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WORLD ECONOMIC DEVELOPMENT UNDER THE INFLUENCE OF ENVIRONMENTAL FACTORS

СВІТОВИЙ ЕКОНОМІЧНИЙ РОЗВИТОК ПІД ВПЛИВОМ ЕКОЛОГІЧНОГО ФАКТОРУ

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Терещенко В.С., Маценко О.М. Світовий економічний розвиток під впливом екологічного фактору. Науково-методична стаття.

У статті розглядаються проблеми в галузі соціально-економічних систем та інститутів щодо забезпечення сталого та екологічно безпечного економічного зростання країни. Автором представлені результати аналізу споживання електроенергії, перехід на відновлювані джерела енергії та системи управління стійким соціально-економічним розвитком країни, в рамках якого описується вплив екологічного фактору на виробництво електроенергії, дається характеристика корупційних процесів, торкаються актуальних питань формування в Україні сприятливого інституційного середовища та участі в економічному розвитку країни. Автором внесені пропозиції (сценарії) переходу України на відновлювані джерела, один з них кардинальний, який дозволить досягти високої ефективності електроенергії на відновлюваних джерелах та високих показників розвитку економіки та екології в країні. Автором зроблено висновок, що з використанням систематизованого плану переходу з'явиться можливість збалансованого управління енергетичними процесами з урахуванням впливу екологічних чинників.

Ключові слова: сонячні панелі, електроенергія, фотоелектричні модулі, екологічний фактор, кардинальний сценарій, зелений тариф

Tereshchenko V.S., Matsenko O.M. World economic development under the influence of environmental factors. Scientific and methodical article.

The article considers the problems in the field of socio-economic systems and institutions to ensure sustainable and environmentally safe economic growth of the country. The author presents the results of analysis of electricity consumption, transition to renewable energy sources and management systems for sustainable socio-economic development of the country, which describes the impact of environmental factors on electricity production, describes corruption processes, touches on current issues of favorable institutional environment in Ukraine and participation in economic development of the country. The author makes proposals (scenarios) for Ukraine's transition to renewable sources, one of which is cardinal, which will achieve high efficiency of electricity from renewable sources and high rates of economic development and ecology in the country. The author concludes that with the use of a systematic transition plan there will be an opportunity for balanced management of energy processes, taking into account the impact of environmental factors.

Keywords: solar panels, electricity, photovoltaic modules, environmental factor, cardinal scenario, green tariff

The world economy is currently developing a new model of general development to ensure a high standard of living and maximize the development of its potential. The impetus for this process was the rapid growth of the financial and economic crisis. Ecology for each country is becoming increasingly important for economic development every year, greatly affecting the cultural, political and social spheres. This is manifested in the formation of state and national environmentally oriented economic policy, lawmaking, investment and innovation in the environmental sphere. Today, the management of household waste is the most important problem for the whole world at the state level. Ukraine must take these trends into account as soon as possible, reorient the development of the economy taking into account the environmental factor.

Global environmental problems, such as warming, harmful emissions from human activities, loss of bioresources, deforestation, etc., have been exacerbated since 2001, posing a major threat to the lives and development of future generations. At present, the scale of world production and consumption has led to a catastrophic imbalance of natural and social systems and, according to many scientists in various fields of science, has exceeded the ability of the environment to cope with the results of human activities. Studies show that nature's ability to cope with the effects of human activities has already been exceeded by 30% (Najam et al., 2007), and humanity's environmental debt is estimated at $ 4 trillion.(Living Planet Report – WWF UK, 2008). Ecology is deteriorating every year, it is part of national and international strategy and in fact intertwines with the entire system of state and international regulation. The financial and economic crisis of 2008-2009 in Ukraine and the need for a

qualitative new increase in production efficiency and energy security forced to reconsider national and international environmental policy, adopt and implement the latest programs and tools in this area.

Aid to developing countries and investment measures for the development of environmentally friendly, low-carbon technologies are fully in line with the latest world trends. They will improve the energy efficiency of the economy and energy security of all energy-dependent countries, accelerate the exit from the crisis, while contributing to solving the problem of global warming and other environmental problems. All countries will benefit: developed countries through the accelerated development of environmental industries, developing countries through the acquisition of energy efficient technologies; at the global level, there will be an opportunity to improve the environmental situation. The development of the world economy is focused in this direction, and Ukraine's alternative is the extent to which it will be able to "fit" into the new model of development, this is what this article is about.

Analysis of recent research and publications

The study of the role of renewable energy sources in achieving the goals of sustainable development is given attention (D. Rannolls, M. Holly, L. Melnik, I. Sotnik, S. Filin, G. Filina, V. Yampolsky and other). However, renewable energy is evolving every year in both national and foreign sources. There are also environmental problems from renewable sources that need further research and solution. Thus, the relevance of these problems, their lack of study, great theoretical and practical significance led to the choice of research topic. However, this issue has not lost its relevance in Ukraine so far and needs further study.

The main part

Ecology began to be gradually integrated into economic strategies in the late 1990s and early 2000s. Currently, ecology is gradually coming to the fore in the system of global relations, becoming a powerful engine of human development. The main thing we are talking about is the economy, but gradually identify other areas, including political and cultural. Attention at the new stage of development is supported by non-standard acceptance at the national, corporate and international levels of commitments on the implementation of environmentally oriented policies and the allocation of funds for them. As a result of the annual meeting of OECD ministers in June 2009 in Paris, the Declaration on Ecologically Oriented Growth was adopted to achieve economic recovery based on the principles of environmental and social sustainability, when all aspects of development (economic, environmental, technological, financial, etc.) are taken into account. complex. Ukraine began cooperation with the OECD in 1997.

As a result, countries should stimulate investment and innovation in this area. It was also decided that the crisis is not an argument for postponing the adoption of appropriate measures, and its termination does not mean the cessation of this direction of development. (OECD, 2009). "Environmental business", with a rapid transition to the economy, has a huge potential that can open in the world of technological development, the third industrial revolution – the "green revolution"(D. Medovnikov & T. Hovhannisyan, 2008). The need to increase the energy efficiency of the economy, reduce fossil fuel consumption and carbon dioxide emissions has given impetus to the revision of public policy, the adoption of new laws and the revision of existing ones. In the United States, several states have announced a reduction in greenhouse gas emissions by 80% by 2050 from 1990 levels, which implies fundamental changes in environmental and technological policy (Goulder & Parry, 2008). The European Union has also launched measures to reduce the negative impact of natural resources on the environment. In 2009, the European Sustainable Development Strategy, which has been in force since 2001, was revised. In 2009, the European Union adopted an economic recovery plan, which provides for the adoption of many environmentally oriented measures: combating stable climate change, the introduction of environmentally friendly technologies, improving professional knowledge in this area and supporting the production of environmentally friendly products. Some EU countries have intensified the creation and implementation of environmental policy. States are seeking and implementing environmental policy instruments, including political and economic ones, and their range is expanding. New standards, such as the standards of the state of California, USA, which require firms to enter into trade agreements or invest only for low-emission enterprises(Senate Bill No. 1368 CHAPTER 598 An Act to Add Chapter 3 (Commencing with Section 8340) to Division 4.1 of the Public Utilities Code, Relating to Electricity, 2006). New government instruments to combat global warming include quotas and special tariffs for renewable energy sources. Quotas determine the share of electricity generated from renewable energy sources in its total production. Special tariffs set an increased price for electricity from renewable sources, at which producers supply it to the grid.

Various large companies are actively involved in the implementation of environmental policy. Despite the crisis, TNCs (multinational corporations) are increasing investment in the development and implementation of technologies aimed primarily at improving energy efficiency and reducing greenhouse gas emissions. Private investment in clean technologies in the world is growing every year, for example by 60% since 2006 to $ 148.4 billion in 2008(Cooperation in Environmental Protection the Sphere in the Context of “Green” Growth: Quo Vadis, Eastern Europe, Caucasus and Central Asia?, 2009).

In order to solve complex environmental problems, in particular climate change, it requires the involvement of developing countries and significant investment from developed countries. According to the World Bank, more than $ 1 trillion will be needed to solve the problem of global warming in the world alone. billion dollars for developing countries. for a year. Developed countries plan to establish a

mechanism for the transfer of environmentally friendly technologies to developing countries.

Analytical review "Prospects for the development of" green "economy in Ukraine: opportunities for" greening "energy showed that in 2030 the demand for electricity will increase by almost 50%, mainly due to increasing demand for electricity in production, trade and housing (Fig. 1). The Ukrainian government also acknowledges that significant reconstruction of production facilities, gas pipelines, oil pipelines and other infrastructure will be required. This will require significant investment and could have a serious impact on the country's economy and future energy demand. Combined with efficiency problems and current political instability, this will inevitably lead to a gap in energy demand that needs to be addressed. (Prospects for the Development of the "Green" Economy in Ukraine: Opportunities for "Greening" the Energy Sector Analytical Review, 2018).

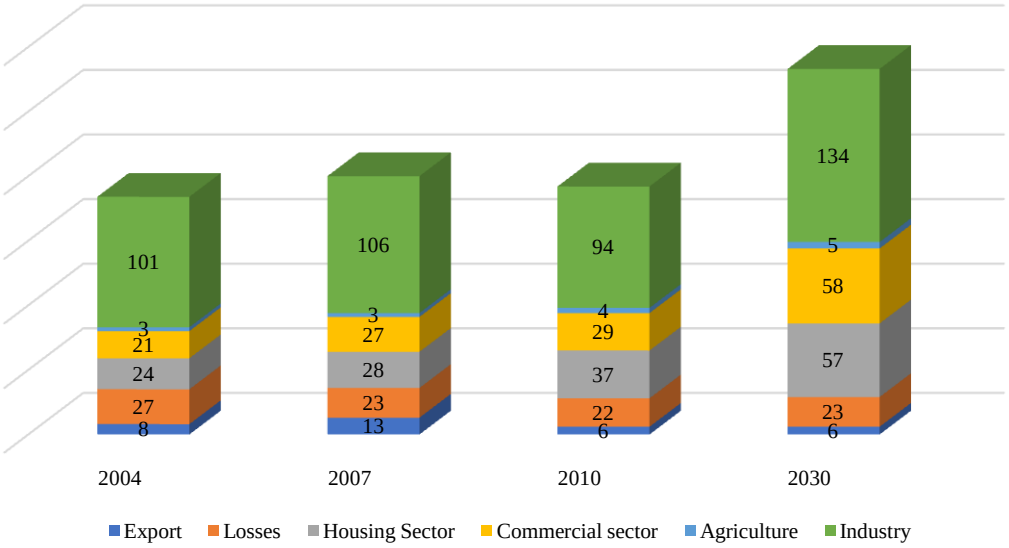

Figure 1. Projected demand for electricity (TWh * year),
Source: authors' own development

The projected relative decline in demand for fossil energy sources, on which our economy is still largely based, will undoubtedly affect the country's development unless real large-scale measures are taken to move to a new paradigm of development. Ukraine is known to have little environmental potential, as the country's forest area is currently shrinking, due to deforestation for export, which could largely offset the negative effects of global industrial development. According to the statistics of world forest areas in 2018, Ukraine was on the 129th place (8.39% of the forest area), and by 2021 this level decreased (Fig. 2).

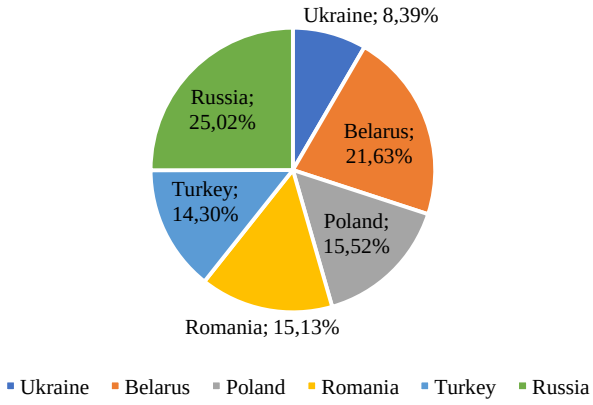

Figure 2. Forest area of Ukraine's neighbors
Source: authors' own development

Currently, the situation in the environment remains very serious. Statistics show that Ukraine is one of the last in the world in many areas of environmental protection. There are serious problems in the field of waste recycling and many other areas. Ukraine's environmental problems have ceased to be purely environmental and have begun to affect economic security. In the settlements of Ukraine, the

environmental situation has become extremely unsatisfactory, including for economic development, which requires large-scale comprehensive environmental measures. The future of national forests remains under threat due to high rates of coniferous deforestation, their irrational exploitation and poor management. With the fact that the average temperature has been increasing in recent years, the level of fire danger and forests is increasing in parallel – this creates serious problems in this area. Areas of depleted and disturbed lands are growing. Almost everywhere there is a tendency to pollution and degradation of soil and vegetation, which negatively affects the efficiency of agriculture and expands the scope of problematic and crisis environmental situations. (O. Mikityuk et al., 2004).

In 2019, due to the introduction of separate collection of household waste in 1,462 settlements, the operation of 34 waste sorting lines, 1 incinerator and 3 incinerators in Ukraine, about 6.1% of household waste was recycled and disposed of, of which: 2% incinerated, and 4,1% of household waste ended up in recycling points and waste processing lines. However, the rest of Ukrainian household waste (94%) is buried.

In 2019, 53 million m3 of household waste was generated in Ukraine – more than 10 million tons, which were placed in 6 thousand landfills and landfills with a total area of 9 thousand hectares (Movement with By-Pass Inputs: From "A" to "Z", 2020).

The main factors of degradation of the natural environment of Ukraine are low efficiency of mechanisms of nature management and environmental protection, sharp weakening of administrative, and first of all control, functions of the state in the field of environmental protection; high share of the shadow economy in the use of natural resources; low technological and organizational level of the economy, a high degree of depreciation of fixed assets; low level of ecological consciousness and ecological culture of the country's population (M. Andrienko & V. Shako, 2016).

In addition to all environmental and economic problems in Ukraine, there are no less influential on the environmental situation - corruption and shadow politics. Many government officials are currently laundering budget funds.

Table 1. Capital investments in environmental protection by types of environmental measures

Year	Total	Including on:				
		air protection and climate change	return water treatment	waste management	protection and rehabilitation of soil, groundwater and surface water	other activities
2013	6038783.0	2411935.1	834114.8	713856.3	324980.1	1753896.7
2014	7959853.9	1915129.7	1122149.3	783965.4	359925.6	3778683.9
2015	7675597.0	1422946.6	848881.2	737498.9	388259.2	4278011.1
2016	13390477.3	2502805.8	1160029.1	2208676.6	419988.9	7098976.9
2017	11025535.2	2608027.4	1276530.2	2470969.5	1284502.0	3385506.1
2018	10074279.3	3505920.6	1692640.7	1182045.8	1444291.6	2249380.6
2019	16255671.8	4276767.6	1753869.1	5754260.9	1721924.9	2748849.3
2020	13239649.8	5595319.4	1578201.4	2899793.4	2554224.5	612111.1

Source: compiled by authors on materials [12]

Officially, capital investments in environmental protection are increasing every year in Ukraine by types of environmental measures (Table 1), but according to independent media statistics, these investments do not reach the full amount due to corrupt shadow schemes, in addition, the price rises. combating negative environmental factors due to the acceleration of inflation every year.

Excessive energy consumption of production and transportation has caused a higher cost of most Ukrainian goods than similar products in other countries, which negatively affects their competitiveness (Ukrstat, 2021). Environmental industries in Ukraine are currently underdeveloped.

A serious problem is that many Ukrainian companies still see the environmental factor as a slowdown in their development. It is much more profitable for such companies to break the law and pay a fine than to carry out expensive and time-consuming environmental measures. Therefore, companies operating in the domestic market of Ukraine and some other countries try to save as much as possible on environmental safety and pay very little attention to environmental protection.

Efficient and conscious treatment of citizens with household waste will reduce the level of environmental pollution, make the environment cleaner and improve the ecology of the state. Citizens need to become more responsible in the separate collection of household waste, and personally influence the quality of the environment (Movement with By-Pass Inputs: From "A" to "Z", 2020).

In addition to the negative impact of harmful emissions and waste, humanity will face another problem due to the use of fossil fuels - exhaustion. It is expected that fossil fuels (oil, gas) will run out in the foreseeable future (oil, gas – in 30-50 years; coal – in 100-150 years), and further complication of its production will continue to increase prices with declining production and supply. Therefore, the

exhaustion of fossil fuels is a serious challenge for the future, which requires finding an alternative in energy supply. Some see the solution to this issue in the use of nuclear energy, but the completeness, complexity of production, the negative impact on the environment of the whole process (from production to disposal of spent fuel), safety calls into question the feasibility of its use. Other countries, limited by their own minerals (energy resources), consider importing them from other countries as an alternative. However, energy dependence on the supplier from time to time leads to serious political, economic, and sometimes military conflicts, so this alternative has great risks and does not solve the question of the exhaustion of fossil fuels in general. Therefore, scientists around the world are looking for ways to solve this problem for a sustainable and secure energy supply. The solution to this problem lies in the plane of renewable energy sources, such as solar, wind, hydro, bioenergy and others.(O. Lysenko & S. Adamova, 2018).

Given the harmful emissions from the production and disposal of solar panels without proper recycling, their use will become a necessity for different countries in the foreseeable future.

With the help of analytical-synthetic and prognostic level, two scenarios of Ukraine's transition to renewable energy sources were built: the basic one is when the country does not take any measures to improve energy efficiency, does not provide for any environmental requirements and more; cardinal - stimulates the implementation of measures to improve energy efficiency, the closure of traditional power plants, the construction of plants for the processing of electronic waste and more.

Research results. Ukraine's transition from traditional (NPP, TPP) to renewable energy sources, namely solar energy, requires a transition plan (scenario) (Table 2).

In the table. 2 summarizes the key conditions and assumptions of the Baseline and Cardinal scenarios.

Electrification of industry is a significant challenge for the implementation of the Cardinal Scenario, as it will require the replacement of almost all existing energy-intensive industrial equipment with new ones.

Table 2. Scenarios of Ukraine's transition to RES

Base	**Cardinal**
The average annual GDP growth rate during 2016-2050 was 4.0%.	
Ukraine's population will decline from 42.9 million in 2015 to 40 million in 2050.	
The price of natural gas from 2020 to 2050 will increase by at least 80%	
There are no measures to increase energy efficiency and energy saving	The implementation of any measures to improve energy efficiency and energy saving to reduce the use of RES is encouraged.
Efficiency of technologies in sectors final energy consumption at the level of 2015	Achieving 90-100% RES in the final consumption of energy resources.
The "green" tariff is valid according to the schedule set by law until 2030, but environmental, climatic or other restrictions on the use there is no fuel.	The "green" tariff is valid in accordance with the schedule defined by the legislation till 2030
No environmental requirements are provided	Gradual closure of TPPs, CHPs by 2050 and decommissioning of NPP units at the end of the life cycle. Possibility to continue operation existing NPP units for a maximum of 20 years until 2049.
Lack of proper recycling of e-waste	Construction of two plants for detailed waste processing (SES) by 2040
Lack of foreign investment	Attracting significant foreign investment in RES

Source: authors' own development

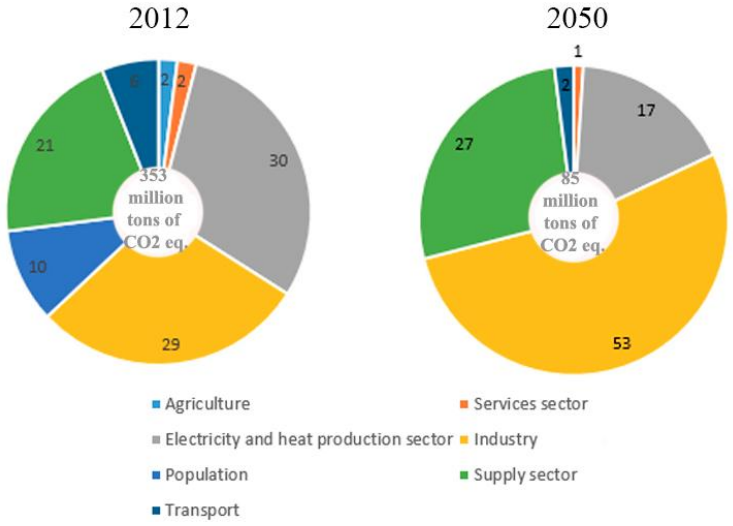

Figure 3. Structure of greenhouse gas emissions under the Cardinal scenario
Source: authors' own development

The results of calculations (Fig. 3) show that achieving the goals of the Cardinal Scenario will lead to a significant reduction in GHG emissions, which in 2050 may be only 10% of the 1990 level. (O. Dyachuk et al., 2017).

$$Мпг = \sum_{k=1}^{d}\sum_{j=1}^{n}\sum_{i=1}^{m} Nj * Bik * Keji \quad (1)$$

where Мпг – greenhouse gas emissions in CO^2 equivalent when using different types of fuel, thousand tons of CO^2 eq;

Nj – the coefficient of recalculation of greenhouse gas emissions in CO^2 eq, which depends on the global warming potential of the j-th greenhouse gas;

Bik – the mass of the i-th type of fuel consumed by the k-th enterprise;

Keji – the emission factor of the j-th greenhouse gas, characterizing the i-th type of fuel;

n – the amount of greenhouse gases produced by the use of different fuels;

m – number of different fuels (O. Korobova & T. Mihina, 2003).

In the cardinal scenario, it is expected that GHG emissions from industry will be more than half, and the population will not carry them out at all. The shares of agriculture, services and transport will be in the range of 0.5-1.5%.

Discussion. On the way to Ukraine's transition to renewable energy there are many obstacles, the main of which are:

1. Economic losses from the decommissioning of nuclear reactors.

2. Reduction of the number of jobs from the transition to renewable sources, where the process of electricity production is mainly automated and does not require human intervention.

3. The need for foreign investment.

4. The existence of shadow corruption schemes in Ukraine, in which all state changes, both in the energy and economy, are significantly ‘slowed down’.

5. Organizational and institutional barriers. Lack of institutions capable of actively implementing projects in the field of RES use.

6. Lack of electronic waste processing plants in Ukraine, the main of which is from solar energy.

The presented problems are urgent and need to be solved, and such a problem as the lack of e-waste processing plants needs additional study.

Conclusions

In compliance with the recommendations and requirements presented in the article, it is expected to improve the environmental situation as a whole, which will bring in the future a reduction in the cost of combating environmental problems and the stability and growth of the state economy.

Ukraine cannot but take into account that the world economy is moving towards ecological principles, and therefore must build its economic and political strategy.

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Abstract

Introduction. The world economy is currently developing a new model of general development to ensure a high standard of living and maximize the development of its potential. The impetus for this process was the rapid growth of the financial and economic crisis. Ecology for each country is becoming increasingly important for economic development every year, greatly affecting the cultural, political and social spheres. This is manifested in the formation of state and national environmentally oriented economic policy, lawmaking, investment and innovation in the environmental sphere. Today, the management of household waste is the most important problem for the whole world at the state level. Ukraine must take these trends into account as soon as possible, reorient the development of the economy taking into account the environmental factor.

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