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## **IMPLEMENTATION OF RESOURCE EFFICIENT AND CLEANER PRODUCTION OPTIONS AT UKRAINIAN ENTERPRISES**

### **Abstract**

Raising resource efficiency is the key task for green transformation of the Ukrainian industry. Resource Efficient and Cleaner Production Centre assists companies in development of options to enhance resource efficiency and environmental performance. However, monitoring shows that companies do not use high potential identified during in-plant assessments. Main barriers at company level are low awareness of the benefits of the resource efficient and cleaner production approach, limited access to financial resources, inadequate human capacities, and absence of incentives from the state.

### **Key words**

resource efficiency, cleaner production, environmental performance, options implementation, financing

### **Introduction**

Today, greening the economy is a global trend. This means the transition from development through consumption of natural resources and related environmental damage towards increasing resource efficiency, dematerialization of production and consumption, and developing new value chains. One of the bases of a green economy is resource efficiency, which is one of the top priorities for most countries, regardless of the amount of available natural resources. The transformation of the economy towards resource efficiency contributes to increasing the competitiveness of business, attracting new sources of growth and creating jobs.

Alongside deepening the process of the Ukrainian economy integration to the global economy, a large number of Ukrainian companies are faced with meeting the requirements and standards of new markets. Ukrainian enterprises need to modernize their production processes, improve product quality and reduce costs through increased resource efficiency, which is particularly relevant in the context of the applied Deep and Comprehensive Free Trade Agreement between Ukraine and the European Union.

Ukraine is trying not to step aside from world economic transformations. Therefore, at the national level, the 17 Sustainable Development Goals have been adopted and adapted. Ukraine also supported the Declaration on Cooperation on Environment and Climate Change in the Eastern Partnership and the Batumi Initiative on Green Economy. Within technical assistance from the EU and other international partners, Ukraine introduces certain elements of sustainable consumption and production principles into its legislation [1].

At the same time, Ukraine is at a lower position compared to the Eastern Partnership (EaP) countries (Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine) by ‘small and medium enterprises (SMEs) in the green economy’ index [2], which includes environmental policies targeting SMEs, incentives and instruments. Other indicators also have room for improvement: e.g. in 2014 energy productivity of Ukraine was the lowest for an EaP region and approximately 3 times lower than European regions [3]. This can be explained by Ukraine’s inherited resource intensive industry with large companies, which need resources reallocation for increasing production efficiency [4]. With general instability in the country and rising prices on main resources such as energy or other production materials these companies are not able to maintain their competitiveness and invest in development. According to national statistics, during 1991-2017, the industries’ share of the national GDP structure decreased from 46% to 21%. The problem of limited access to new technologies and modern methods of improving production is a real fact for the majority of Ukrainian enterprises.

New tasks for building a green resource efficient economy in Ukraine, along with pressing issues of ensuring energy security, efficient use of resources, sustainable growth and job creation, will include work with enterprises. This will mean the emergence of new tools for stimulating such efforts as new laws, norms, fees (taxes), funds, support programs (including international ones). It is important for domestic enterprises to be

prepared for future changes and challenges and to work on their resource efficiency now, thereby investing in their own future.

Resource efficient and cleaner production (RECP) is a component of circular economy [5]. It means following a complex, consecutive preventive environmental strategy in the industrial processes for increasing economic efficiency of an enterprise, decreasing production risks for personnel and decreasing environmental damage [6]. RECP includes permanent activities for identification of innovative solutions aimed at resource (energy, materials, and water) efficiency and their implementation. RECP activities bring overall positive impact on companies' business performance [7].

In Ukraine, RECP is promoted with support of international organisations. In 2007, United Nations Industrial Development Organization (UNIDO) started with the National Cleaner Production Programme in Ukraine. Then, under the framework of "Promoting the Adaptation and Adoption of Resource Efficient and Cleaner Production (RECP) through the Establishment and Operation of a Cleaner Production Centre (CPC) in Ukraine" the Ukrainian RECP Centre was launched in 2013. The Centre became a part of the large network of Cleaner Production Centres created in the framework of the National Cleaner Production Centres programme [8]. In 2014-2017, resource productivity and environmental performance were also promoted within the framework of the RECP Demonstration Component of the EU-funded Programme "Greening Economies in the European Union's Eastern Partnership Countries" (EaP GREEN). The component was focused on the construction materials sector.

### **Methods**

In 2013-2017, operating under the UNIDO project "Promoting the Adaptation and Adoption of Resource Efficient and Cleaner Production (RECP) through the Establishment and Operation of a Cleaner Production Centre (CPC) in Ukraine", the RECP Centre delivered RECP assessments of 108 companies, which represented different sectors, preferably those of construction materials, machine building, and food [9, 10, 11]. Another 13 Ukrainian companies from the construction materials sector passed through RECP assessments in framework of the RECP demonstration component under EaP GREEN programme (2014-2017) in 2014-2016 [12]. These assessments meant full analysis of resources consumption (energy, materials, water) and generation of unproductive outputs (waste, wastewater, air emissions) using the RECP methodology [6]. In assessment process, the following factors of production [13] were analysed: material, machines, environment, and energy. Companies obtained the report with developed, feasibility-studied options on improving their resource efficiency. These options corresponded to device/unit, line/cell/multi-machine system, and facility level [14]. The companies then implemented these options considering their own priorities, conditions and resources. There was no additional financial support provided for these companies.

The data for this paper was collected in options implementation monitoring. All assessed companies were contacted (chief engineers or directors), and they provided their outputs via phone, email or personal interview to complete the standard form. The actual effect of options implementation was identified using accounting equipment or additional measurements taking into consideration changes in productivity. In some cases, when it was not possible to identify actual savings, it was made an assumption that option generated output equalled to calculated at the stage of development one.

### **Influence of financing indicators on implementation of the RECP options**

For 2013-2017, 328 options were developed and proposed to the enterprises. Examples of these options were: replacing equipment, heat insulation, adjusting working regimes, changing technological procedures, etc. [9, 10, 11]. The developed options provided means for companies to save 133'500 MWh of energy, 9'000 t of materials, 2'000'000 t of water, 31'000 t of CO<sub>2</sub>-eq., and USD 9'000'000 annually. However, due to different reasons, companies implemented 86 options or only near 26% of those proposed. Despite proved importance of organizational and technical aspects [15], according to the various surveys [3, 16], one of the main obstacles for options implementation are financial reasons. In addition, the majority of resource efficiency initiatives and management methodologies are concerned primarily with focus on an economic basis [17]. Therefore, here the relations between options implementation and their financial indicators (like payback period, investments etc.) will be considered.

Distributions of developed and implemented options depending on their payback period time are presented in Figure 1. It is obvious that options with a lower payback period are more interesting for companies. Thirty-one percent of proposed options have a payback period of less than 1 year. This figure demonstrates the high potential for improvement possessed by Ukrainian enterprises. Such options are the simplest and provide significant economy that enables accumulating funds and resources for investing in improvements. In addition, this number of options with a short payback period shows some issues with systematic work of companies' technical specialists.

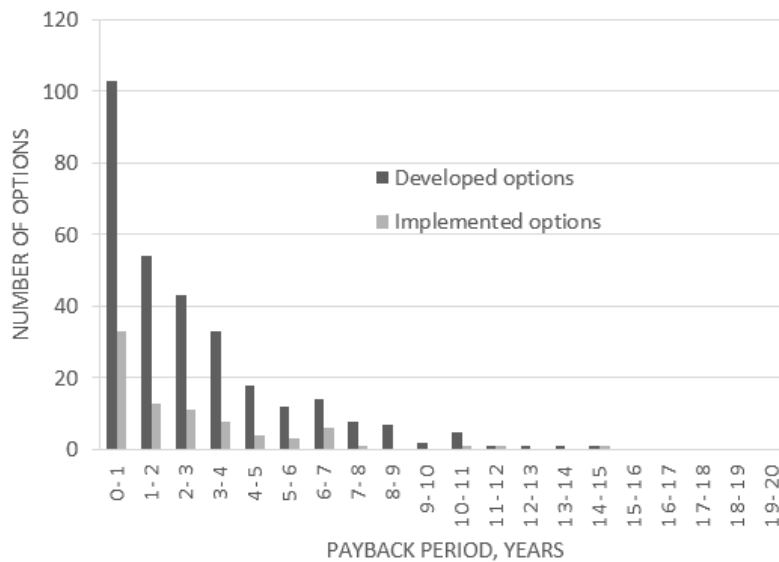


Fig. 1. RECP options and their payback period  
Source: Author's

Sixty-one percent of proposed options have a payback period of less than 3 years, which also demonstrates the huge hidden potential of Ukrainian enterprises for improving performance and investing. However, the investment attractiveness of Ukrainian companies is low due to general instability in the country.

Only 24% of proposed options have a payback period of more than 5 years. The reason for this is that Ukrainian entrepreneurs are very sceptical of such options. Knowing this fact, the RECP experts propose such options only in case they have some additional value such as improving company image, meeting work safety issues etc. For example, heat insulation of an administrative building often has a small turnover, however, improves working conditions and looks of the building (and the company image), which is why it may have a high priority for the company.

A large share (40%) of implemented options are options with a payback period of less than 1 year. For companies' management, these are the easiest decisions - those which do not include any risks. Of the proposed options, 70% options have a payback period of less than 3 years and 84% – less than 5 years. Other options are mentioned aside from those with not only economical but also additional (safety, marketing etc.) reasons. This is also explained by the increase of implementation frequency for options with a long payback period (Fig. 2). The RECP experts propose options with a payback period of more than 7 years only in urgent cases and to companies that must implement these options because of multiple reasons.

Figure 2 demonstrates that options with a payback period of less than 1 year have a higher index of implementation (32%). The share of implemented options is stable for a payback period of from 1 to 5 years (22-25%). This means that for such companies the payback period does not influence their decision-making process.

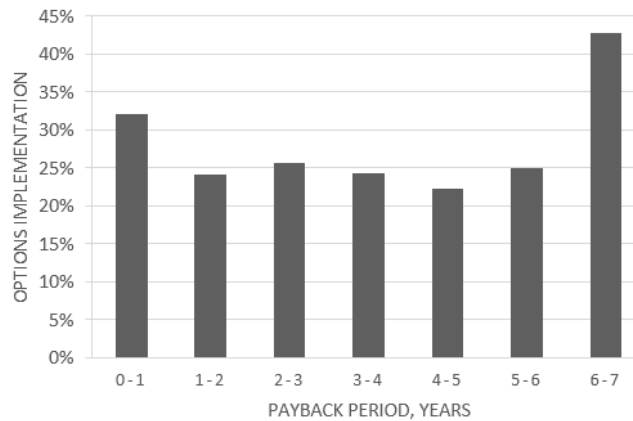


Fig. 2. Implementation of the RECP options depending on their payback period  
Source: Author's

Distributions of developed and implemented options depending on required investments are presented in Figure 3. Developed options with the lowest investments (below USD 5'000) have the largest share (53%) in proposed offers. Developed options with investments of less than USD 20'000 are 77% of all options. Such options with moderate investments are preferred by consultants and experts. Developed options with investments of more than USD 100'000 amount to only 7% of the total number.

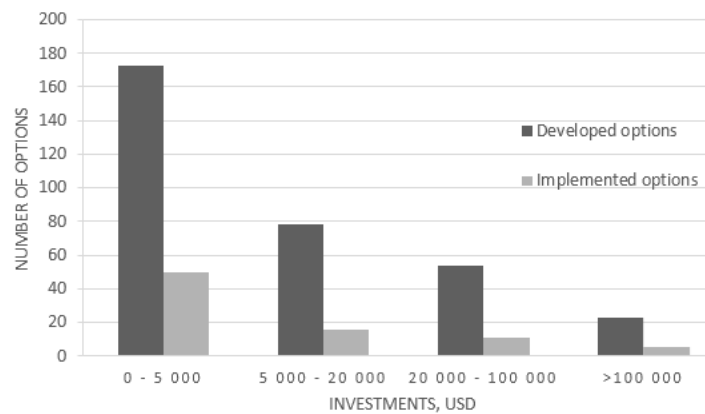


Fig. 3. The RECP options and investments required  
Source: Author's

The same picture holds true for implemented options. Thus, implemented options with investments less than USD 20'000 amount to 80% of all options, while those more than USD 100'000 are near 6%. Implemented options with investments less than USD 5'000 have a little higher share of 61% than developed ones. This is also demonstrated in Figure 4. Options with investments less than USD 5'000 have the highest index of implementation – 29%. The reason is their easy implementation and the lower risk. At the same time, indexes implementation for other proposed ranges are quite the same – 20-22%. This could mean that the amount of investment has no influence on making decisions on options implementation; however, it does not correspond to the thesis that financial issues are the main obstacle for options implementation.

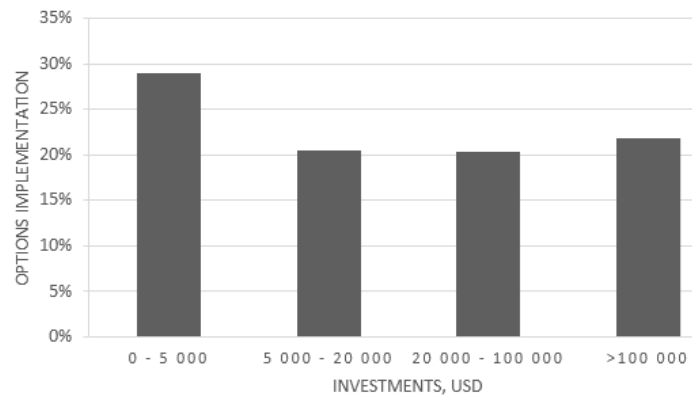


Fig. 3. The RECP options and investments required  
Source: Author's

### Implementing the RECP options at Ukrainian enterprises of construction materials sector

In Ukraine, the construction materials sector possesses a significant potential for business development; it also can provide a basis for 'green' construction and the sustainable development of urban areas. The potential of its green modernisation was emphasised in the framework of the RECP demonstration component under EaP GREEN programme (2014-2017). In 2014-2016, 13 Ukrainian companies from the construction materials sector passed through RECP assessments which enabled the development of above 100 RECP options with annual savings of near 34'000 MWh of energy, 82'000 t of water, 11'000 t of materials, 12'000 t CO<sub>2</sub>-eq. of emissions, 19'000 t of wastewater, 5'000 t of waste and USD 2.3 mln [12]. However, the identified potential was not fully realized. In 2016-2017, a monitoring of options implementation was carried out. It showed that the companies did implement some options and received some savings: for example, 7'000 MWh of energy, 10'000 t of water, 2'500 t of waste and less than USD 0.5 mln, less than one fourth of the potential. The main part of these options were those which were low-cost or without any expenses. In addition, only companies with good economic conditions tried to invest in production modernization.

It is worth mentioning that some companies did not implement developed options due to different reasons. Some of the companies suffered instability because of economic situation in the country. Others lost their markets or could not service their debts. Such companies are now closed or offered for sale. Many companies changed their management and engineering personnel. One of the reasons for this is that there are many qualified specialists are inner displaced people in the Ukrainian labour market. Considering that not all companies were able to implement the options, they were separated between active companies (8 from 13) and inactive (5). General results are very much the same as those mentioned in the previous chapter. For example, cost saving potential was realised at 18%, energy saving – 21%. At the same time, for active companies these indexes are much better – 65% and 88% respectively.

Companies paid the most attention to energy saving options, as it is the most expensive resource. Thus, the main part of funds saving is connected with "energy" options. An emissions decrease is connected with energy saving options as well. Materials efficiency was improved by companies, which used expensive materials such as cement and steel armature. Water saving options were not so popular, because for now, water is still a very cheap resource in Ukraine. Good results in waste and wastewater reduction were achieved because companies firstly understood the real cost of these resources and implemented very simple options ("low hanging fruits").

The companies of the first round (2014-2015) achieved better results in the RECP options implementation. For example, this group achieved annual cost savings of USD 440'000 and energy savings of 6'191'467 kWh. The companies from the second round (2014-2015) achieved annual cost savings of USD 47'000 and energy savings of 816'834 kWh. The main reason for the difference was that the companies of the first round had more time to implement these activities and even developed their own options. Aside from not having enough time, the companies of the second round needed management and financial approval and time to synchronize changes with production rhythm.

### **Financial barriers for RECP implementation**

A survey conducted by UNIDO in EaP countries showed that small and medium enterprises (SMEs) consider insufficient access to finance to be the greatest obstacle to implementing RECP in their operations, followed by insufficient human resources to ensure adequate compliance with environmental regulations [3].

The survey also shows that Ukrainian enterprises prefer to use their own financial resources without the involvement of external sources. The obtained results coincide with the data of the State Statistics Service of Ukraine: in January-March 2017, enterprises invested near USD 240 mln, while the main source of financing was own funds of enterprises and organizations – 68%. Other sources of funding, such as loans, state and local budgets, did not exceed a rate of 5%. Altogether this results in low activity of small and medium-sized businesses in the implementation of resource efficient measures.

The lack of own financial resources can be solved by attracting financing from external sources, such as by lending. Commercial banks and international financial institutions are the main lenders for improving resource and energy efficiency for SMEs. However, in Ukraine the loan rates are the highest compared to other EaP countries. The increasing demands on lending are related with circulating capital issues and debt restructuring rather than investing in resource efficient technologies. Ukrainian enterprises usually try to avoid loans. Thus, among the surveyed companies, only one third of companies considered the possibility of attracting credit funds, and only one third planned to use such funds for the implementation of resource efficient measures [18]. Among the barriers mentioned were the lack of understanding of banks' requirements, lack of qualified staff and, most often, high loan interest rates.

Another opportunity for enterprises to attract funding for implementation of resource efficient options is participation in grant programmes from international organizations and funds. However, such action requires competent personnel with relevant knowledge and experience in writing proposals and drawing international cooperation.

In Ukraine, support and financing for SMEs are mainly implemented through local state business development programmes. All regions of Ukraine have such programmes; however, according to the representatives of enterprises, this mechanism is not attractive due to the small amount of financial resources (USD 7'000-18'000) and the additional attention of the controlling bodies because of the involvement of budget funds. On a national level it is also worth mentioning the launch of Energy Efficiency Fund in December 2017.

Regarding the use of alternative sources of funding, such as crowd funding, engagement of business angels or impact-investors, less than 15% of Ukrainian SMEs are even familiar with such concepts and principles of cooperation [18].

### **Summary and conclusions**

Results of more than 100 RECP assessments of Ukrainian enterprises show their great potential for increasing resource efficiency. The high achievability of this potential is demonstrated by the fact that 53% of developed RECP options for enterprises need investments of less than USD 5'000 and 31% of proposed options have a payback period of less than 1 year.

Ukrainian enterprises prefer to implement low-cost RECP options and options with a short payback period. Therefore, the largest share (40%) of implemented options are options with a payback period of less than 1 year and options with investments of less than USD 5'000 (61%). At the same time, the investments and payback period have high influence on decision-making process only if they are less than USD 5'000 and 1 year respectively. For other investments and payback periods from 1 to 5 years the index of implementation is close (20%-26%). Options with a payback period of more than 5 years are considered and implemented only in case of additional motivation. Ukrainian companies are mainly interested in improving efficiency of energy and lessening expensive raw materials consumption.

Financing issues are one of the main obstacle for implementation of resource efficiency options and other innovation activities at Ukrainian enterprises. Ukrainian SMEs try to use only their own funds. Another gap to be filled is building capacity by actions such as personnel trainings as well as providing convenient and available sources of actual information on financing opportunities for SMEs.

Directions for future investigations may be an analysis of time frames of the RECP options implementation. That will allow finding a period of company support by external experts (consultants) in order to help achieve the successful implementation of the proposed options.

#### **Conflict of interest**

There are no conflicts to declare.

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