Електронне наукове фахове видання **"Ефективна економіка"** включено до переліку наукових фахових видань України з питань економіки (Категорія «Б», Наказ Міністерства освіти і науки України від 11.07.2019 № 975)
www. economy.nayka.com.ua | № 4, 2020 | 30.04.2020 р.

DOI: 10.32702/2307-2105-2020.4.53

CDC 339.727

L. Kudirko
PhD in Economics, Associate Professor, Department of World Economy,
Kyiv National University of Trade and Economics, Kyiv, Ukraine
ORCID ID: 0000-0002-9089-7223
A. Korohod
Master's Degree,
Kyiv National University of Trade and Economics, Kyiv, Ukraine
ORCID ID: 0000-0003-3566-8038

FOREIGN INVESTMENT PRIORITIES ON RENEWABLE ENERGY PROJECTS

Л. П. Кудирко,
к. е. н., професорка кафедри світової економіки,
Київський національний торговельно-економічний університет, м. Київ, Україна
А. Я. Корогод,
здобувачка вищої освіти ступеня магістр,
Київський національний торговельно-економічний університет, м. Київ, Україна

ПРІОРИТЕТИ ІНОЗЕМНОГО ІНВЕСТУВАННЯ У ПРОЕКТИ ВІДНОВЛЮВАНОЇ ЕНЕРГЕТИКИ

The interrelationship in regards to solving worldwide problem on reducing natural energy reserves and developing environmentally friendly ways to obtain them, basing on non-traditional and renewable energy sources (RES), is described in the article. The dynamics and structure of investment infusion into renewable energy projects in the world through the period of 2009 to 2019 are analyzed. The regional and sectoral analysis on the financial resources directness that stimulated the development and generation of "green" energy is carried out. It has been found that China, the USA, Japan and a number of European countries account for the largest amount of investments into the renewable energy over the period under study. It is substantiated that the decrease in the growth rate of energy consumption within economically developed countries is related to a number of factors, including the relocation of the center of global industrial production to the Asian continent, investments priorities in energy-saving technologies rather than the production of energy itself, the increase of ecological criteria, environmental and consumption standards. The reorientation of international investment flows from developed countries to developing countries has been identified, which is stipulated by the access to resources and cheaper generation of energy currents in the sector of renewable energy.
On the basis of the conducted sectoral analysis, the segments of alternative energy have been identified, which show the highest dynamics of development, in particular, solar and wind power. The importance of institutional support for attracting foreign investment into this specified field is emphasized, in particular, through the development and implementation of national alternative energy incentive programs. The effectiveness of both investment and financial instruments of the stimulation and predominance of much more

active use of subsidies for the development of hydrogen alternatives of energy resources in economically developed countries compared to developing countries and countries with transition economies is noted on. The importance of international coordination of alternative energy development efforts and the important role of global regulators in achieving these goals have been identified. Among the most active international institutions, which has stopped financing projects on oil and other kinds of mined fuel, the World Bank is recognized, as well as the International Finance Corporation with its initiative to set up a Green Cornerstone bond fund for emerging markets.

В статті розкрито взаємозв'язок між вирішенням загальносвітової проблеми зменшення запасів природних енергетичних ресурсів та розробкою екологічно безпечних способів їх одержання на основі нетрадиційних і відновлюваних джерел енергії (ВДЕ). Проаналізовано динаміку та структуру інвестиційних потоків у проекти відновлюваної енергетики у світі за період з 2009 по 2019 рік. Здійснено регіональний та секторальний аналіз спрямованості фінансових ресурсів, що стимулювали розвиток та генерацію «зеленої» енергії. Виявлено, що найбільший обсяг інвестицій у відновлювальні джерела енергії за період досліджень припадає на Китай, США, Японію та ряд європейських країн. Обґрунтовано, що зниження темпів зростання енергоспоживання в економічно розвинених країнах пов'язане з низкою чинників, зокрема переміщенням центру глобального промислового виробництва на азійський континент, пріоритетністю інвестиційних вкладень в енергозберігаючі технології, а не у виробництво самої енергії, підвищенням екологічних критеріїв та стандартів виробництва й споживання. Ідентифіковано переорієнтацію міжнародних інвестиційних потоків із розвинених країн до країн що розвиваються, що зумовлено доступом до ресурсів та здешевленням генерації енергетичних потоків у секторі відновлювальних джерел енергії.
На основі проведеного секторального аналізу виявлено сегменти альтернативної енергетики, що демонструють найвищу динаміку розвитку, зокрема сонячна та вітроенергетика. Вказано на важливість інституціональної підтримки щодо залучення іноземних інвестицій в окреслену сферу, зокрема через розробку і реалізацію національних програм стимулювання альтернативної енергетики. Відмічено ефективність як інвестиційних, так і фінансових інструментів такого стимулювання та переважання більш активного використання субсидій на розвиток водневих альтернатив енергоресурсів у економічно розвинених країнах у порівнянні із країнами, що розвиваються та державами із перехідною економікою. Визначено вагомість міжнародної координації зусиль з розвитку альтернативної енергетики та важливу роль глобальних регуляторів в реалізації цих цілей. Серед найбільш активних міжнародних інститутів визнано Світовий Банк, що припинив у цілому фінансувати проекти з видобутку нафти і іншого викопного палива та Міжнародну фінансову корпорацію із її ініціативою створення фонду облігацій Green Cornerstone для ринків, що розвиваються.

***Keywords**: foreign investments; investment resources; renewable energy; alternative energy sources; green energy; renewable energy sources (RES).*

***Ключові слова:** іноземні інвестиції; інвестиційні ресурси; відновлювана енергетика; альтернативні джерела енергетики; «зелена» енергетика; відновлювані джерела енергії (ВДЕ).*

Problem statement. Taking into account the background of rapid population growth and increase in world GDP, catastrophic depletion of resource capital is taking place nowadays. The possibility to avoid negative consequences caused by globalization processes is conditioned by the sustainable development and usage of non-traditional energy sources. The issue of the renewable energy sources use is decisive goal of the UN Sustainable Development Goals and has positive impact on the solution of global problems of humanity, including energy, ecology, and food.

Analysis of recent research and publications. With regards to the importance of developing renewable energy sources across different fields of economy, environmental and energy spheres, the development of renewable energy sources is given the highest priority in scientific and expert communities. The following national scientists have been engaged into research on economic development of alternative energy: A. S. Zaverbnyi [1], V. A. Lavrenchuk [2], S. O. Kudria [3], M. M. Kuzmina [4]. Among foreign scholars, significant achievements in the field of alternative sources are made by M. Huber, D. Dimkova,

T. Hamacher [5] and D. Spencer [6]. In spite of the considerable scientific achievements, the issue of attracting investment resources into RES projects needs profound study.

The purpose of the article is to analyze dynamics and regional priorities on attracting foreign investment into renewable energy projects.

Research outcomes. Within the contemporary conditions of world economic processes development, the sphere of energy supply is characterized by high level of efficiency, diversification of engineering structure and the most effective location of energy objects. However, despite the rapid development and improvement of energy engineering processes, it is still in lack of progress towards achieving the goal of sustainable development 7 [7], according to UN Sustainable Development Goals.

Universal access to energy, raising energetic efficiency and the promotion of renewable energy by 2030 is to lead to the extended economic opportunities and to protect against climate change [8].

It should be noted that the decline in the growth rate of energy consumption among industrialized countries is primarily due to the increase in investment into energy-saving technologies rather than into energy production itself. One of the ways of searching and the main strategic task for solving global problem of reduction of natural energy reserves is the development of environmentally safe ways of obtaining energy resources, the search for environmentally energy friendly raw materials on the grounds of non-traditional and renewable energy sources (RES).

Meeting ever-increasing energy needs, most of the countries are trying to change development scenarios by introducing new policies and focusing on alternative kinds of fuel and energy efficiency issues. Renewable energy by the International Energy Agency (IEA) forecasts is projected to be the fastest growing energy resource with an average 7.6 % of increase annually and a fourfold increase over the next 20 years due to the raising competitiveness of both solar and wind power. In particular, focusing on the dynamics of RES development (Figure 1), it is expected that China will deliver the largest increase in renewable energy production by 2023, surpassing those indicators of the European Union (EU) and the United States [9].

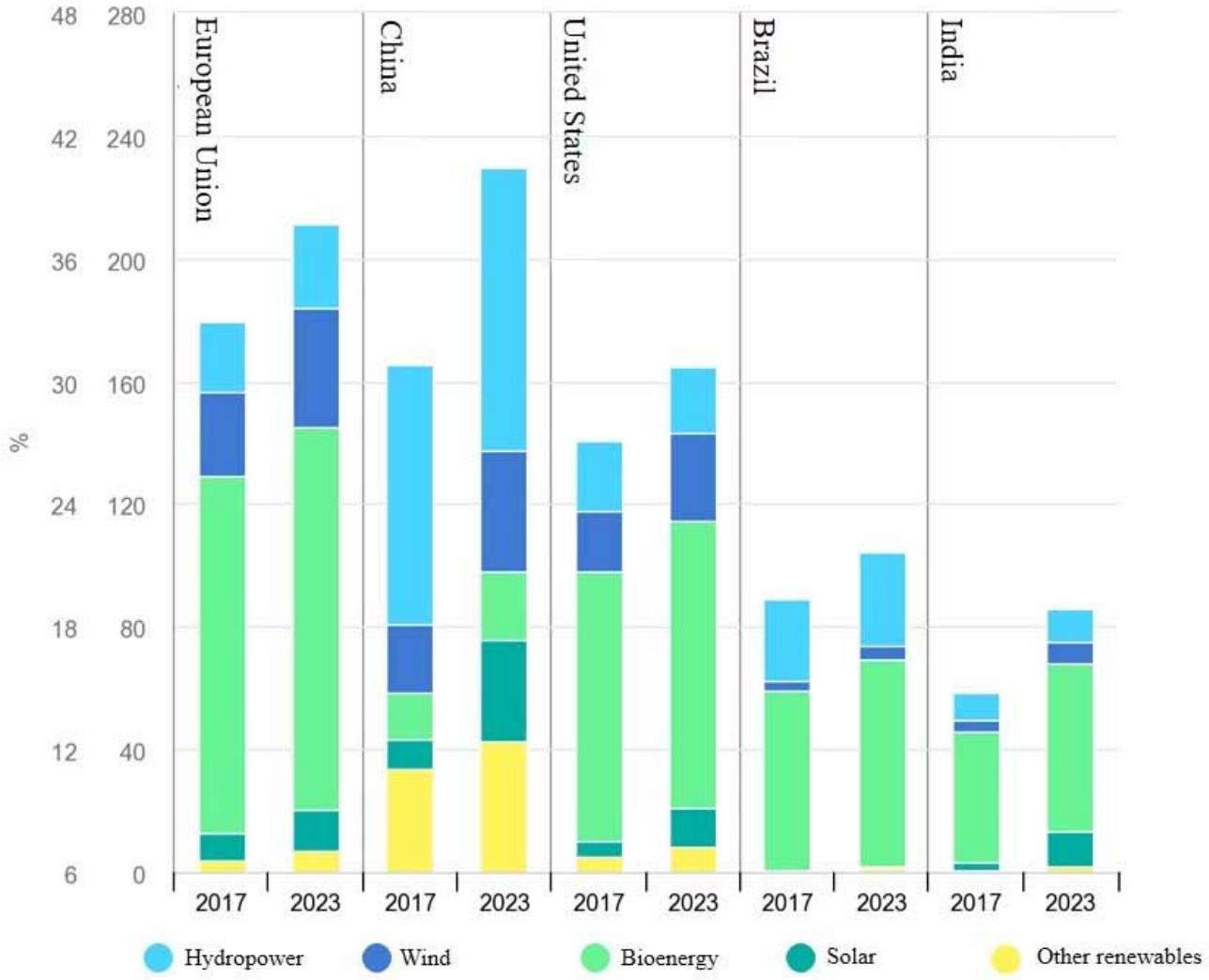

Fig. 1. Consumption of alternative energy in leading markets, 2017 and 2023
(compiled by the author based on [9])

The priorities for the development of the global energy market are largely determined by economically grounded directions for the use of fuel and energy resources. Between 2009 and 2019 there was a significant increase in the number of alternative energy programs. Today, more than 160 countries are focusing on renewable energy development, increasing their investment every year. Investments in "green" energy projects over the last decade should be observed and the leading countries involved in attracting investment should be identified either (Fig. 2).

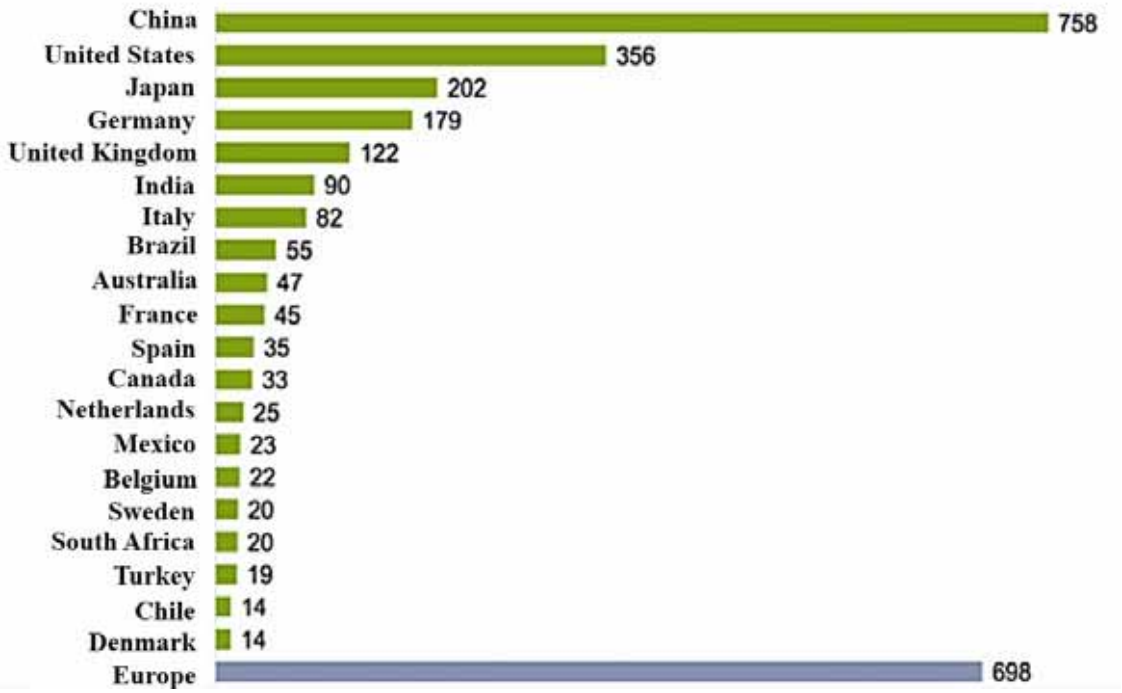

Fig. 2. Top 20 Investment Leaders and Total Funds Raised for RES 2009 – 2019
(compiled by the author based on [10], [11])

Fig. 2 demonstrates total quantitative expression of the investment into the renewable energy potential of the 20 leading markets. As it can be seen from Fig. 2, China is the leading state among countries with investment of USD 758 billion, accounting for almost 31% of the world's total RES investment. The second position is ranked by the USD 356 billion (14% of the world-wide volume). The TOP-20 rating also includes eight European countries, led by Germany (USD 179 billion) and the United Kingdom (USD 122 billion). All in all, total investments of European countries from 2009 to 2019 is estimated at USD 698 billion, which is about 28% of the world's total investment.

To trace the overall picture of attracting investments in "green" energy projects over the last decade, let us analyze their dynamics in the RES sector (Fig. 3).

Fig. 3. Dynamics of investments attraction into RES during 2004-2018, in USD billions
(compiled by the author based on [10], [11])

Figure 3 shows that investments into renewable energy in 2018 were estimated at USD 272.9 billion, which is 12 % less than last year, but still remaining at a high level of USD 250 billion. During the period of 2009 and 2019, there were two investment peaks in RES projects, including 2015, with a total calculation of USD 301.5 billion and in 2017 (USD 308.9 billion).

As it is shown in Fig. 3 above, the investment trend is characterized by gradual increase of attracting funds into alternative energy projects. Despite 12 % decline within investment sector in 2018, compared to its peak in 2017 (USD 308.7 billion), investment on for renewable energy has doubled on mined fuel financing, and the share of "green" technology in the world has increased from 11,3 % in 2017 to 12.6 % in 2018. At the same time, the number of solar and wind power stations set a record of 638 Giga Watts during 2010-2019; this number is very impressive, bearing in mind that by the end of 2009 the solar power engineering was at the level of just about 25 Giga Watts [12].

There is another way to analyze the investment dynamics into RES projects and to understand the tendency for attracting funds during last decades. This analysis consists of geographical division of the world into developed economies and developing countries (this distinguishing of countries meets the OECD criteria), which is presented in the Fig. 4.

In general, developed countries were the first to receive subsidies for the development of hydrogen alternatives to energy in recent decades. However, the most rapid one is the growing demand for RES in developing countries. Figure 3 shows that by 2014 investment into renewable energy projects in developed countries had prevailed, but starting from 2015, the developing countries have been dominating in attracting RES investments.

In 2018, advanced economies received USD 125.8 billion as investments, which is 10% more than the previous year, while developing countries attracted USD 147.1 billion, which is 24% less than in 2017. This change was closely connected to China and India. Total investment within these two giant countries fell down to 36% which is USD 99.6 billion (dark green color in the graph shows this downfall), while that of "other" emerging economies it raised 22% to a record high up USD 47.5 billion of attracted funds.

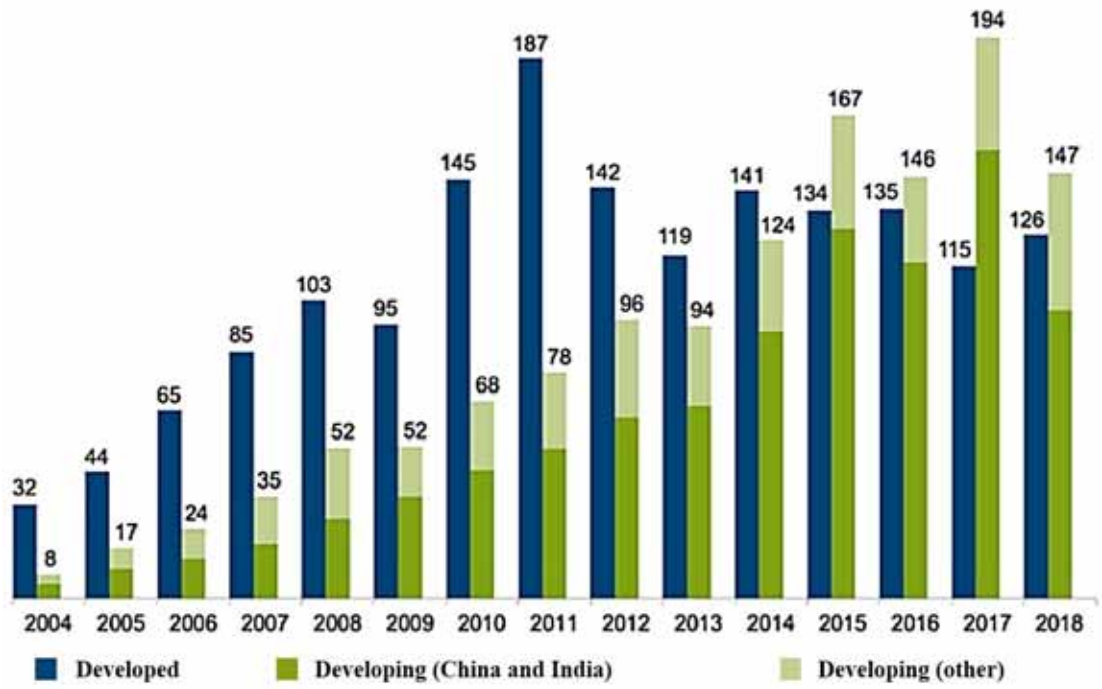

Fig. 4. Dynamics of investments attraction into RES during the period of 2004-2018 by geographical division of countries

(compiled by the author based on [12])

Among European countries, the leaders in terms of investment into RES in 2018 were Spain, Germany, the Netherlands, Sweden, France and other countries listed in Table 1. It is interesting to note that France and Germany (developed countries) showed somewhat of decline compared to 2017, but at the same time Spain (+ 859%) and Belgium (+ 312%) showed strong investment growth. In 2018, USD 2.1 billion was attracted onto domestic RES projects, which 539 % higher than in previous year [12].

Table 1.
RES investments in European countries in 2018, billion USD And it`s changes from 2017

Country	2018, USD bln.	% growth by 2017
Spain	7,5	859 %
Germany	6,3	-52 %
Netherlands	4,9	197 %
Sweden	4,5	122 %
France	4,1	-8 %
Belgium	3,1	312 %
Italy	2,0	92 %
Denmark	1,7	69 %
Norway	1,1	15 %
Finland	1,0	193 %
Ukraine	*2,1*	*539* %

Source: compiled by the author based on [12]

Sectoral analysis reveals vectors of investment in the field of renewable sources. Regarding directions of attracting funds, it is worth considering sectoral diagram presented in Fig. 5.

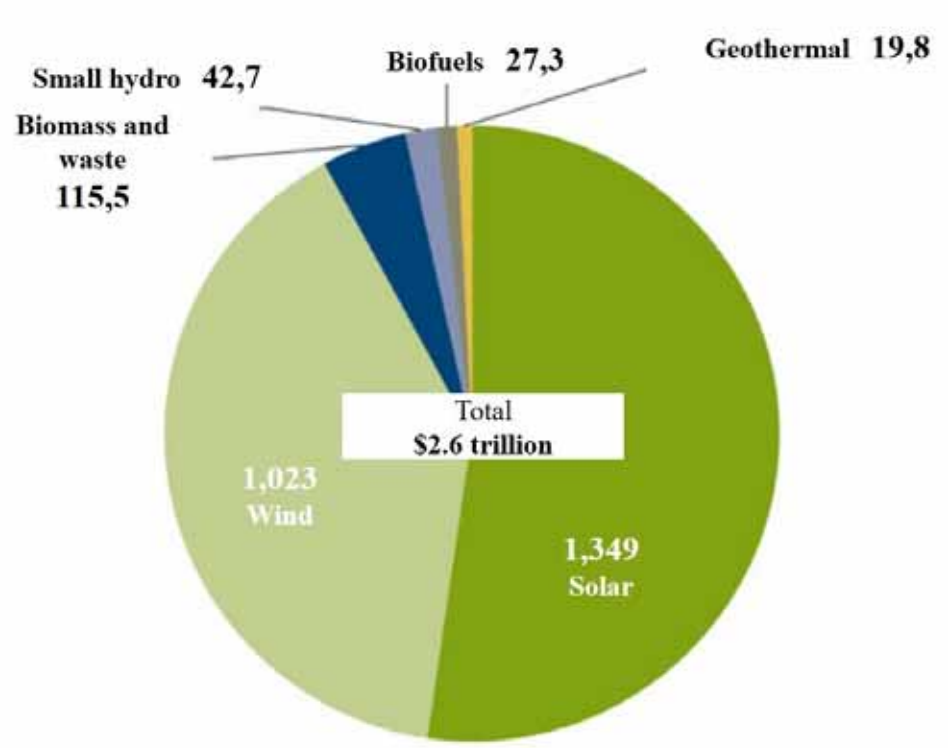

Fig. 5. Total volume of investments into RES projects by sectors during 2009-2019
(compiled by the author based on [10], [11])

Paying much more attention to the analyzed period of 2009 to 2019, let us notify that the total equivalent amounted up to USD 2.6 trillion worldwide. As it can be seen from Fig. 5, solar and wind power engineering projects account for the largest share of investments, which are USD 1,349 trillion and USD 1,023 trillion relatively.

Comparing indicators of attracting investment resources in 2017-2018, it is worth going along with the following dynamics (Fig. 6). In 2018 global solar investment declined to 22 % comparing with the previous year, and amounted just USD 133.5 billion (this reduction is considered as one of the main reasons for the decrease in the overall level of fundraising into RES projects). Instead, there is an observance of raising up to more than 3% into the wind energy projects, amounting USD 129.7 billion in 2018. It is also worth noting about significant increase (61%) of investments into biomass energy projects, which in 2018 attracted over USD 6.8 billion.

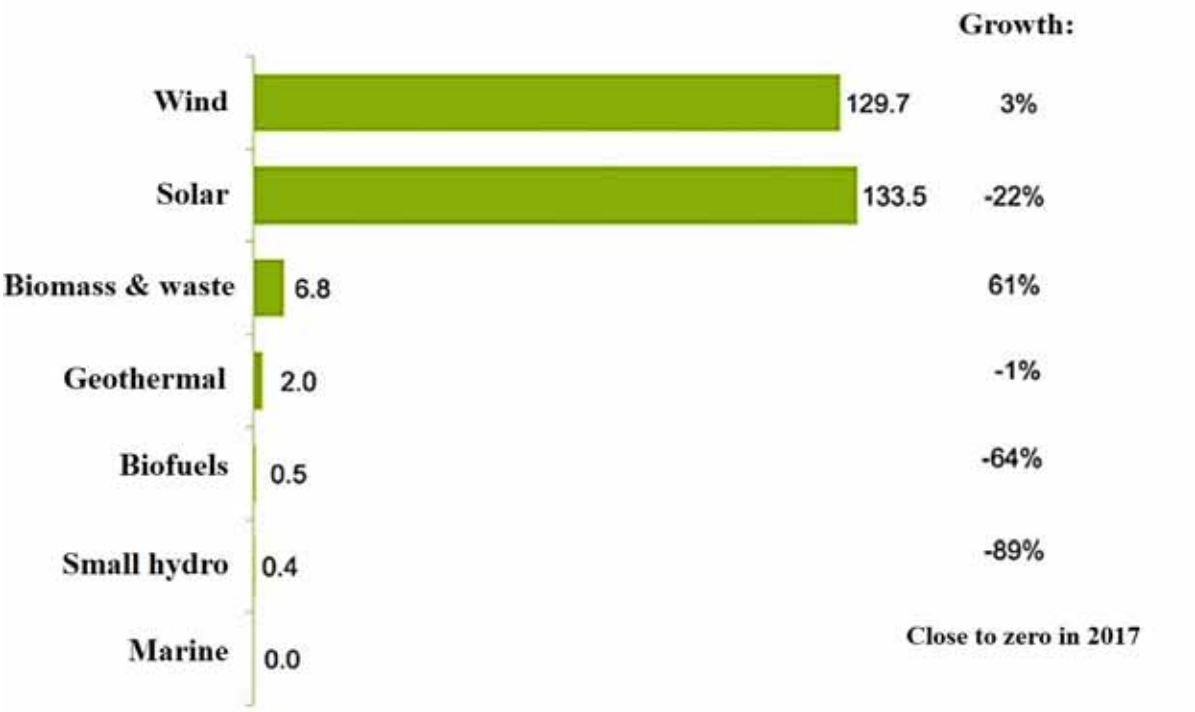

Fig. 6. Dynamics of investments attraction by type of energy during 2017-2018
(compiled by the author based on [12])

According to the requirements of The Paris Agreement, after 2020 the projected directions and investments in the world energy sphere are to be brought into concordance with the low-carbon development strategy up to 2050, according to the decision of the UN International Conference on Climate, in order to prevent the Earth's surface temperature rising above 2° C.

In the late 2017 the Summit on sources finance attraction for climate, the Head of the World Bank (WB) outlined a long list of measures that are to be implemented for effective fulfilment of The Paris Agreement. The main one among them is the following: WB ceases financing oil and other mined fuel projects after 2019. Exemptions are to be made for the poorest countries only where gas production should be energetically beneficial for indigent layers of population. The plans also include USD 325 million contribution from the World Financial Corporation to the Green Cornerstone Bond Fund to create the world's largest "green bond" fund for emerging markets. The fund has already raised more than USD 1 billion on for local climate protection projects and is planning to attract at least USD 1 billion more for further development [13].

Conclusions. Summarizing the above, it should be concluded that the development of alternative energy is gaining momentum on global scale. An important argument within this direction is the introduction of "green" energy projects in both developed and developing countries; this process has been particularly noticeable over the last decade.

Awareness of the benefits from alternative energy by the global community over traditional sources has given a positive impetus to increasing investment into renewable energy. China, the United States, Japan and several European countries account for the largest amount of investment into renewable energy. This amount of investment has been provided by development and implementation of alternative energy promotion principles and programs in these countries. There is also a shift in the trend of global investment infusions from developed countries to developing countries, which is explained by the access to resources and cheaper generation of energy flows in the RES sector.

Sectoral analysis has shown that over the last decade, renewable energy production has increased significantly, with solar and wind power engineering showing the fastest pace.

Therefore, the use of alternative energy sources, stimulating investment infusions into renewable energy projects will allow for rapid transition to renewable energy sources, which is extremely important as it reduces the share of mined fuels, which in its turn leads to increase in greenhouse gas emissions and thus causes irreparable damage to the environment and to the planet in the whole.

References.

1. Zaverbnyj, A.S. (2017), "Factors of influence on formation of strategy of organizational development of energy enterprises", *Innovatsijna ekonomika,* vol. 5-6, no. 69, pp. 96-102.

2. Lavrenchuk V.A. (2012), "Green investments: Ukrainian realities of the alternative energy market", *Investytsii: praktyka ta dosvid*, vol. 22, pp. 35-38.

3. Kudria S. O. (2015), "Status and prospects of renewable energy development in Ukraine", *Visnyk Natsional'noi akademii nauk Ukrainy*, vol. 12, pp. 19-26.

4. Kuz'mina M. M. (2017), "Forms of investment in renewable energy", *Ekonomika ta pravo*, vol. 2, pp. 112-121.

5. Huber, M. Dimkova, D. and Hamacher, T. (2014), “Integration of wind and solar power in Europe: Assessment of flexibility requirements”, *Energy,* vol. 69, pp. 236-246.

6. Spencer, D. (2017), “Statistical review of world energy”, *Energy economics* [Online], available at:https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html (Accessed 20 March 2020).

7. The official site of UN Sustainable Development Goals (2018), “Analysis of the voluntary national reviews relating to Sustainable Development Goal 7”, available at: https://sustainabledevelopment.un.org/content/documents/21159DESASDG7_VNR_Analysis2018_final.pdf (Accessed 20 March 2020).

8. The official site of United Nations (2019), “Special edition: progress towards the Sustainable Development Goals”, available at: https://undocs.org/E/2019/68 (Accessed 20 March 2020).

9. The official site of International Energy Agency (2018), “Renewables 2018 - Analysis and forecasts to 2023”, available at: https://www.iea.org/reports/renewables-2018 (Accessed 20 March 2020).

10. The official site of United Nations Environment Programme (2017), “Renewable energy and energy efficiency in developing countries: Contributions to Reducing Global Emissions”, available at: https://www.unenvironment.org/resources/report/renewable-energy-and-energy-efficiency-developing-countries-contributions-0 (Accessed 20 March 2020).

11. The official site of Bloomberg NEF (2019), “New Energy Outlook 2019”, available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/29752/GTR2019.pdf (Accessed 20 March 2020).

12. The official site of United Nations Environment Programme (2019), “Global Trends in Renewable Energy Investments 2019”, available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/29752/GTR2019.pdf (Accessed 20 March 2020).

13. The official site of Finance UA (2018), “Svitovyj bank prypynyt' investytsii v naftu i haz pislia 2019 roku”, available at: https://news.finance.ua/ua/news/-/416727/svitovyj-bankprypynyt-investytsiyi-v-naftu-i-gaz-pislya-2019-roku (Accessed 20 March 2020).

Список літератури.

1. Завербний А.С. Фактори впливу на формування стратегії організаційного розвитку енергетичних підприємств / А.С. Завербний // Інноваційна економіка. – 2017. – №5-6 (69) – С. 96-102.

2. Лавренчук В.А. "Зелені" інвестиції: українські реалії ринку альтернативної енергетики / В. Лавренчук // Інвестиції: практика та досвід. – 2012. – №22. – С. 35-38.

3. Кудря С. О. Стан та перспективи розвитку відновлюваної енергетики в Україні / С. О. Кудря // Вісник Національної академії наук України. - 2015. - № 12. - С. 19-26.

4. Кузьміна М. М. Форми інвестування у відновлювану енергетику / М.М. Кузьміна // Економіка та право. - 2017. - № 2. - С. 112-121.

5. Huber M. Integration of wind and solar power in Europe: Assessment of flexibility requirements / M. Huber, D. Dimkova, T. Hamacher // Energy. № 69 (2014), p. 236-246.

6. Spencer, D. (2017). Statistical Review of World Energy | Energy economics | BP. Retrieved URL: https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html

7. Analysis of the voluntary national reviews relating to Sustainable Development Goal 7- 2018. URL: https://sustainabledevelopment.un.org/content/documents/21159DESASDG7_VNR_Analysis2018_final.pdf

8. Special edition: progress towards the Sustainable Development Goals / Report of the Secretary-General. URL. https://undocs.org/E/2019/68.

9. Renewables 2018 - Analysis and forecasts to 2023 / International Energy Agency. URL. https://www.iea.org/reports/renewables-2018.

10. United Nations Environment Programme / Renewable energy and energy efficiency in developing countries: Contributions to Reducing Global Emissions. URL. https://www.unenvironment.org/resources/report/renewable-energy-and-energy-efficiency-developing-countries-contributions-0.

11. Bloomberg NEF – New Energy Outlook 2019. URL. https://about.bnef.com/new-energy-outlook/.

12.Global Trends in Renewable Energy Investments 2019. URL. https://wedocs.unep.org/bitstream/handle/20.500.11822/29752/GTR2019.pdf.

13. Світовий банк припинить інвестиції в нафту і газ після 2019 року // News Finance UA. – 2018. URL. https://news.finance.ua/ua/news/-/416727/svitovyj-bankprypynyt-investytsiyi-v-naftu-i-gaz-pislya-2019-roku.

Стаття надійшла до редакції 03.04.2020 р.