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FOREIGN EXPERIENCE OF MODERN MECHANISM OF SOLID INDUSTRIAL WASTE MANAGEMENT SYSTEM FUNCTIONING

Abstract. In the paper the experience of foreign systems of solid waste management is analyzed. The common European policy on waste management, its principles and guidelines are considered. The best practices of some countries that have achieved notable successes in resource saving and solid industrial waste recycling is studied. The levels of waste treatment hierarchy are analyzed and the necessity of building "recycling society" is proved in the article. The major economic instruments of environmental friendly and resource saving activities including the scheme "pay as much as throw away", various taxes for disposal, utilization and / or transportation of waste, compensation / reduction of tax rates for the disposal and / or departure of waste, product certificates or product environmental permits, plans for waste prevention in different sectors of the economy, the transfer of responsibility for the production of waste to the manufacturer, voluntary agreements are named. The conclusion on the possibility of implementing international experience in Ukraine is done.

Keywords: foreign experience, waste management, solid industrial waste, management system, waste treatment.

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ЗАРУБІЖНИЙ ДОСВІД ФУНКЦІОНУВАННЯ СУЧАСНОГО МЕХАНІЗМУ СИСТЕМИ УПРАВЛІННЯ ТВЕРДИМИ ПОБУТОВИМИ ВІДХОДАМИ

Анотація. В статті проаналізовано сучасний зарубіжний досвід організації систем управління твердими побутовими відходами. Розглянуто загальноєвропейську політику у сфері поводження з відходами, її принципи та орієнтири. Досліджено кращі практики окремих країн, що досягли помітних успіхів у ресурсозбереженні та рециклінгу твердих побутових відходів. Зроблено висновок щодо можливості імплементації зарубіжного досвіду в Україні.

Ключові слова: зарубіжний досвід, управління відходами, тверді побутові відходи, система управління, поводження з відходами.

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ЗАРУБЕЖНЫЙ ОПЫТ ФУНКЦИОНИРОВАНИЯ СОВЕРМЕННОГО МЕХАНИЗМА СИСТЕМЫ УПРАВЛЕНИЯ ТВЕРДЫМИ ПРОМЫШЛЕННЫМИ ОТХОДАМИ

Аннотация. В статье проанализирован современный зарубежный опыт организации систем управления твердыми промышленными отходами. Рассмотрена общеевропейская политика в сфере обращения с отходами, ее принципы и ориентиры. Исследованы лучшие

практики отдельных стран, которые достигли заметных успехов в ресурсосбережении и рециклинге твердых промышленных отходов. Сделано вывод относительно возможности имплементации зарубежного опыта в Украине.

Ключевые слова: зарубежный опыт, управление отходами, твердые промышленные отходы, система управления, обращение с отходами.

Формул: 0; рис .: 1, табл .: 0, библ .: 14

Introduction. A characteristic feature of the present stage of post-industrial society is the tendency to move to a more advanced level of waste management. This level of waste treatment is called Integrated Solid Waste Management – an integrated waste management system, based on the conceptual principles of minimization of forming, reliable methods of waste disposal and liquidation at a maximum recovery of useful materials and energy [1].

94% of the materials involved in the production process become waste before the release of the final product, and 80% of manufactured products are discarded after a single use [2]. Today about 99% of raw materials used in the manufacturing or which are components of the goods produced in the United States, become waste within six weeks after the sale. According to the scientists of Wuppertal Institute estimations, currently 10% of the world population consumes about 50% of the resources, while only the US uses 1/3 of the world's materials [3]. Such irrational and imbalanced using of natural resources causes their depletion and progressive accumulation of waste in the environment, raises the task of multiple growth of production efficiency.

Analysis of publications and tasks raising. The study of literary sources testifies that the theoretical base of scientific researches and practical problems solving in the area of forming the system of wastes management in the context of sustainable development is created due to efforts of such foreign and Ukrainian researchers: D. Jacobs & A. De Man, M. Enright, M. Porter, E. Yehoue, S. Tiwari & J. Vinals, M. Voynarenko, O. Demedyuk, O. Kushniretska, G. Kleyner, A. Sigayov and others. They probed different aspects of resource saving and waste reduction in different countries in connection with an increase of economy competitiveness and key problems of forming and functioning of wastes management system. At the same time, the most effective tools of waste management abroad and their branch complex in the context of “zero-waste” management system introduction are still not enough developed.

The aim of the article is to study the best international practices of waste management systems, particularly in Europe, taking into account the priority of Ukraine's European integration.

Results. At the European level a number of measures and projects aimed at minimizing waste and preventing their formation are already implemented. These measures and projects allow us to estimate the potential of some instruments – political, economic and informational that can be used in this area. These instruments, firstly, stimulate the reduction of waste, and secondly, promote wider application of the most preferred waste management technologies (e.g. recycling).

According to many researchers, and we should agree with that, the starting point of waste minimization is creating products, in which initially is the possibility of reuse or safe recycling:

- An increase of the products useful life allows to reduce the need to replace it with a new unit, thereby reducing the amount of resources involved in its production, and the amount of waste generated;

- Warning waste forming by, firstly, the application of advanced low- and non-waste production technologies, and secondly, the maximum use of waste as secondary resources. This approach matches the best concept of "zero waste" by R. Murray, according to which wastes are considered as free full value production resources which allow to improve

significantly the efficiency of economic activity. In this case, the basic principle of the production organization is that it is closed, assuming full involvement of waste generated in the next production cycles as raw materials [4].

Implementation of the considered approaches in management practice in developed countries has led to the achievement of significant environmental and economic results in waste management. European community nowadays is aimed at achieving sustainable development and adheres to the following basic ecological and political principles [5]:

- The principle of preventive action, i.e. community activities aimed at the prevention, prophylaxis of pollution or other environmental damage. The threat of harm to the environment should be taken into account in advance when making decisions, rather than later in the event of contamination;
- The principle of damage compensation to the environment, and the main method of implementation of this principle – the elimination of damage sources. This principle obliges when it is impossible to avoid damage to the environment – "minimize" it, to keep it from spreading and eliminate it as soon as possible;
- The principle of cooperation in which conflicts are resolved by mutual agreement with the participation of all parties;
- The principle of origin combines economic, environmental and organizational aspects of waste management practices. It implies the removal of waste to the site, located as close to the point of generation as possible. It is important here that the transportation of waste would not negatively impact on the environment, as well as risk of illegal dumping and export of waste to other regions or countries should be minimized.

Application of these principles is intended to encourage consumption of renewable and non-renewable resources not exceeding the limits of environment endurance. This can be achieved through the elimination of economic growth from resource consumption, use resources more efficiently and reduce the amount of waste generated [6].

Waste management in the EU includes an integrated approach in order to ensure maximum safety for the environment in waste management and at the same time retrieval the greatest economic benefits of the various components of waste. The foundations of modern sustainable waste management in the EU were established in the early 70th of XX century in order to harmonize the scope of waste management and irrational use of natural resources potential in market conditions prevention. Currently waste management in the European Union is an integral part of the national environmental policy and its key features are focus and consistence. In modern conditions the EU members are focused on the transition from strategy «End of pipe» to the strategy «Clean Production», in which the center of gravity is transferred to the source of environmental problems, waste prevention and reduction, optimization of production processes in the entire system of products lifecycle [5].

In order to form a unified strategy in the field of waste management EU member states also use a common terminology in the field of waste management, stimulate the production of "green" products using eco-labeling schemes, use various methods of economic stimulation, including economic instruments such as taxes or charges for waste forming, transportation and disposal; sale of certificates for processing waste as secondary resources; collateral arrangements for beverage containers; customs duties on the goods importation into the country where processing of these products at the end of their life cycle is difficult, i. e. at the stage of transformation to waste and others.

Each EU country may apply its own laws, but they should not contradict the common European guidelines and enforce their claims handling waste disposal and providing the required level of environmental safety (country-specific laws may be more stringent than the common European directive, but not vice versa).

According to the Directive on waste 2008/98/EU the whole waste management system is based on the following hierarchy – universal model for dealing with any kind of waste. According to the hierarchy waste should be (fig. 1):

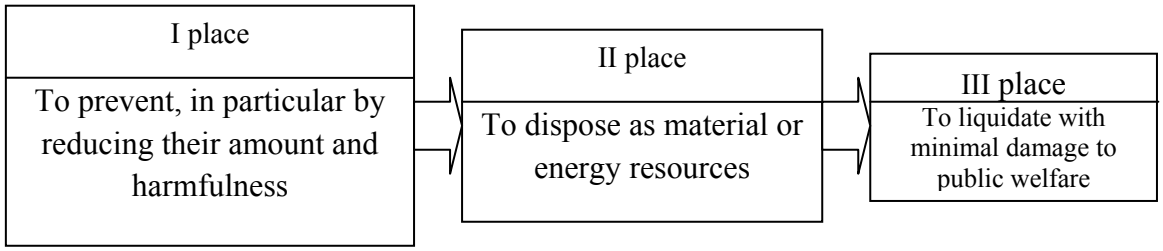

Fig. 1. Levels of waste treatment hierarchy[*)]

[*)] developed by author on the basis of [6]

Waste prevention is closely linked with the raising of efficiency of natural resources using, changing consumer habits and decrease the amount of waste associated with products throughout their life cycle – in production, consumption and their transformation into waste.

Reducing of waste generation means making products with a longer useful life and lower consumption of materials and introducing less polluting production processes, and on the other hand, directing consumer choice and creating demand for goods and services with less impact on the environment.

Following the prevention of waste as the first principle of resources careful handling and reducing environmental pollution in second place among the options for sustainable management of waste is disposal of valuable substances which contains waste and their return to the economic cycle, in conditions of existence of appropriate cost-effective and environmentally friendly processes. In this case very important is important separation of certain waste types in their place of forming or during their reception and collection.

On this background, dumping of waste at landfills can not be considered as sustainable in the long term solution of waste disposal problem and simple incineration of unsorted waste is only a poor option because of the associated material losses, emissions and end residues with a high concentration of harmful substances. Moreover, waste disposal is the least preferred alternative of waste management [6].

According to the Framework Directive on waste 2008/98 / EU the European Union must become “Recycling-society” (Recyclinggesell-chaft), i.e. strive to achieve progress in the sense of moving up the hierarchy, i. e. departure from landfills and increasing the share of recycling and disposal. This statement constitutes the core strategy that takes into account environmental impacts and life cycle of resources. Waste management should be aimed at reducing environmental pollution by waste throughout the product life cycle – from production to recycling and elimination. Waste should be considered not only from the standpoint of environmental pollution to be reduced, but also as potentially recyclable products. Waste management become ultimately controlled material flow in order to be carefully handled with resources to achieve sustainable development of modern society and the needs of the well-being of future generations.

An important support for the practical implementation of the above mentioned objectives to achieve the principles of sustainable waste management are documents BREF (Best available techniques REFerence documents) for understanding enshrined in the legal instruments of the EU norms and almost the best reception. In European practice, the term "best available technology" (BAT) was first introduced at the legislative level by the European Directive 96/61/EU of 24 September 1996 "On Integrated Pollution Prevention and Control".

An efficiency increase of production resources using through the using of achievements of scientific and technological progress provides a multi-million dollar profits to Western companies. In particular, company SC Johnson for five years has increased the productivity of production by 50%, reducing the amount of waste twice, and received a profit $ 125 million US. DuPont Company reduced its energy costs by a third, saving more than $ 17 million US per year and reducing twice greenhouse gas emissions per pound of production. In 2000 the scale of resources saving was there over 400 million U.S. dollars due to increasing resource efficiency of production [7].

The introduction of new approaches to waste management in 1998 enabled Hewlett-Packard (California) to reduce the amount of industrial waste by 95% with the economic effect of $ 870.564 thousand US dollars. For ten years the company Honda (Canada) reduced the amount of waste by 98%. In Denmark today more than half (51%) of industrial and commercial waste is processed. In its capital, Copenhagen, in less than ten years, the proportion of recycled waste generated during construction and demolition, increased from 10 to 90%. In Australia 59% level of municipal waste recycling was reached. In Germany up to 42% of used paper and 50% of glass containers are recycled [7, 8].

Thanks to the introduction of environmental friendly and resource saving activities from 70-ies of XX century, developed countries managed to halt increasing global environmental threats, but on a global scale this problem is still far from being solved.

The major economic instruments in this area should include [9]:

- The scheme "pay as much as throw away", used to minimize the generation of solid waste. It provides the charge for the services of companies engaged in transport and disposal of waste, in accordance with the weight of the waste;
- Various taxes for disposal, utilization and / or transportation of waste, which as a rule, have a fixed rate. In Europe, they are introduced in 10 countries. The highest – in the three Scandinavian countries and the Netherlands – 20-50 euros per tone; in other countries they reach 5-20 euros per tone. In addition, in Denmark, Norway and the Netherlands there is a tax on waste incineration. An important condition for the introduction of taxes is the availability of alternative methods and technologies for waste management and recycling, correlated or more favorable to the cost of conventional waste disposal in landfills;
- Compensation / reduction of tax rates for the disposal and / or departure of waste on the amount spent by an economic entity for waste processing / minimization at source (e.g., composting using special installation);
- Product certificates or product environmental permits, which are authorized to a certain amount (quota) of certain types of waste. If the consumer produces less waste, it may sell his quota to other consumers. Currently, these certificates are widely used in the UK only, mainly when dealing with biodegradable and packaging waste. In general, certificates are convenient tools for businesses in fulfilling their obligations under the assumption of responsibility of manufacturers to reduce waste;
- Plans for waste prevention in different sectors of the economy, which can be developed for whole industries and for individual productions. The advantage of these plans is that they allow us to determine the most cost effective ways of waste prevention; however, for their successful implementation the support of the relevant authorities is required;
- The transfer of responsibility for the production of waste to the manufacturer. In this case, the manufacturer is responsible for the amount and quality of waste that can be formed during the production of its products. This applies mainly to the package, but can also directly affect the product. Generally, the desired level of processing and / or minimizing of specified waste is established by nation-wide authorities. Because the costs can be too high for some manufacturers, usually all or most of the companies in the industry create a specialized company that is engaged in processing and / or disposal of waste for the industry. An example of this tool using is the European system for the collection and recycling of waste "Green dot";

- Voluntary agreements which are usually reached between the authorities responsible for waste management and separate industries. The purpose of such agreements is to reduce certain types of waste to create more than legislative incentives to minimize them. Voluntary agreements are usually initiated directly by the firms of an industry and are binding only for those businesses that have signed them.

It should be noted that the German national environmental legislation can truly be considered as s "pioneer", as it often was the prototype for all European directives and regulations. Thus, the policy on waste management in Germany has a number of areas:

- Establishing a system of waste collection and sorting;
- Construction of infrastructure for their processing;
- Reduction of production of single-use products;
- Minimizing the use of waste disposal methods.

Waste management in Switzerland has its own characteristics. On the basis of differentiated collateral value, the size of which corresponds to the value of recycling of certain types of household appliances, it was managed to carry her back to the designated collection point and ensure that they are recycled. In 2003 there were processed 35 thousand tons of domestic electrical appliances and 30 thousand tones of electrical equipment that is 80 to 93% [10] of the total number of electronic waste generated annually after the end of their useful life. Organized system of waste separate collection and sorting, waste recycling network companies in Switzerland allows to sort about 80% of all household waste.

Large enough experience in waste management has Sweden. The country has a Union of recycling business. To stimulate the extraction of resources from waste it is used subsidies and donations for enterprises to re-use resources. Management for Technical Development provides loans to industrial enterprises to finance the development of technological innovations in the field of environmental protection. If the project is successful, the received loan is repaid with an additional charge of 1% above the discount rate of the Swedish bank, in case of failure – loan reimburse is not required. Issuance of concessional loans is also provided for the construction of processing plants [11].

In addition, more and more popular in Sweden becomes the concept of sustainable urban development SymbioCity. The concept is based on fairly obvious idea: to combine all that can be combined, and get more with less cost, to achieve so-called "synergy". The Swedish experience shows that 75% of all waste is quite suitable for further use, and 95% of household waste can be used for power generation and production of secondary raw materials. The efficiency of collection systems for liquid and solid waste depends on each Sweden: to the system of waste collection should arrive already carefully sorted rubbish. Propaganda in this direction is done in Sweden for many years, and if in the eighties about such sorting system we couldn’t speak, so today a dozen bags of different types of waste is a routine for any Swedish city apartment [12].

The experience in waste management in France deserves attention too. In this country National Agency for recycling of materials and waste disposal operates, as well as the Commission for the use of raw materials, which is exploring the possibility of replacing the primary material by secondary ones. In addition, a Program of research the problems of resources saving and reusing is developed. French law prohibits discrimination and anti-advertising materials obtained by recycling, if they comply with the norms and standards.

Denmark has reached sufficiently high results in the field of waste management, where levies from incinerators were introduced to encourage separate collection and use of recycled materials. The country implemented a strategy concerning the organization of reception of glass bottles and waste generated during construction and demolition of buildings. In Copenhagen, the proportion of undergoing re-use waste generated during buildings construction and demolition, increased from 10 to 90% in less than 10 years. If necessary to solve the problems related to the restoration of materials, the Danish Government may allocate funds for the implementation of research programs [13].

Waste management in Norway has its own specifics. There is a regulatory interaction between the central and local levels. The central government controls create a common base, leaving the municipalities and the industrial sector leeway in creating "local" technologies for collecting and processing waste. Public authorities use a number of tools aimed at stimulating the activity of municipalities, the business community and industry to carry out activities in the field of waste management. Along with sorting garbage by population, industrial solid waste processing lines with electronic recognition systems are introduced [14].

Organizationally the experience of waste management in Japan is noteworthy. In this country, the center "For pure Japan" under the Ministry of International Trade and Industry is created. The center carries out such activities: coordination of cooperation between state bodies, public organizations and businesses in almost all matters relating to the problem of waste management of production and consumption waste; stimulating the private sector in carrying out scientific research; providing financial support to enterprises; dissemination of knowledge about waste management; advertising, including the publication of special booklets, posters; organization of exhibitions; workshops; involvement of the press and television.

There are many banks engaged in environmental lending in Japan. Loans are provided on favorable terms and lower interest rates to contractors engaged in recycling. For example, the Japan Development Bank acts as lender mainly for large enterprises, financing about 50% of the necessary costs by providing loans for up to 10 years at 6.9% [14]. Japan annually produces 12 million. tons of plastic, using a tenth of imported oil. In order to facilitate the recycling of this material standards of production are unified. The same is done for glass bottles, which allows to grind the glass without color sorting. More than half of old newspapers comes into processing. 90% of travel railway tickets with magnetic tape are utilized, which is about 1000 tons of waste per year. Most of the electrical devices are returned to the sellers in exchange for a new models with the appropriate surcharge.

Recently much attention is paid to "green" public procurement as an effective tool for waste management. Sustainable public procurement program, presented by the UN Commission on Sustainable Development, was supported by more than 30 governments and institutions. Government are one the largest consumers in any market. Research show that public procurement accounts for between 15 to 25 percent of GDP, which has great potential for the implementation of environmental innovation.

In many developed countries there are public exchanges of secondary raw materials. For example, in the UK the British market of secondary raw materials operates, in the Nordic countries – Nordic sales organization of secondary raw materials, in the Netherlands – Dutch Exchange Center of secondary raw materials [11]. Most modern exchanges of secondary raw materials are electronic trading platforms that publish lists of proposed and required secondary raw materials. Usually the lists includes from 10 to 15 types of industrial waste. The composition of the list may vary depending on geographic location and the composition of businesses located in the area.

Conclusions. Waste management is an integral part of environmental management in developed countries, and it is carried out in the direction of environmental protection and resource saving.

Thus, the presence of a sufficiently broad management tools for optimal resource using and minimizing waste forming allows developed countries to solve successfully the problem of waste management. Supported by technological and legal framework, economic instruments contribute to the efficiency increasing of production and consumption, thereby reducing the volume of waste. Application of the analyzed foreign experience of waste management, in particular waste minimization and prevention in Ukraine, in our opinion, will significantly increase the effectiveness of domestic natural resources. However, it should take into account the specifics and trends of the national economy development.

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