

FORMATION OF ENERGY SAVINGS DIRECTIONS AT OIL AND FAT INDUSTRY ENTERPRISES OF UKRAINE

Popov Mykola, Ph.D. - Notovskyi Pavlo, Ph.D.

Associate Professor - Associate Professor
National technical University «Kharkiv Polytechnic Institute»
e-mail: pgpererva@gmail.com

ABSTRACT

In the Ukrainian economy, due to the high energy intensity of gross domestic product (2.6 times higher than the industrialized countries of the world), rising prices for traditional fuel and energy resources, increasing energy imports, the problem of energy saving in Ukraine is one of the topical and strategic value. One of the largest consumers of the fuel and energy resources of the food industry is the oil and fat industry. A generic indicator of the efficiency of energy use at the oil and fat industry is energy intensity of production, ie an indicator characterizing the total costs of fuel and energy resources for the production of a unit of finished products. The article analyzes in detail the indices of the use of fuel and energy resources as a whole for the oil and fat industry, for certain types of its products, as well as for individual enterprises of this industry.

The main priority directions of energy efficiency improvement in the oil and fat industry are identified and substantiated, which the authors refer to: creation of an energy complex for burning sunflower husk with obtaining heat and electricity, granulation of husk with its further use as an alternative bio-economic entity.

Specific recommendations have been developed to reduce the energy content of oil and fat products through the development of highly efficient energy-saving technologies, circuits, lines, units, units and energy-efficient equipment at industrial enterprises.

INTRODUCTION

The decisive tendency to solve urgent problems of development of social production is the activation of innovative activity of domestic enterprises. This fully meets the requirements of the current stage of functioning of such a significant sector of Ukrainian industry as oil and fat production.

In a competitive environment of oil and fat enterprises, with a steady increase in energy costs in the cost structure, low level of implementation of energy-saving technologies, the problem of innovative susceptibility to energy saving becomes of particular relevance and strategic importance in terms of ensuring competitive advantages of the market, as well as in terms of competitive advantages of products. border.

The need for oil and fat products both in the domestic market and abroad is one of the main incentives for further increase of its production volumes at the enterprises in our country. The favorable market environment, which is emerging in the world market for oil and fat products, contributes to the growth of exports of these goods. In addition, the accession to the WTO made its adjustments, which undoubtedly affected the development of the oil and fat complex of Ukraine. This proved to be a tougher requirement for products sold and increased competition. Therefore, improving the competitiveness of oil and fat products is a very pressing issue and is of strategic importance for Ukrainian enterprises.

Today, due to the high energy intensity of gross domestic product (2.6 times higher than the

industrialized countries of the world) (Popov, 2013), rising prices for traditional fuel and energy resources, increasing imports of energy, the problem of energy saving in Ukraine is one of the topical and has strategic importance. The oil and fat industry, which occupies one of the leading positions of the Ukrainian industrial sector in the formation of the state budget and export potential, is not an exception, since the tendency of energy consumption in the structure of the cost of production of production is increasing up to 40 - 45% at some enterprises (Kocziszky G., 2017).

ANALYSIS OF MAJOR ACHIEVEMENTS AND LITERATURE

Analysis of the current state and trends of the development of oil and fat production during 2012-2013 shows that the represented commodity group is one of the leading and budget-forming sectors of the agro-industrial complex of Ukraine at the expense of export potential, which accounts for 50.6% of total exports of food and processing products industry. It is determined that especially the dynamic development is acquired by the oil-producing complex - in the world ranking of producers of sunflower unrefined oil Ukraine in 2011 / 12-2012 / 13 marketing years is in the first place. However, the tendency of increasing the competitiveness of the oil-producing complex is constrained by the growth of energy costs in the cost structure. According to industry estimates, their share in the processing of raw materials (sunflower seeds under tolling conditions) is about 44%.

Some theoretical and methodological aspects of the economic efficiency of the oil and fat industry enterprises have been covered in the scientific literature of scientists, among them: Veres Somosi M. (2017, 2018), Kocziszky G. (2017, 2018), Pererva P.G. (2016, 2018), Sikorska M. (2016, 2017), Kobieliava T.O. (2016, 2017), Reichling P. (2017, 2018), Poberezhnyi R. (2014, 2016), Kosenko O.P. (2017, 2018), Gutsan O. (2017) and others.

However, despite significant scientific and methodological developments in this area, some problems of methodological and applied nature in terms of reducing the energy content of the oil and fat industry are not well-researched, including the issues of formation of an adequate level of innovative susceptibility to energy-saving technologies the typical beneficial effects of energy conservation of oil and fat production enterprises, the assessment of the efficiency of the use of alternative and renewable energy sources energy, methodological support for efficient choice of energy-saving technologies. There was virtually no consideration of the energy component, in particular indicators that determine the level of energy consumption per unit of output. In Ukraine, the cost of consumed fuel and energy resources in the oil and fat industry in Ukraine is as high as 5 ÷ 12%, which is primarily due to the fact that the economy has moved to the world prices for fuel and energy. Therefore, the issues of increasing the efficiency of use of fuel and energy resources, reducing their specific costs and reducing man-made impact on the environment 184 are urgent.

Therefore, the purpose of this article is to evaluate the consumption of energy resources by oil and fat industry and to develop measures to improve their efficient use.

RESEARCH RESULTS

At the present stage, one of the main problems of the Ukrainian economy is the high energy intensity of GDP, which amounts to 0.89 kg of conventional fuel per \$ 1 of manufactured products, which is 3-5 times higher than in developed countries (PopovM.O., 2013). The reason for the high energy intensity is the excessive consumption of energy resources per unit

of production in the industries and the imperfect sectoral structure of the economy. The food industry and processing of agricultural products is the most energy-intensive industry in the agro-industrial complex of Ukraine.

One of the largest consumers of the fuel and energy resources of the food industry is the oil and fat industry. A generic indicator of the efficiency of energy use at the oil and fat industry is energy intensity of production, ie an indicator characterizing the total costs of fuel and energy resources for the production of a unit of finished products.

The analysis (Table 1) shows that the most energy-intensive is the process of production of straw, which includes technological processes of hydrogenation, refining and deodorization. The estimated energy intensity is 217.0 kg / t (55.5% is thermal energy, 44.5% is electricity). With the full refining of the oil, the energy intensity is 131 kg / t (82.5% is thermal energy, 17.5 is electricity). In the production of margarine and mayonnaise, the energy intensity is 74.0 kg / t and 58.0 kg / t, respectively.

Table 1 - Energy intensity of oil and fat products
(number of kilograms of conventional fuel per tonne of product - kg / t)

Type of production of oil and fat industry	Energy consumption of products, kg / t
Unrefined sunflower oil	126, 18
Unrefined soybean oil	224, 25
Unrefined rapeseed oil	171, 46
The oil is refined	131, 29
Salomas	217, 58
Margarine products	46, 89
Mayonnaise	58, 05

On the basis of the analysis, trends of energy intensity of oil and fat products in the section of industrial enterprises were determined (Table 2).

Table 2 - Dynamics of energy intensity of production of production in the context of the oil and fat industry enterprises (number of kilograms of conventional fuel per ton of production - kg / t)

Company name	Year of observation				
	2014	2015	2016	2017	2018
<i>Production of unrefined sunflower oil</i>					
Poltava Oil Extraction Plant	95,68	98,13	97,49	89,05	85,76
Dnipro Oil Extraction Plant	66,84	66,83	65,33	60,36	62,16
Prikolotnyan Oil and Extraction Plant	115,20	119,70	119,67	115,37	114,64
Chernivtsi oil and fat plant	129,10	165,26	122,94	121,61	111,98
Svativska Oil LLC	175,43	175,43	165,18	145,66	150,42
Volchansk Oil Extraction Plant	160,02	151,67	148,16	142,74	140,57
Melitopol Oil Extraction Plant	174,08	174,31	167,81	155,23	152,49
Zaporozhye oil and fat combine	141,59	141,42	141,25	141,09	98,25
Kropyvnytskyi Oil PJSC	156,59	136,45	138,48	137,42	170,99
<i>Production of mayonnaise products</i>					
Poltava Oil Extraction Plant	-	58,22	65,09	40,56	40,57
Dnipro Oil Extraction Plant	32,11	32,08	32,03	30,33	31,01
Prikolotnyan Oil and Extraction Plant	-	31,44	31,41	28,18	27,84
Chernivtsi oil and fat plant	170,12	163,76	170,75	117,85	103,15
<i>Production of margarine products</i>					
Kharkiv Oil and Fat Plant	58,89	58,89	58,98	58,46	56,45
Kiev margarine plant	60,95	60,95	62,44	62,56	62,39
Nizhyn Fat Combine	65,36	65,36	64,88	63,18	62,41
Kharkiv Oil and Fat Plant	43,75	43,33	43,34	43,29	43,09
Lviv fat factory	43,90	43,23	41,28	41,85	42,52
Kiev margarine plant	35,20	35,19	35,23	35,93	35,23

Source: calculated by the authors based on the data of the oil and fat enterprises

The data presented in table 1 indicate that, as a whole, in the industry there is a tendency to reduce the energy intensity of production of oil and fat products. However, by examining this indicator for individual industrial enterprises, it can be observed its significant fluctuations. Thus, at the enterprises for the production of unrefined sunflower oil, the production of the Dnipro oil-extraction plant – 62,16 kg / t and the Poltava oil-extraction plant – 85,76 kg / t is the least energy-intensive. The energy intensity of Zaporizhzhya Oil and Fat Plant is not much higher – 98,25 kg/t. It should be noted that from 2014 to 2017 at Zaporizhzhya oil and fat plant energy intensity was almost at the same level (141,59 – 141,09 kg / t), and in 2018 was – 98,25 kg / t, that is, the indicator decreased 1,5 times. This can be explained, first of all, by a radical reconstruction of the company with the construction of new energy-saving facilities and the installation of modern energy-efficient equipment. At the same time, the most energy-intensive is the production of unrefined sunflower oil at such enterprises as: Melitopol Oil and Extraction Plant – 152,49 kg / t, LLC "Svativska Oil" – 150,42 kg/t, Volchansk Oil and Extraction Plant – 140,57 kg/t and PJSC "Kropyvnytskyi Oil" - 170,99 kg/t. The main reason for the high energy intensity at these enterprises is due to the use of outdated technological lines, which have sufficiently high physical and moral deterioration of equipment and low level of automation and mechanization of the production process. Let us note the jump of

intensive growth of this indicator in 2018 at PJSC "Kropyvnytskyi Oil". Thus, according to the specialists of the enterprise, the main factor in such a situation is the reconstruction of the boiler house with the installation of a cogeneration unit for the production of heat and electricity. In the context of refined sunflower oil production enterprises, the highest utilization of fuel and energy resources per unit of production is observed at the Chernivtsi oil and fat plant – 103,15 kg / t, while the least energy-intensive is the production at the Prikolotnyan oil and extraction plant and 27 kg / t. Dnipro oil extraction plant – 31,01 kg / t. At the studied enterprises for the production of margarine and mayonnaise products, the trends of energy intensity during 2014 - 2018 are practically unchanged.

At the same time, the expenditures of fuel and energy resources for the production of a unit of relevant products by enterprises are almost at the same level. This provision indicates a lack of innovative sensitivity and activation for energy efficiency in the production of this type of product.

Therefore, based on the above analysis, we can conclude that, given the rather slow tendency to reduce the energy consumption of oil and fat products, as well as the significant variation of this indicator in the context of industrial enterprises, the implementation of energy-saving measures in the production activities of economic entities is an indispensable strategy direction. This issue is especially relevant in the realities of the current market economy of Ukraine, since the level of energy efficiency is one of the determining factors in the formation of competitiveness of products both in the domestic market and abroad. The review and systematization of scientific works on this issue allows to distinguish priority energy-saving measures in the oil and fat industry (Popov M.O., 2015):

- optimization of processes for the organization of movement and interaction of material and energy flows in existing devices, units, installations, lines and schemes of production, as well as their improvement;

- creation of an energy complex for combustion of sunflower husk with obtaining heat and electricity;

- development of recommendations for increasing the efficiency of boilers operating on the hull;

- use of self-regulating electric cables;

- use of vacuum pumps with electric drives instead of steam-jet units;

- improvement of the regulatory framework for energy conservation in the oil and fat industry;

- introduction of information-mathematical model of energy technology complex using pinch-analysis of heat-exchange systems and technological schemes of oil-fat production;

- use of heat of extraction oil for preheating of the locale;

- use of cogeneration unit. Cogeneration is a combined process of producing heat and electricity. The main impetus for the use of this facility is the amendments to the Law of Ukraine "On Electricity" (The Law, 2013) according to which electricity produced using alternative sources of energy should be purchased at a higher price than traditional generation. And as you know, in the oil-extraction plants as an alternative source of energy is used sunflower husk;

- revision of the legal framework on energy conservation and definition of organizational, technical and scientific tasks, the implementation of which will provide significant savings of fuel and energy resources.

- energy audit and energy management;

- introduction of energy-saving technologies and new equipment and materials, replacement of obsolete and physically outdated steam boilers, boiler-auxiliary equipment, modernization of the equipment taking into account the saving of fuel and energy resources, increasing its reliability, environmental protection;

- attraction of non-traditional renewable energy sources. Oil and fat plants already have experience in using biomass, namely sunflower husk, to produce heat as steam. In our opinion, there are also other potential non-traditional renewable energy sources, such as solar, wind, low-energy, geothermal, and others.

Today, due to the high energy intensity of gross domestic product (2.6 times higher than the industrialized countries of the world) (Poberezhnyi R., 2014), rising prices for traditional fuel and energy resources, increasing energy imports, the problem of energy saving in Ukraine is one of the topical and has strategic importance. The oil and fat industry, which occupies one of the leading positions of the Ukrainian industrial sector in the formation of the state budget and export potential, is not an exception, since the tendency of energy consumption in the structure of the cost of production of production is increasing up to 40 - 45% at some enterprises (Reichling P., 2017).

The main priority areas for improving energy efficiency in the oil and fat industry include:

1. Creation of an energy complex for combustion of sunflower husk to produce heat and electricity (cogeneration) Cogeneration is a combined production of thermal and electric energy (Popov M.O., 2012).

The main tasks of the energy complex include the following:

- complete and reliable burning of sunflower husk. This requirement is provided by the husk accumulation and transportation system and a special power boiler.

- reliable production of technological steam;

- generation of electricity. Provides a modern, high efficiency steam turbine with a wide load range;

- compliance with environmental requirements of Ukrainian and European standards.

2. Granulation of the husk and its further use as an alternative biofuel According to 2018 data, Ukraine received 1169.2 thousand tons of sunflower husk. At the same time, 818.44 thousand tonnes were burned in boilers, 273.5 thousand tonnes were granulated and 77.26 thousand tonnes were placed on landfills. That is, there is a significant reserve of unused husk, which is expedient to be processed into pellets with their subsequent use as an alternative eco-friendly biofuel. Granular fuel has several advantages, namely: consistent quality characteristics, convenient storage, the ability to use in systems with automatic fuel supply, solves the problem of environmentally friendly waste disposal.

The technology for the production of fuel pellets includes the following basic operations:

- preliminary preparation of raw materials;

- obtaining granules;

- operations with finished granules.

3. Organization of a rational condensate farm.

A rational organization of the condensate economy can be achieved by implementing a number of simple and relatively easily feasible measures, which include, first of all, the following:

- proper operation of condensate systems, ensuring timely and complete removal of condensate from heat consuming appliances, heating appliances and steam lines, with maximum use of the heat contained therein;

- installation of modern steam-locking devices that prevent condensate pipelines from flowing into the condensate line;
- elimination of condensate losses due to condensation line leakage and collections overflow; thermal insulation of condensate lines and in general of all heat consuming equipment; cleaning of condensate from oils and other contaminants that prevent its use for powering steam boilers;
- equipping condensate systems with the necessary measuring instruments; automation of condensate removal from condensate tanks and regulation of condensate system operation.

CONCLUSIONS

Thus, on the basis of the conducted research, it is possible to reach the following conclusions:

- trends in energy consumption of oil and fat production have a slow decline;
- at most oil and fat plants the use of fuel and energy resources per unit of output is too high;
- energy saving in the context of increasing demand for Ukrainian oil and fat products is a priority area for improving energy efficiency and, accordingly, ensuring the competitiveness of enterprises in the domestic and world markets.

The authors prove that to increase the level of competitiveness of oil and fat products in both the domestic and world markets, one of the potential directions is to increase energy efficiency and, accordingly, to reduce the costs of heat and electricity in the cost structure. Therefore, energy conservation at the oil and fat industry is one of the key issues to date.

The development and implementation of energy efficiency trends proposed in this study will reduce fuel consumption by 10-15% and increase the competitiveness of oil and fat product markets both domestically and internationally.

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