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Alternative sources and problems of energy saving in Ukraine

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ALTERNATIVE SOURCES AND PROBLEMS OF ENERGY SAVING IN UKRAINE

ABSTRACT

In our time energy-saving technologies are key trends of the global economy. They are using in almost all spheres of human activity, including the food industry. They help to raise the level and quality of life, the international competitiveness of the economy in general and competitiveness of the enterprise's production and to consolidate as national as food safety of the country.

Author reveals the following questions: analyzed such energy saving characteristics as economic efficiency and energy intensity of gross domestic product; offering of a conceptual framework of the types alternative sources of energy and their definitions, which meets Ukrainian legislation and take in account European experience; analyzed the structure of capacity of different sources of alternative energy in Ukraine; proved that food industry and processing of agricultural products is the most energy intensive industry in the agricultural sector in Ukraine; the proposals of energy saving technologies for food enterprises were given; opened connection between the food safety of the country and energy saving processes.

Keywords: energy saving, alternative sources of energy, food safety, food industry

Introduction

Ukraine, as a nonvolatile country, continues to search for new ways of energy generating, while maintaining the environment. To achieve energy policy goals of

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sustainability, security of supply and improved competitiveness, the production of renewable energy is promoted across Europe.

To produce quality products in the right quantities and at acceptable prices, to develop and to implement modern biological technologies, to modernize industry, to attract investments, to operate successfully and to develop food industry in Ukraine, aimed primarily at ensuring food security of the country, it is necessary to use the basic principles of energy efficiency and energy saving technologies.

1. Energy-saving technologies in Ukraine

Energy-saving technologies should be used as on the food enterprises, in the process of production and auxiliary processes, as outside of them. Then in the general summation the result will be justified and can be seen at the level of national and food safety of the country.

High economic efficiency is one of the energy saving characteristics. The cost per ton of conditional fuel (t.c.f.), got from energy saving, is several times less than the cost of its production or sale. Therefore, for Ukraine increasing of energy efficiency and energy saving is a strategic line of economy and social development in the short and long-term periods.

The energy intensity of gross domestic product is a generalized macroeconomic indicator, which reflects the level of fuel and energy consumption per unit of gross domestic product. And at the same time is one of the fundamental characteristics of the economy of each country¹.

According to statistics of the International Energy Agency and the state statistics organization energy intensity of gross domestic product (GDP) in Ukraine was 0.4 t.c.f. per \$ 1 in 2011 (0.5 kg of oil equivalent per \$ 1.). Thus energy intensity of production in Ukraine is 2.6 times higher than the world average level, for example such countries as Denmark and Japan have 0.1 kg, UK has 0.14 kg, Germany and France have 0.18 kg, USA has 0.21 kg, Russia has 0.47 kg of oil equivalent to \$ 1 (Figure 1).

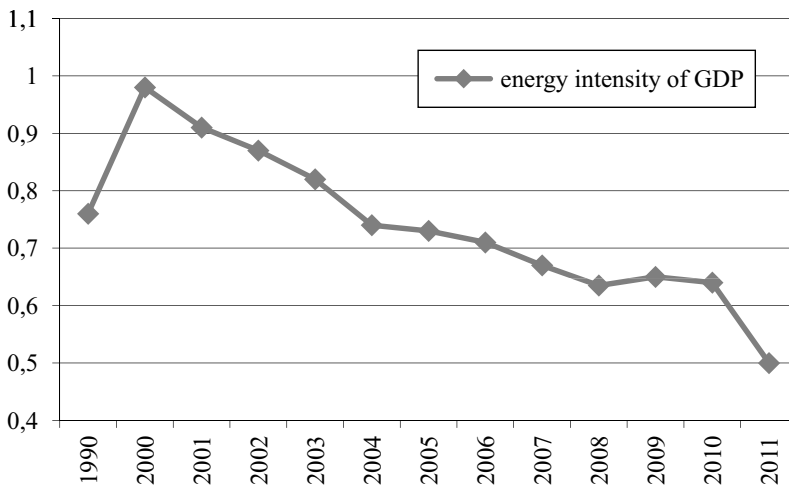
Despite that, it is necessary to note, that in 2000–2008 years in Ukraine GDP has been reduced from 0, 98 to 0.635 kg.c.f. / UAH. In 2009 the energy intensity of

¹ Ю.В. Дзядикевич, М.В. Буряк, Р.І. Розум, *Енергетичний менеджмент*, Тернопіль: Економічна думка, 2010, s. 295.

GDP increased by 1.4% and amounted to 0.65 kg.c.f. / UAH, which was caused by substantial reduction of GDP by 15% due to the crisis processes in the country. However, in 2010 – 2011 years energy intensity of GDP significantly decreased, which was caused by the implementation of energy saving policy and the reforming of housing – communal sphere. Despite the positive trend Ukraine's economy is still one of the most energy-intensive in comparison with developed countries of Europe².

Rising of prices on energy, shortage of supplying of traditional fuels and problems of environmental pollution activate questions against society. These questions are connected to the process of finding alternative sources of energy and new energy technologies. This problem poses a number of covert, but no less important issues, one of them is the implementation of optimal mechanisms for using alternative energy in the country.

Figure 1. Energy intensity of GDP in Ukraine from 1990 till 2011



Source: compiled by author according to Дзядикевич Ю.В., М.В. Буряк, П.І. Розум.

According to the State Program of the economy activation, which was presented on February 27, 2013 at a meeting of the Cabinet of Ministers, Ukraine

² Державний комітет статистики України. Офіційний сайт, www.ukrstat.gov.ua/ (2.06.2014).

will attempt to reduce consumption rate on 1.5–3% per year. Absolute priority of the government in 2013–2014 years will be increasing of energy efficiency³. For developing a positive trend of reducing energy intensity of GDP in recent years, economic mechanisms, which encourage energy savings will be improved. In particular, energy efficiency, including using of alternative energy, will be one of the most important conditions of any form of state support for enterprises. In addition, State program provides further implementation of projects aimed at ensuring energy safety of the country and the establishment of alternative energy sources.

In the EU since 2001 the clear classification of renewable energy is being existed⁴:

- wind energy (onshore and offshore),
- solar energy (photovoltaic and solar thermal power plants),
- geothermal energy,
- hydropower (in small and large scale),
- wave energy,
- tidal power,
- biomass,
- biogas (including waste and sewage gas).

2. Alternative sources of energy

European directive that defines this classification contains categorical instrumentations with clear details of all known at this moment sources of alternative energy. In comparison, Ukrainian legislation does not contain many explanations for these definitions. It leads to leaving out important types of alternative energy sources, to uninforming entrepreneurs about the possibilities of using alternative energy in enterprises in all sectors of economy. Therefore, we analyzed number of references, generalized and systematized a number of diverse concepts about

³ Законодавча база України. Офіційний сайт, www.rada.gov (04.06.2014).

⁴ Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions. Action Plan to Improve Energy Efficiency in the European Community, Brussels, 29.02.2000.

alternative sources of energy and decided to offer a conceptual framework of the alternative sources of energy. Formulated definitions do not conflict with Ukrainian legislation and take in account European experience (Table 1).

Table 1. Definitions of alternative sources of energy

| Category | Definition |
|--|--|
| Wind energy | Form of alternative (renewable) energy, source of it is sun and it is based on the kinetic energy of the wind that is converted to electricity. |
| Solar energy | Form of alternative (renewable) energy, which uses energy flow from a natural source (which has a much higher temperature than traditional technical sources) and converts it into energy in any convenient for its using form. |
| Geothermal energy | Form of alternative (renewable) energy, which is based on using of deep geothermal energy reserves and their subsequent transformation into heat and in some cases electrical energy. |
| Aquatic alternative sources of energy: | |
| – Hydropower | Form of alternative (renewable) energy, which is a system of converting the energy of hydraulic flow of falling water into mechanical, but more likely to electrical energy. |
| – Wave energy | Form of alternative (renewable) energy, which is a method of producing electrical energy by converting the potential energy into kinetic energy of waves. |
| – Tidal energy | Form of alternative (renewable) energy, which uses tidal power to further its transformation into electrical energy. |
| Biomass | Organic compound of carbon, which in combination with oxygen (which occurs during photosynthesis under the influence of solar radiation, which is a natural option of converting solar energy) during the combustion or resulting from natural metabolism produce heat. Biomass under the influence of chemical or biochemical processes can be transformed into heat, electricity, bio-fuel (gaseous methane, methanol, liquid or solid charcoal) and biogas. |

Source: compiled by author.

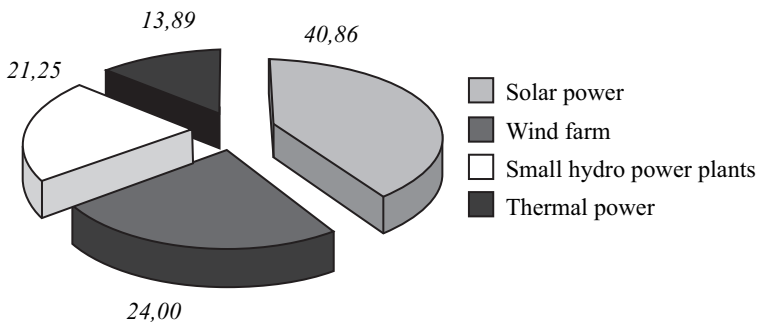
The most important national projects that were implemented in 2011 are such as a solar power plant of 7.5 MW in the Autonomous Republic of Crimea, p. Rodnikova Simferopol district; a solar power plant in Ohotnikova Saki region (also in the Crimea) with 80 MW; a solar power plant in the village Sloboda-Bushanskaya Vinnitsa region 0.6 MW.

In the segment of wind power at the end of 2010 year was commissioned Phase 1 of wind Ochakovskaya plant total capacity of which is 25 MW. Electricity gener-

ated at this station will be fed into the network of Mykolaivska district energy company and served consumers Ochakov district Mykolaiv region. It is planned that the annual electricity production will be $72000 \text{ MW} \cdot \text{h}^5$.

Besides in the Ukrainian market of alternative energy there are two industrial plants for the production of bio-fuels with a total capacity of about 30 thousand tons per year. One of them is located in Donetsk and produce bio-fuels (gasoline A-98a, A-95A and A-92A with 30% ethanol content). Its capacity is 20 tons per day. The capacity of Ukrainian alternative sources of energy in percents is shown on the Figure 2.

Figure 2. Capacity of different sources of alternative energy in Ukraine



Source: compiled by author.

Overall, at the end of 2011, the total installed capacity of Ukrainian alternative energy is more than 450 MW. In this case, to solar power belongs 200 MW, to wind farm – 117.5 MW, to small hydro power plants – 104 MW and thermal power generation facilities on alternative fuel (agricultural and wood waste) – 68 MW. And the amount of investment, according to the National Agency for Energy Conservation and Energy Efficiency in Ukraine in renewable energy over the last year is estimated at more than EUR 400 million⁶.

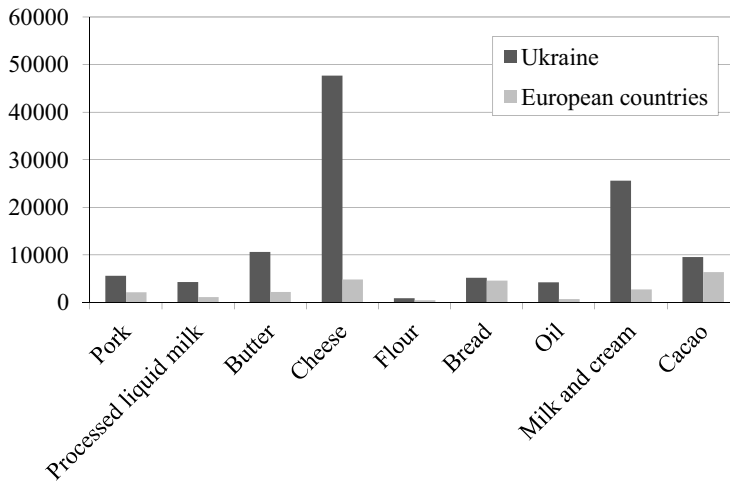
⁵ Державний комітет статистики України. Офіційний сайт, www.ukrstat.gov.ua/ (2.06.2014).

⁶ *Ibidem*.

3. Structural and technological restructuring of the food industry

Food industry and processing of agricultural products is the most energy intensive industry in the agricultural sector of Ukraine. The value of the specific energy consumption for food production in Ukraine is much higher than rates in Europe (Figure 3).

Figure 3. Energy consumption for food production in Ukraine and in Europe



Source: compiled by author according to the Nicolosi M., Fuersch M.

It means that, if in Europe the production of one ton of cheese consumed 4800 MJ, in Ukraine it is 47 688 MJ, or 9.93 times more, milk and cream 2700 MJ and 25,615 MJ, or 9.5 times more. Costs of production of butter are at 4.8 times higher (10,478 MJ / t in Ukraine to 2200 MJ / t in Europe) and 6.25 times higher into production of oil (4199 MJ / t to 672 MJ / t), 3,9 times more higher into production of liquid milk (4294 MJ / t in Ukraine to 1100 MJ / t in Europe)⁷.

The question is arising about reducing of energy intensity of food. Structural and technological restructuring of the food industry with improving energy efficien-

⁷ M. Nicolosi, M. Fuersch, *Implications of the European Renewables Directive on RES-E Support Scheme Designs and its Impact on the Conventional Power Markets*, International Association for Energy Economics, 2009, s. 25–29.

cy and energy conservation involves withdrawing obsolete and worn out equipment, discontinuation of inefficient in terms of energy production and introduction of innovative technologies, equipment and automatic systems. An important part of technological measures related to the modernization and improvement of processes aimed at increasing the complexity of using energy resources, reducing losses, optimization modes.

Perspective way of solving this problem is using of energy-saving technologies and the implementation and using sources of alternative energy.

And also it is necessary to intrduce new alternative energy. According to the Lviv center energy efficiency and energy management, Ukraine could have 60 million tons of fuel annually from renewable energy (approximately now Ukraine takes about 220 million tons of standard fuel). This means that country can substitute with alternative forms of energy about 30% of the energy needs.

Especially effective in Ukraine could be production of bio-fuels. In Ukraine, can be build 2950 biogas plants, including 300 units for pig plants, 150 – on poultry farms and 2,500 – on farms and cattle food industry.

If these proposals are done capacity will be 7523 MWth (megawatt of thermal energy) and 492 MWe (megawatt of energy), and getting biogas at 10–15 billion m³ / year. This will lead to the replacement of 4.83 million t.c.f./ per year and reducing of CO₂ emissions by 7.3 million tons / year.

In Ukraine there is a problem of creating energy plantations, such as corn, which is one of the most efficient storage of solar energy in the form of biomass and provides the energy in equivalent about 15 t.c.f./ per hectare. Can also be used sowing of other crops with a large vegetative mass (rapeseed and other oilseeds). In the future, may also acquire development of cultivation, on a commercial basis at inconvenient and unsuitable for the farming lands, fast-growing (for 3–5 years) trees (poplar, ash, willow, etc.) for further their long-term using as fuel for thermal power plants. These trees have a relatively high value of heat of combustion equal to 20.8 – 20.7 MJ / kg of dry wood. But when growing so-called energy plantations (canola, corn, etc.) it is necessary to remember about food safety and independence of Ukraine. It is important to prevent such situation that Ukraine will not have grain and other food crops. Also effective in Ukraine will be growing of algae with their subsequent processing into bio-fuels⁸.

⁸ Ю.В. Дзядикевич, М.В. Буряк, Р.І. Розум, *Енергетичний менеджмент*, Тернопіль Економічна думка, 2010, s 295.

Energy strategy was approved by the Government in early 2006. The strategy paper suggests increasing of using alternative energy sources by the year 2030 to 40.4 tons of oil equivalent. The highest growth is expected in using of solar energy and wind power. In 2030, the total capacity of power plants for the production of electricity from alternative energy sources (excluding bio-fuels and small hydro) should grows to 2.1 GW. State program on energy conservation and efficiency determines that by 2015 the share of „green” energy in the total energy balance of the country should be not less than 10%, and by 2030 this figure should reach 30%⁹.

As well as energy savings, the concept of food safety “From Farm to Table” has been taking place in food and food related fields, and many food manufacturers have introduced HACCP or ISO22000 management systems in order to increase the level of food safety.

These systems consist of hardware, software, and cooperative working of both factors, which is essential for their effective function.

On the other hand, food related accidents or troubles have occurred frequently and threatened food safety. In addition, most of these are in the field of food processing and manufacturing steps.

When considering from the view of energy savings, some reasons for these accidents are not only improper application of energy savings and manpower savings to those steps but also managers’ misunderstanding or lack of awareness of energy savings and food safety.

Introduction of reasonable and effective energy savings and manpower positioning will be required and lead to an increase in trust of factories among consumers.

Conclusion

Ukraine has great potential for alternative and renewable energy, but to use it and to implement this energy potential Ukraine needs to develop national and regional programs and regulations. As well as attracting significant investment from the state.

In Ukraine energy potentials should be developed as the potential of solar energy, potential of wind energy, potential of peat, potential of energy excess pressure natural gas, the potential of geothermal energy, the energy potential of methane, the energy potential of small rivers.

⁹ Энергетична стратегія України на період до 2030 року від березня 2006 року, nr 145.

Food industry enterprises in Ukraine should take into account that the best technical and economic indicators of using alternative energy sources will be achieved when combined production of heat and electricity, as well as combinations of both between themselves and with the technique and technology of food and beverages.

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ALTERNATYWNE ŹRÓDŁA ENERGII I KWESTIE OSZCZĘDZANIA ENERGII NA UKRAINIE

Abstrakt

W naszych czasach rozwój technologii energooszczędnych jest jednym z najważniejszych trendów w gospodarce światowej. Stosowane są one niemal we wszystkich sferach ludzkiej aktywności, w tym w przemyśle spożywczym. Przyczyniają się do podniesienia poziomu i jakości życia, międzynarodowej konkurencyjności gospodarki i przedsiębiorstw produkcyjnych, jak i do ogólnokrajowej konsolidacji i bezpieczeństwa żywności w kraju.

Autor prezentuje następujące zagadnienia: analiza takich czynników, jak oszczędność energii i ekonomiczna efektywność energochłonności produktu krajowego brutto; propozycja ramowej koncepcji różnych rodzajów alternatywnych źródeł energii oraz ich definicji, która spełnia warunki ukraińskiego ustawodawstwa i uwzględnia doświadczenia europejskie; analiza struktury możliwości różnych źródeł alternatywnej energii na Ukrainie; dowód na to, że przemysł spożywczy i przetwórstwo produktów rolnych to najbardziej energochłon-

na gałęź przemysłu w sektorze rolniczym na Ukrainie; propozycje energooszczędnych technologii dla przedsiębiorstw spożywczych; połączenie między bezpieczeństwem żywności w kraju i procesami oszczędzania energii.

Słowa kluczowe: oszczędzanie energii, alternatywne źródła energii, bezpieczeństwo żywności, przemysł spożywczy.

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