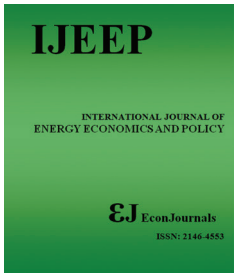


International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2021, 11(3), 460-467.

The Transition to Renewable Energy Sources as a Threat to Resource Economies

Ivan Udalov*

Financial University under the Government of the Russian Federation, Moscow, Russia. *Email: ivandudalov@gmail.com

Received: 23 March 2020 **Accepted:** 10 March 2021 **DOI:** https://doi.org/10.32479/ijeep.10902

ABSTRACT

Changes in global development benchmarks, the gradual depletion of natural resources, as well as global climatic changes are forcing economic actors around the world to look for alternative methods of energy production. The transition to them can be difficult due to the high cost of the produced energy and pressure from states and corporations specializing in the extraction of classical energy sources. The article is devoted to the study of the transition to renewable energy. The article uses a statistical analysis of indicators and makes a conclusion about the relationship between development trends. It is clear with a fair amount of confidence that the positive dynamics of the renewable energy market is leading to changes in the energy market in the USA, Europe and some other parts of the world.

Keywords: Renewable Energy Sources, Export and Consumption Of Fossil Energy, Alternative energy, Resource economies
JEL Classifications: C10, E21, E23, Q41, Q42

1. INTRODUCTION

Due to the growing pace of introduction of new technologies within the renewable energy industry, which is reflected in the improvement of technologies for processing natural gas. A decrease in the degree of emission of substances harmful to the environment and an increase in the efficiency of energy extraction became noticeable (McDonagh et al., 2018).

Additional difficulties for companies supplying fossil resources may arise due to the expansion of the use of alternative energy in developed countries, including the member states of the European Union, the United States, China and Australia. The latter has ample opportunities in the field of replacing the consumption of energy derived from fossil fuels due to that generated by solar radiation, geothermal processes (Siegel et al., 2014), sea waves and wind (Manasseh et al., 2017; Teske et al., 2016). One of the promising industries that is gradually starting to be introduced into practice in Australia and other countries is the use of biomass resources for the production of energy, including that obtained with the help of ethanol and other chemical compounds, which illustrates the wide variability of the industry development (Puri et al., 2012; Raison, 2006; Román-Leshkov et al., 2007).

Aim of this work is to identify the relationship between the dynamics of the development of the renewable energy industry, expressed in the total volume (and its growth rate) of generated energy from renewable sources, the share of electricity produced from alternative sources in global generation, and the dynamics of production and consumption of fossil resources in relation to all over the world and macro regions specializing in energy production and occupying key positions in their consumption.

It is assumed that an increase in the growth rate of generated energy from alternative sources, their share in the global structure of energy resources, will negatively affect the production of some fossil energy sources in the European Region and the United States. At the same time, the impact on the consumption and production of oil and natural gas or fossil fuels in general in the resource economies of the countries of the Middle East region and the

Russian Federation (CIS) will not be significant. In addition, it is assumed that the Asian market, one of the largest consumers of fossil fuels, will be weakly responsive to the development of the renewable energy industry.

2. LITERATURE REVIEW

The development of alternative energy is an integral part of the environmental policy of the states of the world, aimed at reducing emissions into the atmosphere and other environmental pollution. The main regulatory document that serves as the basis for building the line of this policy is the 2015 Paris Agreement, which sets environmental standards for countries, and a number of other agreements of national or regional significance (Martek et al., 2019).

Analysis of the literature, extracting from it the necessary information related to the consideration of the problems and prospects of using renewable energy sources, is an integral part of the research methodology, which is used by a number of authoritative researchers (Reim et al., 2015).

As part of the implementation of these agreements, an effective method is the expansion of the use of alternative energy sources to supply enterprises and households with electricity (Sommerfeld et al., 2017).

Difficulties in this case are inefficient schemes for the use and storage of energy, which can lead to losses in the capacity of solar panels or other common alternative energy tools used by local residents (Vieira et al., 2017).

In a number of cases, the available opportunities for using these methods are not used or are insufficiently used, which in practice is confirmed by the experience of the Australian Confederation, whose power grid is 86.3% dependent on fossil resources, although in practice there are broad prospects for the use of thermal energy (from heat of magma), light radiation, wind energy, sea energy and other water resources (Li et al., 2020; Zhang et al., 2018).

However, this issue is controversial in the scientific community, since some scientists put forward the opinion that the costs of introducing and maintaining renewable energy technologies may be prohibitive for the country's economy, which is also considered on the example of Australia (Trainer, 2012 and Yumashev et al, 2020).

In the framework of increasing demand for these energy sources, interest in them is also manifested by world economic giants such as the People's Republic of China and the United States of America. Both states are known for the widespread use of fossil energy sources, but as part of a strategy to diversify risks associated with the energy market and global climate changes, they are forced to develop alternative energy (Tran and Smith, 2017; Musa et al., 2018).

Among ordinary investors, the demand for securities of companies specializing in the generation of energy from alternative sources is growing as the industry develops and serves as one of the most promising long-term investments for market participants (Masini and Menichetti, 2012).

A long-term strategy for expanding the use of alternative energy should be based not only on national policy in this area. Local communities and communities should play a leading role in the introduction of solar energy technologies, the use of biomass resources, winds, etc., since without local response, the initiative is subject to high risks (Petersen, 2018; Mey et al., 2016).

Support from the population in promoting alternative energy can be achieved through educational activities, promotion of an agitation campaign, which allow achieving social approval of this policy by society (Romanach et al., 2015). A positive impetus for the introduction of alternative energy as an innovative project can be created by such methods of interaction with social groups as collecting and processing feedback, consulting specialists with the population, and more (Slaughter, 2000; Nyangarika et al., 2019a; Nyangarika et al., 2018, Nie et al., 2020).

An important aspect, according to scientists, is the involvement of private investors and their conviction in the need to introduce alternative energy. One of the arguments in favor of investing in this industry may be its positive impact on the growth of financial and other types of markets (Wüstenhagen et al., 2007).

In the context of Australia, the researchers found that when implementing renewable energy policies, it is necessary to adhere to the principles of procedural fairness in relation to local communities, and in some cases, increased government control (Simpson and Clifton, 2016; Denisova et al., 2019; Mikhaylov, 2018a; Mikhaylov, 2018b).

Some researchers suggest relying on qualitative methods of public opinion research to identify the most effective method of action in the framework of direct campaigning or other work with various social groups (Myers, 2013).

Public policy should use various methods to encourage the population to participate in the implementation of renewable energy technologies in life, for example, in Australia, the government not only supports the campaign, but also provides financial support to economic actors involved in the renewable energy market, in particular installers and manufacturers solar panels (Poruschi et al., 2018), which are able to maximize energy production from a variety of sources under conditions of fluctuating temperature and sunlight (Rajesh and Carolin Mabel, 2015).

The use of environmentally friendly technologies in human economic activity can reduce the burden on the environment and harmonize the development of society in accordance with a stable forward movement. (Martek et al., 2018; An and Mikhaylov, 2020).

The importance of the human factor in the question raised determines the use in research of methods aimed at empirical reflection of social factors and their representation not only through statistical analysis, but also through the tools of other paradigms, for example, interpretism, which describes phenomena in society from a different perspective. (Molder, 2010; Mikhaylov, 2019; Dooyum et al., 2020; An et al., 2021; Gura et al., 2020).

3. METHODS

The wide format of the research topic posed necessitated the use of a large array of statistical and economic data on the position and dynamics of some areas of the world economy, in particular the renewable energy sector, the extractive industry and the electric power industry in general, when writing it. In the context of the study, this information is a collection of materials illustrating the dynamics of energy production from various sources (fossil and alternative), the consumption of several types of fossil energy carriers (natural gas and oil), the volume of electricity produced from renewable resources and fossil fuels as a percentage of the total volume of produced energy in a particular region or country. The World Bank database was used to obtain the above information on the share of energy produced from renewable sources and on the share of energy consumption from fossil sources. Industry statistics for oil, gas, coal and alternative energy were obtained from the Global Energy Statistical Yearbook 2020 compiled by Enerdata. Based on this information, the growth rates of the produced resource, its consumption, as well as the volume of produced energy from renewable sources were calculated. The Our World in Data database will be used to obtain information on the volumes of energy produced from different types of sources (fossil and alternative). As objects of research, data will be taken on large consumers and producers of oil, gas, and other fossil fuels (individual macroregions and countries), as well as macroregions in which there is a steady trend towards the introduction of alternative energy into the economy (Europe, the United States).

To identify the strength and direction of the relationship between the development indicators of the named industries for different groups of countries, a linear correlation coefficient was applied (1). This indicator is a universal indicator that measures the strength of the relationship between various statistical indicators.

$$r_{XY} = \frac{cov_{XY}}{\sigma_X \sigma_Y} = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum (X - \bar{X})^2 \sum (Y - \bar{Y})^2}} \quad (1)$$

Using this indicator, it will be revealed how strong the influence of the dynamics of the renewable energy industry has on the economies of countries with a leading share of the fuel and energy complex in the structure of the economy, developed and developing countries, dependent on the position in the energy market.

To calculate the correlation coefficient, the following data series were taken: the dynamics of the volumes of crude oil produced by individual regions, countries and the world, the volume of national consumption of petroleum products in different parts of the world, states and on a global scale, the volume of natural gas production in the above-named territories, the volume of natural gas consumption according to the same geographical criteria, the share and total volume of energy produced from renewable sources in the global structure of electricity production and some other indicators related to the renewable and classical energy industry (Mikhaylov et al., 2020).

After calculating the correlation indicators, a regression analysis of the relationships of those indicators was carried out for which the highest correlation relationship was revealed, in order to confirm the obtained result and draw conclusions about the significance of the constructed model and its quality (An et al., 2020a; An et al., 2020b; An et al., 2019).

When constructing a regression model, the following linear regression model will be used (2). Using a linear regression model allows us to reveal the degree of relationship between the dependent variable Y and the independent value X (Montgomery et al., 2012).

The values of the dependent variable are the indicators of factors associated with the oil, gas and other energy industry using fossil resources, and the values of the variable X are the indicators of the alternative energy industry.

$$Y_i = a_0 + a_1 X_i + \varepsilon_i \quad (2)$$

After building a model and studying the quality of the relationship between the features, using the Fisher criterion at a significance level of 0.05 (3), the parameters of the significance of the constructed model are assessed, which allows us to conclude about the significance of the research results and their significance in the formation of general conclusions. The quality of the linear regression model will be assessed using the average approximation error (4), which makes it possible to evaluate the resulting model and the prospect of using the results obtained when forming conclusions.

$$F = \frac{R^2/(k-1)}{(1-R^2)/(n-k)} \sim F(k-1; n-k) \quad (3)$$

$$A = \frac{1}{n} \sum \frac{|y_i - \bar{y}_i|}{y_i} * 100\% \quad (4)$$

Further, the following abbreviation system is used for the considered indicators (Table 1).

4. RESULTS AND DISCUSSION

Tools of statistical analysis were used in this work to study the relationship between the mutual influence of the renewable energy sectors and the fuel and energy complex. Table 2 presents the

Table 1: Terminology summary

RE	Renewable energy production (Table 2: growth rate; Table 3: TWh)
CO	Crude oil production (growth rate)
OPDC	Oil products domestic consumption (growth rate)
NPDC	Natural gas domestic consumption (growth rate);
NGC	Natural gas production (growth rate)
REO	Renewable electricity output (% of total electricity output)
FFC	Fossil fuel energy consumption (% of total);
EPOGC	Electricity production from oil, gas and coal sources (TWh)
CALP	Coal and lignite production (growth rate)
CALDC	Coal and lignite domestic consumption (growth rate)

Table 2: Renewable and electricity production correlation summary

	Crude oil production	Oil products domestic consumption	Natural gas production	Natural gas domestic consumption	Coal production	Coal domestic consumption	Fossil fuel consumption
World	0,139602633	0,036230783	0,296118261	0,339951158	0,115006226	0,167675044	0,023729146
Europe	−0,439891855	−0,244111845	−0,17176038	−0,038958751	0,057257687	0,002939557	-
European Union	−0,298779053	−0,300910946	−0,165592644	−0,014825033	0,02275935	−0,04089746	−0,6100536
CIS	0,079153626	0,344892044	0,333931729	0,215327724	0,335462573	0,325278784	-
Asia	−0,067549397	0,122785138	−0,261040734	−0,074157696	0,072169976	−0,224458173	-
Middle east	0,042705977	−0,31947571	−0,06681043	−0,144230863	-	-	−0,7402730
United states	0,419090286	−0,219193205	0,198677891	0,410990087	−0,347252561	0,081697406	−0,8213636
OECD	-	-	-	-	-	-	−0,6894659
Russian federation	-	-	-	-	-	-	0,16696222

Source: World bank, Enerdata

results of the correlation analysis of the indicators of the growth rates of energy produced from renewable sources by the chain method and the indicators of production and consumption of the three main types of fossil energy carriers: oil, natural gas, coal and brown coal. The obtained results of the correlation study allow us to draw preliminary conclusions that the positive dynamics of energy production from renewable resources negatively affects oil production in the European region and, to a lesser extent, in Asia; the opposite trend is observed in relation to the USA, the Middle East and the CIS. Based on the values of the indicators, it can be stated that the growth in oil production to varying degrees may be associated with an increase in the output of the renewable energy industry.

A similar trend in relation to European countries can be traced while analyzing the correlation of indicators of consumption of petroleum products: the higher the growth rate of production of the renewable energy industry, the less the amount of consumption of petroleum products in the European region grows. In the Middle East, there is a similar negative trend, which is more pronounced in comparison with the countries of the European Region, the indicator of the United States also shows an inverse correlation.

Based on the data in the above tables, it can be assumed that there is no serious effect on the volume of oil production and consumption in the countries of the Middle East region, the CIS and Asia from the growth of the share of renewable energy.

A similar correlation analysis of data on production and production of natural gas showed similar results. Consumption indicators for all regions, with the exception of the CIS and the USA, where there is a direct correlation, are associated with the indicator of alternative energy production in the opposite direction. Comparing the results of the calculations, we can come to the conclusion that the indicators of correlation between the growth rates of the oil and gas industry and the consumption of their products almost completely coincide in directions, although the relationship with respect to the gas sector is less strong.

Preliminarily, it can be stated that the fuel and energy complex of the CIS countries and the Middle East (oil and gas) are not subject to risk from the development of alternative energy, since between the indicators there is either a direct correlation expressed by an average strength, or a weakly expressed feedback, that is, the growth of the industry renewable energy on a global scale leads to an increase in oil and gas production in the above regions. But at the same time, the opposite conclusion can be drawn regarding the consumption of oil and gas products.

Additional analysis was carried out in order to identify the relationship between the dynamics of the development of the renewable energy industry and the trends in the development of the spheres of production and consumption of coal and brown coal.

From its results, it can be concluded that the growth rate of coal mined in the United States is decreasing as the growth rate of the volume of energy produced from renewable sources increases. A similar in strength, but inverse in direction, relationship is observed in the indicators of the CIS, however, the hypothesis implying the presence of a positive effect of renewable energy on the coal industry of this group of countries is rather doubtful.

Further correlation analysis of the indicators of the share of renewable energy in the total production of the world energy complex and the share of energy consumption from fossil fuels showed a strong feedback in relation to the countries of Europe and the United States. On this basis, it can be assumed that against the background of an increase in the volume of produced alternative energy, the consumption of fossil resources in the energy sector is falling. One should not exclude the fact that scientific and technological progress can also have an impact on consumption, in particular, enterprises can use more modern equipment that consumes less energy with the same level of efficiency or allows more economical use of fossil resources (Mikhaylov, 2020).

The results of the correlation analysis of the volume of energy produced from fossil and alternative resources in TWh showed a similar result in relation to previous statistical studies, which shows that the global increase in energy from renewable sources causes a decrease in energy consumption from fossil sources in the European Region (Table 3).

Based on the results of the entire correlation analysis, it can be stated that with regard to the United States there is a strong inverse correlation between the indicators of the development of alternative energy and the dynamics of energy consumption from fossil fuels and the consumption of petroleum products, as well as the growth rate of coal production. With regard to the

European region and the EU countries, it can be assumed that the growth of the alternative energy industry leads to a slowdown in the growth of production and consumption of natural gas, oil and petroleum products. To a lesser extent, the growth in the production of alternative energy negatively affects coal production in Europe.

Correlation results also show an inverse correlation for the Middle East and OECD countries between the share of energy consumption from fossil sources and the share of global energy produced from renewable sources. Based on these data, as well as on the results of the general correlation analysis, it can be stated that the development of renewable energy on a global scale has an impact exclusively on certain regions of the world, in particular Europe and the United States. To confirm the general conclusion made, a regression analysis was carried out for some of the indicators of correlation relationships, which are the most significant in the research issue (Table 4).

Regression analysis models built on the basis of the above statistical data, in most cases, did not confirm the hypothesis about the presence of one or another relationship between the factors. This conclusion was made on the basis of the observed value of the Fisher criterion and its relationship with the critical value.

The hypothesis of the significance of the constructed models was confirmed in relation to the model of the influence of the growth rates of global energy production from renewable sources on the growth rates of crude oil production in the European Region, and the existence of a connection can be stated between the growth rates of REO and the growth rates of natural gas consumption in the United States.

Table 3: Electricity production by source correlation summary

Region	World RE
Europe EPOGC	−0,186004589
Russian federation EPOGC	0,432485633
United states EPOGC	0,394443415
World EPOGC	0,932046698

Source: Our World in Data

Then analyzing regression models, you can pay attention to the indicators of the Middle East region. Although the hypothesis of the significance of this model according to Fisher's criterion can be rejected, the observed value of F is close to critical, which suggests a weak relationship between the growth rates of consumption of oil products and natural gas by the Middle East countries and the growth rates of global electricity generation from renewable sources.

A similar assumption about the presence of a weak link can be made about the growth rate of consumption of coal and brown coal in the United States.

The study revealed a contradictory picture: on the one hand, the correlation analysis showed the presence of an inverse correlation relationship between the indicators of the renewable energy industry, the oil and coal industry, as well as the consumption of various kinds of fossil resources, on the other hand, analysis using a regression model, checking by the Fisher criterion and the average approximation errors revealed insufficient quality in a number of models and insufficient significance, which is the basis for skepticism about the preliminary conclusions made.

Some models partially confirmed the hypotheses put forward earlier about the relationship between some indicators. In some models, the presence of a connection was not confirmed, however, a small difference between the observed and the critical value of the Fisher criterion gives reason to assume its existence (Figures 1 and 2).

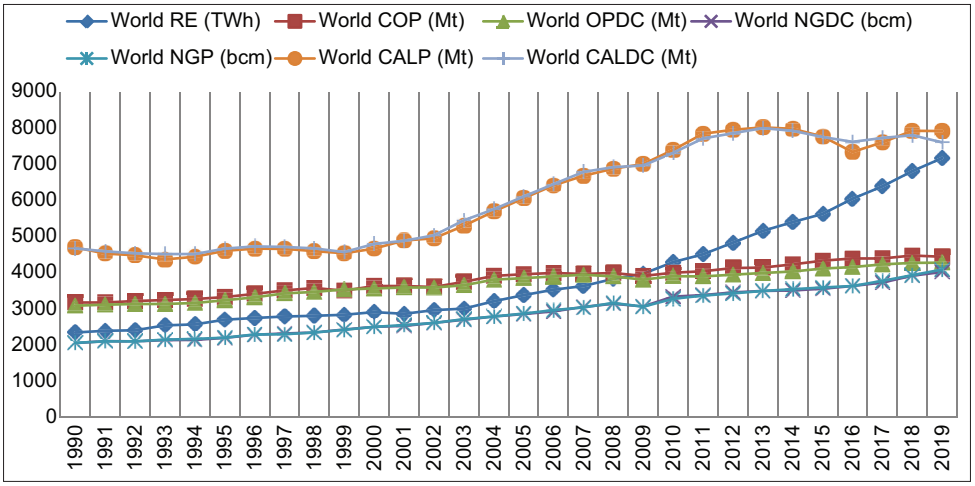
After analyzing the development trends of the indicators given in this article, it can be stated that the generation of energy from alternative sources has been rapidly increasing since about 2007. Looking at the graph, you can see that since 2008, a slowdown in the growth of production and consumption of hard and brown coal began. Of course, it is not worth connecting this fact exclusively with the development of alternative energy, since the 2008 crisis is of greater importance in this matter. However, further, as the volume of electricity generated from renewable sources grew, the growth in coal production and consumption practically stopped, which made it possible to put forward the assumption that the rapid development of alternative energy slowed down the growth of the coal industry.

Table 4: Renewable and electricity production regression summary

Regression model	F	F-critical	A
World RE/Europe COP	6,478192416	4,182964289	4,078831435
World RE/EU COP	2,646512209	4,182964289	4,521690221
World RE/USA OPDC	1,362704905	4,182964289	2,288374458
World RE/Middle East OPDC	3,068982555	4,182964289	2,367489201
World RE/EU UPDC	2,688188175	4,182964289	1,459498193
World RE/EU NGDC	0,005935408	4,182964289	3,531027225
World RE/USA NGDC	5,487567716	4,182964289	2,353655049
World RE/Middle East NGDC	3,068982555	4,182964289	2,367489201
World RE/Europe NGP	0,82075765	4,182964289	3,492287506
World RE/Asia NGP	1,974379863	4,182964289	2,438455545
World RE/USA CALP	3,70220519	4,182964289	4,27340414
World RE/EU CALP	0,013992924	4,182964289	3,098674073
World RE/USA CALDC	1,432469657	4,182964289	3,910935518
World RE/EU CALDC	0,045235922	4,182964289	3,739029778
World RE/Europe EPOGC	0,935402621	4,195971819	7,922701532

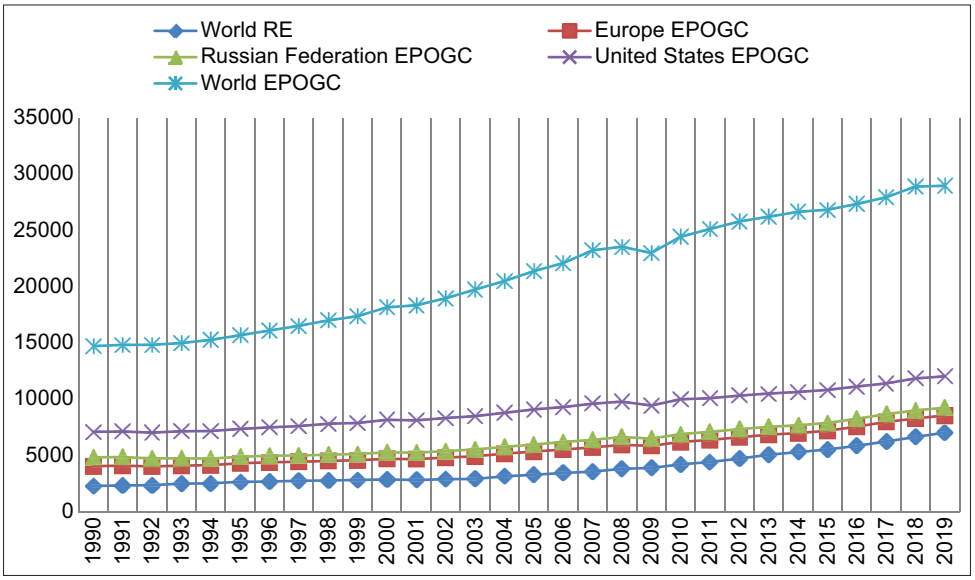
Source: World bank, Enerdata, Our world in data

Figure 1: Graphic interpretation of the dynamics of the main indicators of the research



Source: Enerdata, Our World in Data

Figure 2: Electricity production from oil, gas, coal sources and renewables (TWh)



Source: Our world in data

At the same time, the volumes of produced and consumed oil practically did not change, which may indicate the absence of a strong influence of the alternative energy industry on this segment of the economy of the countries.

However, if we consider the dynamics of energy production from renewable sources on a global scale and compare it with the indicators of energy production from fossil sources on the same scale, then we can state that there is a huge gap between values. If we compare World RE with European and Russian indicators, then we can safely say that in the short term, the value of world production of renewable energy will surpass them.

It can be suggested that the weak link between the factors of classical and alternative energy is due to low prices for fossil resources and the relative ease of their extraction. In addition to this, a number of researchers note that the use of renewable energy sources on a permanent basis is difficult due to climatic and seasonal factors, which, however, can be overcome by a combination of different technologies, for example, solar and wind energy (Olatomiwa et al., 2016; Prasad et al., 2017).

5. CONCLUSION

The global trend towards an increase in the share of the contribution of the renewable energy industry in the overall structure of energy production has a certain negative impact on the industries associated with the extraction of fossil fuels, in particular, on the extraction of crude oil. As previously assumed, the impact on the fuel and energy complexes of the countries of the Middle East, Asia, and the CIS is either positive and compelling to increase oil and gas production or is insignificant.

It can be stated with a fair degree of confidence that the positive dynamics of the renewable energy market has an impact on the process of reducing natural gas consumption in the United States. It is less likely that there is an impact of the growth in global energy

production from alternative sources and on the rate of increase in the consumption of oil and natural gas in the Middle East.

Based on the calculations carried out, it can be stated that the further development of alternative energy to a certain extent (currently not by a significant amount) will allow the economy to be reoriented to a more technological and progressive path of development and reduce the amount of harmful emissions into the environment due to the gradual reduction in the consumption of certain types of fossils. resources. But currently.

However, do not forget that for the production of equipment that extracts energy from alternative sources, in particular, solar panels, a large amount of energy is required, and the results of production can cause certain harm to the environment (Stoppato, 2008).

The upward dynamics of the total volume of energy production obtained from renewable energy sources indicates that in the future the influence of the subjects of this sphere of the economy will increase.

At the same time, one should not note the rather weak influence of the dynamics of the renewable industry on the trends in the consumption of fossil resources, as evidenced by the above figures of positive correlation coefficients. It can be stated that the Asian region, mainly China, India and other countries of the Asian macro region for some time will continue to increase the consumption of fossil energy resources, based on the data obtained during the study.

To a certain extent, as mentioned above, this is due to the cheaper price for the extraction, processing of fossil raw materials and their use in generating electricity, in comparison with the cost of alternative energy technologies.

In addition, some scientists believe that in the future, humanity has yet to create a sustainable and efficient energy network of renewable energy (Robert et al., 2018). This is confirmed by the increasing demand for more generated energy, which has been considered in the example of some developed countries (Yusaf et al., 2011).

In the context of global climate change, mankind needs to think about the prospective revision of energy development guidelines to harmonize relations with the environment, to ensure that the risks of an environmental disaster and risks associated with the depletion of fossil resources are reduced.

REFERENCES

An, J., Mikhaylov, A. (2020), Russian energy projects in South Africa. Journal of Energy in Southern Africa, 31(3), 7809.

An, J., Mikhaylov, A., Jung, S.U. (2021), The strategy of south korea in the global oil market. Energies, 13(10), 2491.

An, J., Mikhaylov, A., Moiseev, N. (2019), Oil price predictors: Machine learning approach. International Journal of Energy Economics and Policy, 9(5), 1-6.

An, J., Mikhaylov, A., Richter, U.H. (2020b), Trade war effects: Evidence from sectors of energy and resources in Africa. Heliyon, 6(12), e05693.

Denisova, V., Mikhaylov, A., Lopatin, E. (2019), Blockchain infrastructure and growth of global power consumption. International Journal of Energy Economics and Policy, 9(4), 22-29.

Dooyum, U.D., Mikhaylov, A., Varyash, I. (2020), Energy security concept in Russia and South Korea. International Journal of Energy Economics and Policy, 10(4), 102-107.

Gura, D., Mikhaylov, A., Glushkov, S., Zaikov, M., Shaikh, Z.A. (2020), Model for estimating power dissipation along the interconnect length in single on-chip topology. Evolutionary Intelligence, 2, S12065.

Li, H.X., Edwards, D.J., Hosseini, M.R., Costin, G.P. (2020), A review on renewable energy transition in Australia: An updated depiction. Journal of cleaner production, 242, 118475.

Manasseh, R., McInnes, K.L., Hemer, M.A. (2017), Pioneering developments of marine renewable energy in Australia. The International Journal of Ocean and Climate Systems, 8(1), 50-67.

Martek, I., Hosseini, M.R., Shrestha, A., Edwards, D.J., Durdyev, S. (2019), Barriers inhibiting the transition to sustainability within the Australian construction industry: An investigation of technical and social interactions. Journal of Cleaner Production, 211, 281-292.

Martek, I., Hosseini, M.R., Shrestha, A., Zavadskas, E.K., Seaton, S. (2018), The sustainability narrative in contemporary architecture: falling short of building a sustainable future. Sustainability, 10(4), 981.

Masini, A., Menichetti, E. (2012), The impact of behavioural factors in the renewable energy investment decision making process: Conceptual framework and empirical findings. Energy Policy, 40, 28-38.

McDonagh, S., O'Shea, R., Wall, D.M., Deane, J., Murphy, J.D. (2018), Modelling of a power-to-gas system to predict the levelised cost of energy of an advanced renewable gaseous transport fuel. Applied Energy, 215, 444-456.

Mey, F., Diesendorf, M., MacGill, I. (2016), Can local government play a greater role for community renewable energy? A case study from Australia. Energy Research and Social Science, 21, 33-43.

Mikhaylov, A. (2018a), Pricing in oil market and using probit model for analysis of stock market effects. International Journal of Energy Economics and Policy, 8(2), 69-73.

Mikhaylov, A. (2018b), Volatility spillover effect between stock and exchange rate in oil exporting countries. International Journal of Energy Economics and Policy, 8(3), 321-326.

Mikhaylov, A. (2019), Oil and gas budget revenues in Russia after crisis in 2015. International Journal of Energy Economics and Policy, 9(2), 375-380.

Mikhaylov, A. (2020), Cryptocurrency market development: Hurst method. Finance: Theory and Practice, 24(3), 81-91.

Mikhaylov, A., Moiseev, N., Aleshin, K., Burkhardt, T. (2020), Global climate change and greenhouse effect. Entrepreneurship and Sustainability Issues, 7(4), 2897-2913.

Molder, B. (2010), Mind ascribed: An elaboration and defence of interpretivism. In: Advances in Consciousness Research. London: John Benjamins Publishing.

Montgomery, D.C., Peck, E.A., Vining, G.G. (2012), Introduction to Linear Regression Analysis. Hoboken: John Wiley and Sons.

Musa, S.D., Zhonghua, T., Ibrahim, A.O., Habib, M. (2018), China's energy status: A critical look at fossils and renewable options. Renewable and Sustainable Energy Reviews, 81, 2281-2290.

Myers, M.D. (2013), Qualitative Research in Business and Management. London: Sage Publications Limited.

Nie, D., Panfilova, E., Samusenkov, V., Mikhaylov, A. (2020), E-learning financing models in Russia for sustainable development. Sustainability, 12(11), 4412.

Nyangarika, A., Mikhaylov, A., Richter, U. (2019a), Oil price factors:

Forecasting on the base of modified auto-regressive integrated moving average model. International Journal of Energy Economics and Policy, 9(1), 149-160.
Nyangarika, A., Mikhaylov, A., Tang, BJ. (2018), Correlation of oil prices and gross domestic product in oil producing countries. International Journal of Energy Economics and Policy, 8(5), 42-48.
Olatomiwa, L., Mekhilef, S., Ismail, M.S., Moghavvemi, M. (2016), Energy management strategies in hybrid renewable energy systems: A review. Renewable and Sustainable Energy Reviews, 62, 821-835.
Petersen, J.P. (2018), The application of municipal renewable energy policies at community level in Denmark: A taxonomy of implementation challenges. Sustainable Cities and Society, 38, 205-218.
Poruschi, L., Ambrey, C.L., Smart, J.C.R. (2018), Revisiting feed-in tariffs in Australia: A review. Renewable and Sustainable Energy Reviews, 82, 260-270.
Prasad, A.A., Taylor, R.A., Kay, M. (2017), Assessment of solar and wind resource synergy in Australia. Applied Energy, 190, 354-367.
Puri, M., Abraham, R.E., Barrow, C.J. (2012), Biofuel production: Prospects, challenges and feedstock in Australia. Renewable and Sustainable Energy Reviews, 16(8), 6022-6031.
Raison, R.J. (2006), Opportunities and impediments to the expansion of forest bioenergy in Australia. Biomass Bioenergy, 30(12), 1021-1024.
Rajesh, R., Carolin Mabel, M. (2015), A comprehensive review of photovoltaic systems. Renewable and Sustainable Energy Reviews, 51, 231-248.
Reim, W., Parida, V., Ortqvist, D. (2015), Product-service systems (PSS) business models and tactics - a systematic literature review. Journal of Cleaner Production, 97, 61-75.
Robert, F.C., Sisodia, G.S., Gopalan, S. (2018), A critical review on the utilization of storage and demand response for the implementation of renewable energy microgrids. Sustainable Cities and Society, 40, 735-745.
Romanach, L., Carr-Cornish, S., Muriuki, G. (2015), Societal acceptance of an emerging energy technology: How is geothermal energy portrayed in Australian media? Renewable and Sustainable Energy Reviews, 42, 1143-1150.
Román-Leshkov, Y., Barrett, C.J., Liu, Z.Y., Dumesic, J.A. (2007), Production of dimethylfuran for liquid fuels from biomass-derived carbohydrates. Nature, 447(7147), 982-5.
Siegel, C., Schrank, C.E., Bryan, S.E., Beardsmore, G.R., Purdy, D.J. (2014), Heat-producing crust regulation of subsurface temperatures: A stochastic model re-evaluation of the geothermal potential in southwestern Queensland, Australia. Geothermics, 51, 182-200.
Simpson, G., Clifton, J. (2016), Subsidies for residential solar photovoltaic energy systems in Western Australia: Distributional, procedural and outcome justice. Renewable and Sustainable Energy Reviews, 65, 262-273.
Slaughter, E.S. (2000), Implementation of construction innovations. Building Research and Information, 28, 2-17.
Sommerfeld, J., Buys, L., Vine, D. (2017), Residential consumers' experiences in the adoption and use of solar PV. Energy Policy, 105, 10-16.
Stoppato, A. (2008), Life cycle assessment of photovoltaic electricity generation. Energy, 33(2), 224-232.
Teske, S., Dominish, E., Ison, N., Maras, K. (2016) 100% Renewable Energy for Australia. ISF for GetUp! And Solar Citizens, https://www.uts.edu.au/sites/default/files/article/downloads/ ISF_100%25_Australian_Renewable_Energy_Report.pdf
Trainer, T. (2012), Can Australia run on renewable energy? The negative case. Energy Policy, 50, 306-314.
Tran, T.T.D., Smith, A.D. (2017), Evaluation of renewable energy technologies and their potential for technical integration and cost-effective use within the U.S. energy sector. Renewable and Sustainable Energy Reviews, 80, 1372-1388.
Vieira, F.M., Moura, P.S., de Almeida, A.T. (2017), Energy storage system for self-consumption of photovoltaic energy in residential zero energy buildings. Renewable Energy, 103, 308-320.
Wüstenhagen, R., Wolsink, M., Bürer, M.J. (2007), Social acceptance of renewable energy innovation: An introduction to the concept. Energy Policy, 35(5), 2683-2691.
Yumashev, A., Ślusarczyk, B., Kondrashev, S., Mikhaylov, A. (2020), Global indicators of sustainable development: Evaluation of the influence of the human development index on consumption and quality of energy. Energies, 13, 2768.
Yusaf, T., Goh, S., Borserio, J. (2011), Potential of renewable energy alternatives in Australia. Renewable and Sustainable Energy Reviews, 15(5), 2214-2221.
Zhang, X., Li, H.Y., Deng, Z.D., Ringler, C., Gao, Y., Hejazi, M.I., Leung, L.R. (2018), Impacts of climate change, policy and water-energy-food nexus on hydropower development. Renewable Energy, 116, 827-834.