlyaemoy Energy Minister. Vetroэnerhetycheskyy sector: II materials mezhdunarodnogo the investment forum – ["Hlobalnыy LOOK at Black Sea Ukraine"] (Sevastopol, 6-7 September 2012) / Ukrainskaia vetroэnerhetycheskaya Association. 2012. - 22 p.
24. *Morhun Y.* Botyevskaya VES Will Samoa moschnoy Vetroelektrostantsija Ukraine / *Yuri Morhun* // Pryazovskaya virgin soil. – 2012. – 15 oktabrya.
25. *Konechenkov AE* Trends vetroэnerhetycheskoho development sector of Ukraine: Mezhdunarodnoy conference materials – ["Investment and Trade in Renewable Energy in the Black Sea"], (Kiev, 3-4 April 2012) / Ukrainskaia vetroэnerhetycheskaya Association. 2012. - 22 p.
26. *Vetroэnerhetycheskye* -power concern "Vetryanые Parks of Ukraine" / Alter Energy. info [electronic resource] / 2013. Access to the journal .:
http://www.alterenergy.info/windenergy. Access Date: 12.03.2013.
27. *Proektyruyuschyesya* stroyaschyesya wind farm and / Vetryanые parks Ukraine [electronic resource] / 2013. Access to the journal .: http://wpu.com.ua/?page_id=23. Access Date: 12.03.2013.
28. *E. Oleinik* Evropeyskyy Experience Using timber for teplosnabzhenyya / *Eugene Oleinik* // Kommunalnoe economy. – 2008. – Number 2. – S. 30-34.
29. *Dolynskyy A.* Ability zameschenyya natural gas in Ukraine for schet mestnыh species fuel / *Anatoly Dolynskyy, George Geletukha* // Эnerhetycheskaya Politics Ukraine. – 2006. – № 3-4. – S. 60-65.
30. *E. Oleinik* Energy plantations. Is it possible to reduce Ukraine's dependence on imported energy? / *Evgeny Oleinik, Nicholas Zhovmir Konstantin Drozd, Tatiana Yelovikova* // Green Energy. – 2007. – Number 3. – S. 6-9.
31. *Complex* energy-saving system of production and use of solid and liquid biofuels in terms of AIC Guidelines for agricultural enterprises of Ukraine / *MD Melnychuk, VA Dubrovin, V. Myronenko, VM Polishchuk, V. Kravchuk PV Grynko, AV Burylko*. - By: Agrar Media Group, 2011. - 144 p.
32. *Shevchenko IA* Modern aspects of pig manure utilization / *IA Shevchenko, AA Lyashenko* // Profitable pig. – 2012. – Number 5 (11). – S. 26-27.

33. *Geletukha GG* BUILDING collection and utylyzatsyy svalochnoho gas in Ukraine / *GG Geletukha, JB Matveev, KA Kopeykyn* // Problems collection, Converting and utylyzatsyy waste. - Odessa - 2002. - P. 46-50
34. *Belik AK* Experience Introduction biogas collection system in Lugansk Ranges of solid waste of household / *AK Belik, JB Matveev, IV Rushkovskyy* // Problems collection, Converting and utylyzatsyy waste: Sat. nauchnыh articles for V Mezhdunarodnoy scientific conference. – Odessa .: CNT ЭРУ ONYUA, 2004. – S. 317-321.
35. *Vasylov RG* Prospects of development byotoplyva in. Messages 1. Biodiesel engine / *RG Vasylov* / Vesnyk biotechnology and physical and hymycheskoy im biology. YA Ovchinnikov. – 2007. – V.3. – №1 – S. 47-54.
36. *Law* Ukraine from 20.11.2012 № 5485-VI "On Amendments to the Law of Ukraine" On Electricity "to stimulate the production of electricity from alternative energy sources." – [Effective as of 04.01.2013 p.].

*Provedennaya evaluation of STATUS Using vozobnovlyaemыh energy sources (rivers, the wind, the sun, byomassы) in Ukraine. Done production analysis tehnycheskyh funds to obtain vozobnovlyaemoy energy to Ukrainian enterprises.*

***Byomassa, biogas, BIOETHANOL, toplyvnыe hranulы, Biodiesel engine, Vetrogenerator, Sun electric power, GES, green tariff.***

*Evaluation of status of use of renewable energy sources (rivers, wind, solar, biomass) in Ukraine. An analysis made of the production of technical facilities for the receipt of renewable energy at Ukrainian enterprises.*

***Biomass, biogas, bioethanol, fuel granules, biodiesel, wind generator, solar power, small HPPs, green tariff.***

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## FEATURES DEREVYNNOSTRUZHKOVYH DEFORMATION OF PLATES IN BENDING STRESS CONCENTRATORS

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***VB Berezin, a graduate student ****
***OO Ivchenko, student***

*A study of deformation and fracture processes derevynnostruzhkovyh plates without stress concentrators and stress concentrators in the form of round holes at three dot bend. As a result of*