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**АКТУАЛЬНІ ПРОБЛЕМИ ФОРМУВАННЯ
ІНФОРМАЦІЙНО-АНАЛІТИЧНОГО ЗАБЕЗПЕЧЕННЯ
ЩОДО СТАТИСТИЧНОГО ОЦІНЮВАННЯ
ЕФЕКТИВНОСТІ ВИКОРИСТАННЯ ЕНЕРГІЇ
В УКРАЇНІ**

**CURRENT PROBLEMS OF INFORMATION PROVISION
AND ANALYTICAL SUPPORT FOR ENERGY EFFICIENCY
STATISTICAL ASSESSMENT IN UKRAINE**

**АКТУАЛЬНЫЕ ПРОБЛЕМЫ ФОРМИРОВАНИЯ
ИНФОРМАЦИОННО-АНАЛИТИЧЕСКОГО
ОБЕСПЕЧЕНИЯ ПО СТАТИСТИЧЕСКОГО
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ИСПОЛЬЗОВАНИЯ ЭНЕРГИИ В УКРАИНЕ**

АНОТАЦІЯ. Статтю присвячено формуванню якісного інформаційно-аналітичного забезпечення щодо статистичного оцінювання енергетичної ефективності використання енергії з відновлюваних джерел енергії, а також аналізу даних з відновлюваних джерел енергії і наявних статистичних даних для оцінки енергоспоживання домогосподарствами.

КЛЮЧОВІ СЛОВА. Енергія; формування; інформаційно-аналітичне забезпечення; відновлювані джерела енергії; енергія, яку використовують домашні господарства; показники енергоефективності; гідроенергетика; статистичні дані.

ANNOTATION. The article is devoted to the provision of high-quality information and analytical support for statistical assessment of energy efficiency of energy use from renewable energy sources, and data analysis of the renewable energy and available statistical data for the energy consumption in households' assessment.

KEY WORDS. Energy; provision of information and analytical support; renewable energy sources; the energy used in households; energy efficiency indicators; hydropower; statistical data.

АННОТАЦИЯ. Статья посвящена формированию качественного информационно-аналитического обеспечения по статистическому оцениванию энергетической эффективности использования энергии из возобновляемых источников энергии, а также анализа данных из возобновляемых источников энергии и имеющих статистических данных для оценки энергопотребления домохозяйствами.

КЛЮЧЕВЫЕ СЛОВА: энергия; формирования; информационно-аналитическое обеспечение; возобновляемые источники энергии; энергия, которую используют домашние хозяйства; показатели энергоэффективности; гидроэнергетика; статистические данные.

Setting up an issue. Ensuring energy security in Ukraine is a priority task of the state policy in the energy sector, a necessary condition for its implementation an uninterrupted supply of energy, creating strategic fuel reserves, energy saving and efficient internal energy resources use. It should be noted that relevant issues in this area is the routes search for involving the use of alternative energy.

Informational and analytical provision for implementation and support energy policy aimed to efficient and rational use of energy resources is a wide range of current, detailed and comparative data on energy statistics.

Provision of detailed efficiency assessment requires a greater disaggregation level for information on final energy consumption and connected data for each individual type of economic activity.

Information and analytical support provision remain topical in the area of renewable energy, existing coverage of all existing energy types involving to the system all information available from various sources.

To assess the current situation, identify key indicators of energy efficiency and study the major trends specialists apply a wide range of statistical analysis methods.

Analysis of recent research and publications. Energy and raw materials reservation is a key condition for the efficient functioning of the economy. Solving the problem of energy efficiency highlighted in the works of V. O. Barannik, V. M. Heyts, V. V. Mikitenko, M. M. Mitrahovych, O. M. Sukhodolya, Y. P. Yaschenko. The subject of alternative energy use presented in works of I. V. Bondarenko, S. A. Kudrya, P. F. Vasco, A. K. Shyndlovsky.

Setting up an assignment. The relevance of the issue caused by the need in provision of statistical energy efficiency and intensity indicators system. Its use is very necessary on the national level as well as on the level of individual sectors and sections of the economy, economic activities or areas of end use. In addition, there is a need to systematize and provide information on methodological approaches to statistical

analysis on renewable energy production and consumption data, including indicators calculated using energy balance and additional data.

The current system of statistical indicators from the perspective of system allows: to study international experience in statistical survey of energy consumption in households; make gradual analysis of renewable energy sources. Also promotes the effective use of available statistical data for evaluating energy use in households of Ukraine.

The aim of the article is to highlight the problems of provision information and analytical support for energy efficiency assessment and renewable energy use in households of Ukraine.

Materials and results. One of the advantages of the alternative energy use is opportunity to reduce the harmful effects of greenhouse gas emissions.

More than 150 countries — representing 90 % of world economic activity and nearly 90 % of global greenhouse gas emissions connected with energetics. In France, 12 December 2015 world leaders from 189 countries adopted the Paris agreement within the United Nations Framework Convention on Climate Change (agreement to keep global temperature increase of 1.5 degrees, countries obligations to reduce greenhouse gas emissions) [1].

One of the ways for these agreements implementation is an active involvement of alternative energy sources in all sectors of the economy.

Energy statistics combined with other statistical and administrative data is the basis for the analysis of production and development prospects for using energy from renewable sources.

Eurostat for detailed analysis of renewable resources and calculation of their share in total final energy consumption use specially developed software — SHARES. The product is designed according to legislative regulations on renewable energy sources, it is based on a mathematical model that allows the use of standardized calorific values defined separately for certain sectors (including transport), that makes it impossible to get identical results, independently calculating the share of renewable energy in its final consumption according to the energy balance of the country. Using standardized calorific values allow comparisons between regions and countries.

The program also assumes the procedure for getting automatically normalize data from hydropower, so it is important to have and to provide data on the hydroelectric power production for at least the past 14 years. Ukrainian energy statistics participation in using this

software facilitates the implementation of Directive 2009/28 / EU on the promotion of the renewable energy use at the national level.

The basis for the calculation of the renewable energy share in total final energy consumption is 5 annual questionnaires IEA / Statistical Department of the UN / Eurostat.

SHARES is a software built on the basis of Excel. It is an affordable, easy-to-use and partially includes instructions to it. The official Eurostat website provides SHARES operation manual, and links to legislative and regulatory documents governing the software.

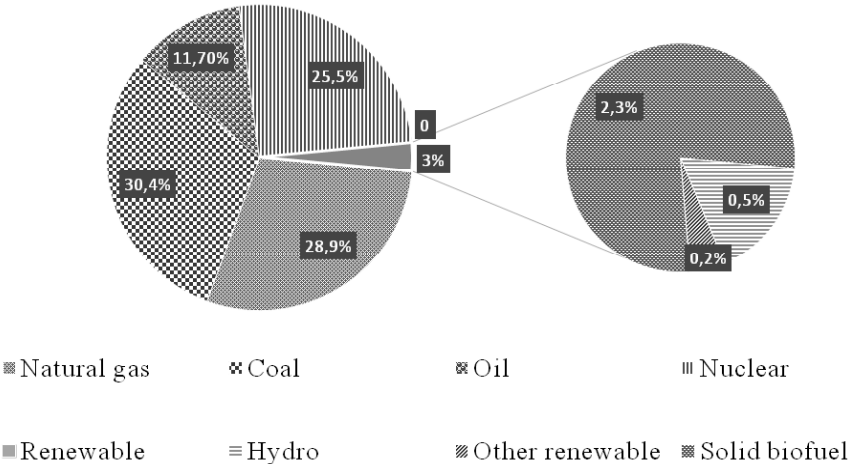


Fig. 1. Energy sources in total primary supply [2]

Despite minor changes in structure there were no significant changes of the energy distribution in its total primary supply compared to the previous period. In renewable energy supply of in 2015 the biggest part is solid biofuel — 83.3 %.

The main source of electricity production from renewable energy sources in Ukraine is hydropower.

The total capacity of small hydro power plants operated in Ukraine, is more than 100 MW, more than 100 small and mini hydropower plants require restoration and reconstruction. A number of small hydro power plants built on the river Pivdeny Bug, including one of them — in the area of Ladyzhyn in Vinnytsia region. The total cost-effective potential for small hydropower Ukraine is evaluated more than 3.0 bln. KW h. Most of the undeveloped potential is in the Carpathian region, where foreseen the construction of small

hydropower plants with reservoirs of complex target. Small hydropower cascade on the river is being constructed on Teresva river with the capacity of 16 MW. According to the development strategy of small hydro power plants it is planned to increase their capacities up to 700 MW in 2020, and up to 1040 MW in 2030.

Table 1

ELECTRICITY PRODUCTION IN UKRAINE

	Total electricity production, mln. kW·h	Growth rate, %	Percent rate, %	Electricity, produced by Hydro			
				Total, mln. kW·h	Growth rate, %	Percent rate %	capacity ≤10000 kW
2000	171445	–	–	11392	–	–	11219
2001	172972	101	1	12146	101	1	11950
2002	173734	100	0	9754	100	0	9549
2003	180360	104	4	9357	96	–4	9195
2004	182165	101	1	11852	127	27	11666
2005	186055	102	2	12472	105	5	12221
2006	193381	104	4	13010	104	4	12723
2007	196251	101	1	10229	79	–21	10022
2008	192586	98	–2	11482	112	12	11244
2009	173619	90	–10	11910	104	4	11693
2010	188828	109	9	13130	110	10	12859
2011	194947	103	3	10925	83	–17	10237
2012	198878	102	2	10974	100	0	10278
2013	194377	98	–2	14450	132	32	13482
2014	182815	94	–6	9299	64	–36	8194
2015	163682	90	–10	6971	75	–25	5210

Source: calculated by authors using the official statistics [4, 5]

From 93 to 97 % of electricity in the previous years were produced by hydroelectric plants with the capacity that exceeded 10,000 kW and only in 2015 there was a drop in production of hydroelectricity through arid weather conditions and a significant increase in power generation on pumped hydro power plants.

In the future some increase of electricity production foreseen by reconstruction and modernization of existing hydropower facilities and using resources of small and medium rivers. Works should be done to transform the existing hydroelectric and pumped hydro power plants that will allow to increase significantly the regulatory capacity regarding to existing.

The advantages of hydroelectric power include:

- hydroelectric power plant activity is not accompanied by the emissions of carbon monoxide and carbon dioxide, oxides of nitrogen and sulfur, dust and other harmful pollutants and does not pollute the soil;

- water belongs to a renewable energy. The hydrological cycle replenishes the source of potential energy due to downfalls and drainage;

- hydroelectric power plant productivity is easily controlled by changing the flow rate of water supplied to the turbine;

- reservoir built for hydroelectric power, can be used as a recreation area;

- water in artificial reservoirs is rather clean. It is possible to use it for irrigation and as a drinking water and.

The disadvantages of hydroelectric power plants are:

- large enough reservoir flood large peaces of land that may be used for other purposes;

- destruction or accident cause a catastrophic dam always flooding downstream;

- construction of hydroelectric power plants ineffective in flat areas;

- prolonged drought reduces and may completely suspend electricity production at hydropower plants;

- the level of water in artificial reservoirs always changed dramatically, so construction near residential buildings is inappropriate;

- dam reduces the level of oxygen in the water, which can lead to the death of fish and impact plantage in the reservoir and around it;

- dam can break the fish spawning cycle. There are efforts to solve this problem, but it leads to raising costs for hydropower plants construction and operation.

A significant source of renewable energy is the solid biofuel mainly used to produce heat. The largest share in the final consumption of solid biofuels is in households — 85 %.

Most member countries of the Energy Community had special sampling statistical survey on households energy use. In Ukraine, due to the difficult political and economic circumstances, this topic is not studied enough.

Currently it is reasonable to make statistical analysis of energy use in households on the basis of available statistical information.

According to the International Energy Agency (IEA) data in the world residential sector accounts for 38 % of total heat use in 2010. In Ukraine, the final consumption of heat in household sector in 2010 made 41 % in 2015 — 38 % of the heat final consumption in Ukraine [2].

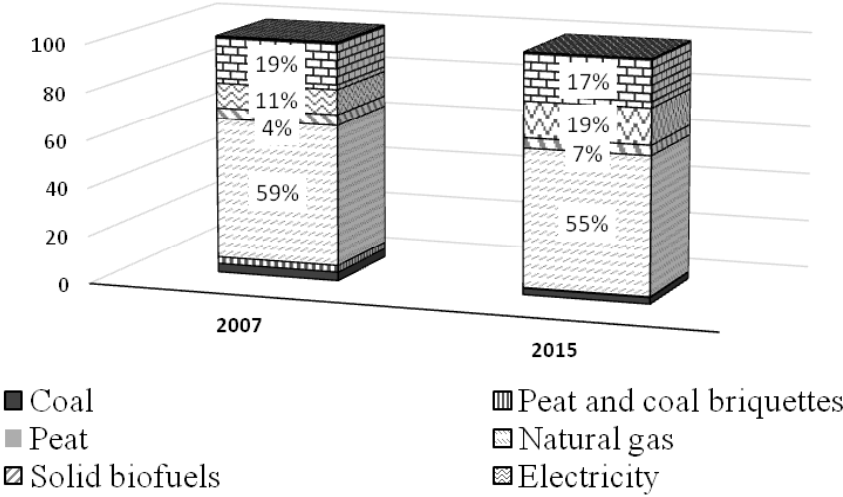


Fig. 2. Fuel and energy consumption in households of Ukraine in 2007, 2015, % [2]

In 2015 in total final energy consumption among the major energy end users in Ukraine the largest are household sector — 32.5 % and sector of industry — 32.2 %.

Analysis of energy balance structure in time series data showed that among energy used in the residential sector in the period from 2007 to 2015 the largest share in the consumption of natural gas

accounted for 59 % in 2012, 58 % in 2014. and 55 % in 2015. At the same time, analysis of energy intensity (table 2) indicates that most value of natural gas per thousand households observed in 2010-2011. Since 2012, there is a tendency of gradually reduction in the use of natural gas in households.

Table 2

ENERGY CONSUMPTION IN HOUSEHOLDS OF UKRAINE 2007—2015

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Вугілля, торф, брикети, ТЈ	60415	31694	23069	19929	29643	29936	28470	12142	12686
Нафтопродукти, ТЈ	29894	2847	2219	2512	3517	2973	1717	1340	586
Природний газ, ТЈ	559398	579453	553202	588790	588664	576104	565762	491656	380287
Solid biofuels, TJ	16412	45594	38560	38267	39230	39188	41700	44799	45929
Electricity, TJ	101739	112541	120831	132303	138499	138290	149008	140342	133307
Heat, TJ	195565	184345	186689	215202	188699	196026	195398	163160	120329
Amount of households, thsnd. for 31.12	17341,1	17199,0	17096,8	17050,3	17022,7	16984,1	16958,7	16784,6	16886,4
Consumed per thsnd. households.:									
Coal, peat briquettes, TJ/thsnd. households	3,484	1,843	1,349	1,169	1,741	1,763	1,679	0,723	0,751
Oil products, TJ/thsnd. households	1,724	0,166	0,130	0,147	0,207	0,175	0,101	0,080	0,035
Natural gas, TJ/thsnd. households.	32,259	33,691	32,357	34,533	34,581	33,920	33,361	29,292	22,520

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Solid biofuels, TJ/thsnd. households	0,946	2,651	2,255	2,244	2,305	2,307	2,459	2,669	2,720
Electricity, TJ/thsnd. households	5,867	6,543	7,067	7,760	8,136	8,142	8,787	8,361	7,894
Heat, TJ /thsnd. households	11,278	10,718	10,920	12,622	11,085	11,542	11,522	9,721	7,126

Source: calculated by authors using the official statistics [2, 7—14].

Instead, an increased the consumption of solid biofuels and waste, as well as electricity in 2015 that became the second according to its intensity among all types of energy used in households of Ukraine. Due to the temporary occupation of the Crimea, city of Sevastopol and the zone of ATO in 2014-2015 there has been a reduction in heat use of households, respectively 15.7 % and 38.2 % compared to 2013.

Together with other energy resources, significant volumes of natural gas are aimed to provide heating in households, so despite the slight decrease high energy intensity level show the indicators of heating and electricity consumption in households.

Conclusions. Determination of the priority areas for alternative energy development and evaluation of benefits and prospects of hydropower development is impossible without detailed analysis of the structure and dynamics of statistics in energetics as well as in the other sectors of the economy. To gain the best results the mentioned data should be used for detailed assessment, modelling and forecasting.

For decision-making and building an effective energy policy, it is important to have accurate, complete and comparable information obtained by applying the best international methodologies and approaches.

The article presents the results of the statistical method of efficiency evaluation in energy sector. The largest end-use sector namely residential was studied taking into account the best practices of the international approach to the problem; highlighted the prospects of renewable energy sources development namely hydropower as the most powerful source of energy for renewable electricity production.

Directions for future research:

- Final energy consumption in households energy intensity assessment according to the areas of use (heating, water heating, cooking, lighting and electricity supply for appliances, cooling);
- Comparative analysis of renewable energy use in households of Ukraine and the countries of the world;
- Additional data use and accounting impacts (climate, regional peculiarities);
- Consider to use the software SHARES for calculation the share of renewable energy consumption.

References

1. World Energy Outlook special briefing for COP21 «Energy and Climate Change» OECD / IEA, 2015. [Electronic resource]: — Access: <https://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf>
2. Energy balance of Ukraine in 2007—2015. [Electronic resource]: — Access: <http://www.ukrstat.gov.ua>
3. Baranyk Z. P. The condition and development of the energy security in Ukraine / Z. P. Baranyk, S. I. Bozhko // Market economy formation: coll. scientific articles — K.: KNEU, 2011.
4. Statistical Bulletin «Electricity and some technical and economic indicators of power plants in Ukraine» in 2007-2015. [Electronic resource]: — Access: <http://www.ukrstat.gov.ua>
5. Data of statistical observation forms No. 1-n (NPP) and No. 6 te
6. Dwelling Fund of Ukraine in 2007. Statistical Bulletin. — K.: State Statistics Committee of Ukraine, 2008. — 351 p.
7. Dwelling Fund of Ukraine in 2008. Statistical Bulletin. — K.: State Statistics Committee of Ukraine, 2009. — 351 p.
8. Dwelling Fund of Ukraine in 2009. Statistical Bulletin. — K.: State Statistics Committee of Ukraine, 2010. — 351 p.
9. Dwelling Fund of Ukraine in 2010. Statistical Bulletin. — K.: State Statistics Service of Ukraine, 2011. — 375 p.
10. Dwelling Fund of Ukraine in 2011. Statistical Bulletin. — K.: State Statistics Service of Ukraine, 2012. — 351 p.
11. Dwelling Fund of Ukraine in 2012. Statistical Bulletin. — K.: State Statistics Service of Ukraine, 2013. — 338 p.
12. Dwelling Fund of Ukraine in 2013. Statistical Bulletin. — K.: State Statistics Service of Ukraine, 2014. — 95 p.
13. Dwelling Fund of Ukraine in 2014. Statistical Bulletin. — K.: State Statistics Service of Ukraine, 2015. — 91 p.
14. Dwelling Fund of Ukraine in 2015. Statistical Bulletin. — K.: State Statistics Service of Ukraine, 2016. — 77 p.

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