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Article

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Provided in Cooperation with:
International Journal of Energy Economics and Policy (IJEEP)

Reference: Shuvalova, Olga Vladimirovna/Chernyaev, Maxim Vasilyevich et. al. (2018). Peculiarities of the Russian and German energy policies in the field of alternative energy development. In: International Journal of Energy Economics and Policy 8 (4), S. 199 - 206.

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International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2018, 8(4), 199-206.

Peculiarities of the Russian and German Energy Policies in the Field of Alternative Energy Development

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ABSTRACT

This article is purported to analyze the experience of energy policy implemented by governments of Germany and Russia in the field of alternative energy, and assess a possibility of applying an accumulated experience of foreign countries in today's Russian environment. The profitability of energy production based on usage of alternative sources is still substantially lower compared to energy production based on fossil fuels combustion process. Governmental measures aimed at developing alternative energy include the following ones: Formation of a new pricing policy, shifting towards alternative energy sources, use of insurance schemes, establishment of a minimum level of prices for energy produced from utilization of alternative energy sources, etc. A lot of countries have accomplished a long process in the field alternative energy technology introduction. Meanwhile Russia, in spite of its considerable experience of alternative energy development in the second half of the 20th century during the soviet period, is not yet in line with the latest world progress in this field.

Keywords: Alternative Energy Sources, Energy Resources, German and Russian Energy Policy
JEL Classifications: Q40, Q42

1. INTRODUCTION

"Alternative energy sources" concept includes solar energy, energy of wind, biomass, tide, and geothermal heat. "Renewable energy sources" is a wider concept, as it includes, in addition, a power potential of major and lesser rivers. But hydroelectric power potential is widely used in the most of developed countries, and thus, increase in the field of hydroelectric energy production is hardly promising.

Development of an economy based on alternative renewable energy sources in the world depends greatly on a number of factors. In addition to an environmental factor, these include a struggle to reduce anthropogenic footprint onto the environment, and, for developed countries, intent to reduce their dependence on imported coal, oil and gas. At the same time, countries having renewable energy production technology experience struggle for technological leadership.

The article deals with the global experience of introducing alternative energy sources and a vision of how it can be used in Russia. Every country in the world has its own prerequisites for introduction of alternative energy sources: Different degrees of deficiency in energy resources, different financial capacities of states and societies, historical prerequisites, various principles of organizing energy industry as one of the most important parts of national economies. No doubt, introduction of alternative energy sources technology provides a great multiplying effect for recovery of an economy. Moreover, it provides a technological breakthrough (i.e., increasing profitability of power plants, developing energy-

saving technologies, searching for opportunities to accumulate electric power, increase in power systems capabilities utilization efficacy), creates new jobs, and improves the overall energy performance of an economy.

In order to assist in reduction of energy and material consumption and related environmental impact, the United Nations (UN) Industrial Development Organization and the UN Environment Program (UNEP) have launched a program to ensure environmentally friendly and more resource-efficient production. Since 2016, the 17 provisions in the field of sustainable development, set out in the "2030 Agenda for Sustainable Development", which were officially adopted by world leaders in September 2015 at the milestone summit of the UN, officially came into force.

Russia must fulfill a number of international obligations, since the task of introducing alternative energy sources technology is specified in international treaties sanctioned by the Russian Federation.

1.1. Study Hypothesis

On the one hand, there is a contradiction between different approaches to energy policy in different countries of the world, and on the other hand, there are ones in understanding the importance and necessity of implementation of alternative energy sources technology in Russian and foreign economic doctrines. It is necessary to take into account the fact that Russian fuel and energy sector, based on traditional energy sources usage, is the basis of the national security of the country. It is assumed that analysis of approaches to understanding advantages and disadvantages of global introduction of alternative energy sources technology, and analysis of German and Russian experience in creation of energy policies may reveal the most significant external factors that are formed due to globalization and the prospects for alternative energy industry development in Russia.

The topic of wide introduction of alternative energy sources technology has become an integral part of the reports made by the global leading energy organizations - the International Energy Agency, the International Renewable Energy Agency, a number of organizations dealing with renewable energy policies, etc. Several well-known scientists also take part in development of alternative energy industry in Russia, and some of their works are worth to be noted: (Tarnizhevsky, 2006; Mastepanov, 2015a; Mastepanov, 2015b; Sumin, 2017; Chernyaev, 2014).

Alternative energy sources role in energy policy is widely spoken about in foreign specialized resources and mass media. In spite of that, opinions with regard to the issue of necessity to incite alternative energy sources technology vary greatly. Most theorists empathize the economic components - feasibility calculations (Horschig and Thrän, 2017). Thus, Germany government spends tens of billions Euro to support this sector of industry (Growitsch, 2016; Growitsch and Meier, 2015). Many other European countries and countries beyond European Union can't afford such policy (Chodkowska-Miszczuk et al., 2017). Since the use of alternative energy sources is much less profitable compared to fossil energy production, in such countries rich with fossil fuels, including Australia and the Republic of South Africa (Lombard and Ferreira, 2015), alternative energy source technology implementation meets significant problems.

Nevertheless, despite of the difficulties associated with the development of industries based on the use of alternative energy sources, interest in their use is growing in virtually any country of the world. This is due to the fact that production data have a multiplication effect, stimulate the development of high-tech industries. Also, the development of alternative energy sector contributes to the economic recovery in rural areas (Wagner et al., 2013). In addition, many countries having deficient reserves of their own energy sources find this program useful for reduction of their dependence on import of these.

It is obvious that environmental protection is also an important matter, but its weight is far from decisive in introduction of alternative energy sources. Such measures as thermal insulation of buildings, improvement of heat processing efficiency in general, and reduction of emissions of harmful fumes into environment from transport vehicles give a greater result for maintaining environmental balance compared to replacement of fossil fuels with alternative and renewable energy sources in production of electric power (Growitsch, 2016).

2. METHODS

Despite the fact that alternative energy is a quite new and, to some extent, a rather high-tech industry, the significantly long way has come along in its development. At the same time, implementation of energy policy requires from numerous governments to face a number of challenges. Therefore, in our opinion, it is necessary to study major documents regulating activity of energy actors in different countries first.

For this purpose, some documents characterizing German and Russian energy policies, and the ones of some other countries, as well as development strategies of this industry were analyzed. Capacity figures of power plants operating based on alternative energy sources in different countries around the world were compared. Factors influencing changes in German energy policy regarding the development of alternative energy industry in the 21st century are revealed. An assessment of the former Soviet Union's experience and future of the development of alternative energy technology in today's Russia were also reviewed.

It is known that the production of electric power based on use of alternative energy sources has its benefits and shortcomings. One of the main features is that unlike fossil fuels alternative energy sources at the current stage of engineering and technology development can't become the only source of energy production, since the generation of electric power using them is not constant due to he limitations inherent to each method (Rodionova and Shuvalova, 2011; Chernyaev and Rodionova, 2017).

3. RESULTS

3.1. The Stages of German Energy Policy History Concerning Alternative Energy Technology Development during the 21st Century

Production based on the use of renewable energy sources, including hydropower, became an essential component of German energy sector. For the period from 1990 till 2016, the share of renewable energy in the total energy consumption in Germany had increased from 1.3% to 12.6%. And the share of renewable sources in electric power generation is even higher - 31.7% (according to the information provided by the Official Website of the Ministry of the Environment, 2017).

Let us identify and characterize the stages of German Energy Policy change. After the Second World War, the country was divided into two states - the Western Germany and the Eastern Germany, where a centralized planned economy was implemented. Therefore, the energy policies of these countries had a range of differences. In the Western Germany the period since 1949 till the early 1970s is considered to be the period of the "German economic miracle." Economic growth was facilitated by low global prices and availability of energy resources, including oil.

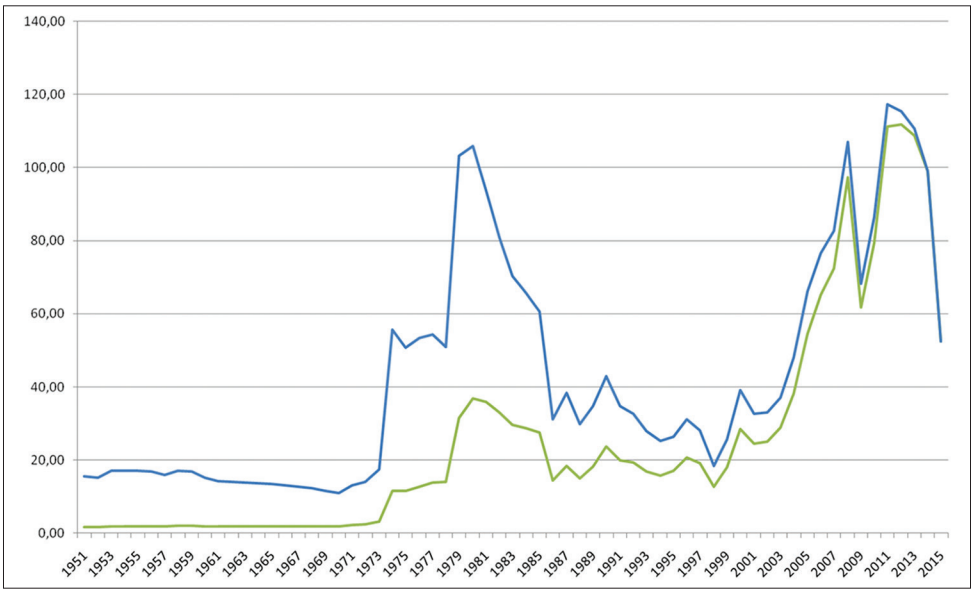
The next stage (the stage of diversification of energy resources and supplying countries) since the early 1970s to the late 1980s passed in the context of the global energy crisis, when the Arabic countries imposed an oil supplies embargo because of the Arab-Israeli conflict. The global supply of oil decreased sharply, and oil prices rose respectively (Figure 1). In 1973, global oil prices were $2.83 per barrel, and in 1980 they raised up to $36.15 per barrel in current prices. Germany took a course toward a total saving of energy resources and revised the list of its oil suppliers. In 1973, the Law on reliable energy supply was adopted. At this stage, due to the changes in the German government's energy policy, the share of natural gas (supplied from the USSR) and nuclear energy (newly constructed NPPs) grew in the fuel and energy balance.

The new stage began with the reunification of Germany in 1990. The energy system of the former Eastern Germany required modernization in order to comply with the one of the Western Germany. The natural gas was the most promising source of energy in Germany. By the mid-1980s the market of nuclear reactors in Germany was already saturated. There was no place to build new nuclear power plants on the territory of Germany. Gradually, Germany decided to refuse building new nuclear power plants. And in 2001, the Law on the Orderly Termination of the Use of Nuclear Energy for Commercial Electric power Production was adopted (Stilllegung Kerntechnischer Anlagen, 2017). However, Germany suffered a lot from this process, since nuclear power plants had been covering the major part of the electric power load schedule. In 2000, the share of nuclear energy in the structure of consumption of primary energy sources in the Germany constituted 25%. The country's government set a goal to replace this share of nuclear energy with other sources within the next 20 years. In 2016, nuclear energy sector share dropped to as little as about 7% of primary energy consumption.

At that moment high hopes were put on alternative energy sources due to their environmental friendliness and "renewability." But at that stage of technological development, their introduction was unprofitable and their development was forced only through subsidies from the German government. Even before the reunification of Germany in 1989, Germany adopted its first governmental program for the development of wind power technology, "100 MW Wind Energy." In 1991, the Law on the Priority Transmission of Renewable Energy Power into Electric System came into force. In 1990, the "Thousand Roofs" program was adopted, which in 2000 evolved into the "100 Thousand Roofs" program. It included governmental co-financing of photoelectric cells installation onto buildings' roofs throughout Germany (Shuvalova, 2012).

The today's stage of the energy policy can be dated since the adoption of a new Energy Economy Law in 1998 ("Erneuerbare

Figure 1: Trend in oil prices change since 1951 till 2015 (USD per barrel) (BP Statistical Review, 2017)



Energien Gesetz," 2016; The Official Website of the German Ministry of Environment, Nature and Nuclear Reactor Safety dedicated to issues of renewable energy sources implementation, n. d.). Germany had joined the EU-announced program aimed at liberalization of the electric power and gas markets. The goal of liberalization was proclaimed to reduce the cost of electric power and gas for an end user by reducing companies' expenditures via intensification of competition. The policy of subsidizing alternative energy sources facilitates the emergence of new energy suppliers within the energy market, and initially to promotion of competition.

In 1999, an environmental tax was imposed on all energy production entities, except for renewable energy ones, including heat and power production facilities, using relatively environmentally friendly steam and gas turbine plants. In 2000, the Law on Renewable Energy Sources came into force. Its goal was to increase the share of electric power generated from renewable energy sources in Germany. According to the forecast, such share should reach 35% by 2020, 50% - by 2030, 65% - by 2040, and as high as 80% of the total energy consumption by 2050.

This law obliges German power system operators to supply the entire amount of electric power produced using renewable energy sources to power transmission networks. In addition, producers of "green" electric power receive a subsidy from the state budget for a guaranteed period of time (Sumin, 2017).

Figures used in the Law are adjusted in accordance with the requirements of the current situation. For example, the Law on Renewable Energy Sources was already revised three times - in 2004, 2009, and 2012. For example, subsidies amount and period were reduced, stimulating the development of technology and increasing the profitability of energy production based on renewable energy sources.

In 2002, Germany was one of the first countries to ratify the Kyoto Protocol on measures to protect the environment and reduce harmful emissions to the atmosphere within the UN Framework Convention on Climate Change. This step led to the adoption of the "Greenhouse Gas Emissions Quotes Trading Law" in 2003. Additional incentives to reduce the environmental burden were the Law on the Joint Production of Heat and Energy, the Energy Saving Directive adopted in 2002, and other regulatory provisions.

Along implementation of the Program to Introduce Alternative Energy Sources Technology and Reduce Carbon Dioxide Emissions from Fossil Fuel Power Plants by Government of Germany, the role of the legacy power monopolies in Germany is changing. Large electric power monopolies have managed to alter their structure, and today at least a half of the electric power generation is based on using alternative energy sources, and not coal, natural gas or oil, as it was before. Large companies possess considerable financial resources not only for construction of innovative electric power plants, but also for acquisition of companies working in the field of alternative energy. However, such monopolies have lost their significance in the electric power market. During the first stage of the electric power market liberalization they were controlling 80% of the electric power production in Germany, and now power plants owned by them account for only half of the total electric power production in Germany. This phenomenon can be explained by not only emergence of independent electric power suppliers (owners of power plants using alternative energy sources), but also by allocation of assets from the monopoly businesses - power plants operating on fossil fuels.

3.2. The Stages of Russian Energy Policy History and Alternative Energy Technology Development Perspectives in Russia.

The principles of the electric power industry in Russia differ a lot from those of the Western countries. The USSR has accumulated a vast experience in use of renewable energy sources. Let's characterize the stages of development of energy policy in Russia.

The epoch of wide distribution of electric technology in Russia fell on the period after the revolution 1917. The development of electric power engineering in the Soviet Union was deeply centralized - from the beginning of the 1920s, according to the State Electrification Plan of Russia (GOELRO), which included construction of large "regional" power plants - GRES, mainly those using peat and coal, and high-voltage long-distance power lines. As a result of the implementation of the GOELRO plan, the world's largest unified energy system had been created.

Besides, during the establishment of Soviet power small power plants operated using alternative energy sources were used in the industry. But then along with implementation of the GOELRO plan they were replaced by large power plants based on fossil fuels combustion process. So, back in 1929 the electric power in Kursk was produced by the world's first wind power plant with an output of 8 kW. 2 years later a wind plant with an output capacity of 100 kW was built to supply energy to Sevastopol (this Crimean plant was destroyed during the Second World War in 1942). In the 1930s and 1960s the Soviet Union arranged a serial production of small wind turbines with a power of 3–4 kW on the basis of the research and production association "Vetroen" in the city of Istra, Moscow region. The total capacity of wind turbines, located mainly in rural areas throughout the USSR, reached 100 MW (according to the information provided by the Official Website of RusHydro JSC, 2016).

The period after the Second World War (1950–1970) featured development of new large oil and gas fields in the Urals-Volga region and beyond, including the ones in Western Siberia. At the same time, close cooperation was established among the countries of Socialist Block of Eastern Europe (Poland, Hungary, Czechoslovakia, Bulgaria, etc.) with regard to energy supplies. Considering the enormous hydroelectric power potential of the USSR, it is worthy to note increase in use of hydroelectric power resources and construction of a number of the largest hydroelectric power plants in Siberia.

Among other trends in the development of alternative energy in the Soviet Union a number of plants using energy of sea tides, as well as geothermal energy to generate electric power were developed. In 1966, the first geothermal power plant, Pauzhetskaya PP, having a capacity of 5 MW was built at Kamchatka. In 1968, the first in the USSR experimental industrial tidal power plant, Kislogubskaya

PP, having a capacity of 0.4 MW was commissioned on the coast of the Barents Sea near Murmansk. Both plants in Russia are currently in operation. In 2008, after a reconstruction the Pauzhetsk power plant its output capacity reached 16.6 MW. In 2006, Sevmash Company installed a new 1.5 MW power unit at the Kislogubskaya power plant.

In the late 1970s the new stage of energy policy development was observed. The world energy crisis 1970s brought influence, which lead to further increase of hydrocarbon exports, and the change of supplies vector in favour of far abroad countries. At that times, the Soviet Union attached the great importance to development of nuclear power industry (Davtyan, 2016).

It is necessary to point out that in late 1980s in the USSR several pilot projects were implemented in the field of alternative energy sources. In particular, by the order of the Ministry of Energy and Electrification of the USSR wind power engineering developed. Also in 1981 the State Committee of the USSR on Science and Engineering of the USSR Academy of Science adopted all-Union Scientific and Technical Program of Alternative Renewable Energy Sources Development, and in 1987 the Ordinance of the USSR Council of Ministers dedicated to development of wind power industry. Creation of wind power installations having capacity of 30, 100, 300, 1000 kW was provided for. In 1985 the USSR build the first in the country industrial solar power station with the capacity of 5 MW in Crimea, which was destroyed in 1990s (the Official Website of OJSC "Rushydro," 2016).

In the result of the collapse of the Soviet Union the unified power industry infrastructure was destroyed and profound changes happened. That determined the beginning of the following stage of Russian energy policy development. During 1990s Russia and other CIS-countries faced the sharp decline in production and consummation of primary energy sources. However, oil and gas export increased again, with export to West European countries being significantly higher than export to the East Europe, including CIS.

The present-day stage of Russian energy policy development was determined by the fact that in 2001 the industry liberalization was declared" which meant privatization of electric energy sector. Necessity in technical re-equipment of the outdated power station fleet was officially declared to be the purpose of liberalization in Russia. In 2008, RAO Unified Energy Systems of Russia divided into multiple companies by types of activity (generation, transfer and sale).

Beyond the market there are two independently operating public corporations, which are Rosatom in nuclear power engineering and Rushydro in hydro power engineering. It is connected with peculiarities of technological production of electric energy on nuclear and hydro power stations. Besides, federal grid company of unified energy system engaged in trunk lines operation, and the system operator of the unified energy system still remain in public ownership.

Diversification of export oil and gas flows from Russia took place at the account of increase of export to Asia-Pacific countries (China, Republic of Korea, Japan etc.). In 1990s within the frame of production sharing agreements foreign investors proceeded to development of Sakhalin Shelf deposits. Later, Gazprom and other Russian companies joined them. In 2009 the plant was built on Sakhalin for natural gas liquefaction for export abroad, and construction of the second one is in progress, and one more is being built on Yamal peninsula. The project of East Siberia - Pacific Ocean oil pipeline has been implemented since 2004. In 2014, Russia assumed to deliver natural gas to China for 30-year period - construction of the Power of Siberia pipeline is now in progress.

The present-day period under review of Russian energy policy makes it possible to identify the main vector of development and to determine the main trends in the industry development. But one should notice that the shaped industry modernization program at the account of knowledge-intensive innovation economy using the means of hydrocarbon export has not been jet achieved.

The pattern of consumption of primary energy sources consists of natural gas as the first share (more than 50%, 2015), oil as the second one (more than 20%), coal as the third one (13%), nuclear energy as the fourth one (7%) and hydropower as the fifth one (6%). Share of alternative energy sources is still miniscule (BP Statistical Review of World Energy, 2016). Though, it should be taken into account that production of power with usage of natural gas is one of the most environmentally clean power productions. Thus, at the present moment Russia faces no pressing issue of switch to alternative energy sources in order to solve environmental problems.

Russia still possesses sufficient reserves of fossil fuel: Oil, gas, coal, peat, shale, uranium (Table 1). For instance, Russian share of oil reserves was 6.4% in 2015 (the 6th country in the world after Venezuela, Saudi Arabia, Canada, Iraq and Iran), share of natural

Table 1: Share of countries in world energy industry by energy resources reserves (%)

Countries	1991	2004	2006	2008	2010	2012	2015
Oil reserves							
Russia	10.6	7.7	7.5	7.1	6.5	6.2	6.4
EU	0.8	0.5	0.5	0.4	0.4	0.4	0.3
USA	2.9	2.1	2.1	1.9	2.1	2.6	3.2
China	1.4	1.1	1.1	1.1	1.1	1.1	1.1
Middle East	60.2	54.9	54.6	50.6	46.8	47.3	47.3
Natural gas reserves							
Russia	27.3	19.9	19.7	18.5	17.9	17.3	17.3
EU	3.3	1.8	1.8	1.5	1.3	0.8	0.7
USA	4.1	3.5	3.8	4.1	4.9	4.7	5.6
China	0.9	1.0	1.1	1.6	1.6	1.7	2.1
Middle East	37.2	46.2	45.9	44.3	44.6	43.2	42.8
Coal reserves (of all types)							
Russia							17.6
EU							6.3
USA							26.6
China							12.8
Middle East							3.7

Source: Calculated by the authors based on BP Statistical Review of World Energy, 2016

gas reserves was 17.3% (the second place in the world after Iran), the share of coal reserves was 17.6% (the third place in the world after the USA and China).

In recent years Russia has had no major projects in the field of alternative energy development. Though there is positive experience of usage of alternative energy sources in the USSR. However, there is intent to take care of future new ages and of ecological cleanliness of future electric power production in the country. In 2005 the Government of the Russian Federation and the International Bank for Reconstruction and Development concluded an agreement of grant-making to finance Russian Program of Renewable Energy Sources Development. Thus, new energy policy was born in present-day Russia, which is aimed at development of alternative energy (Kopylov and Shutkin, 2016). In 2009 two statutory acts were adopted - "energy strategy of Russia for the period until 2030" (RF Government Executive Order d/d November 13, 2009) and "fundamental objectives of public Policy in the field of enhancement of energy performance of electric energy based on usage of renewable energy sources for the period until 2020" (Russian Federation Government Executive Order d/d January 08th, 2009), which provided for increase of share of energy produced based on renewable sources from 1% in 2008 up to 4.5% in 2020. In 2013 the RF Government signed the Executive Order "Concerning Incentive Mechanisms of Renewable Energy Sources Usage on Wholesale Market of Electric Energy and Power" (RF Government Executive Order, 2013). It contained provisions pursuant to which investors shall receive compensation of their costs connected with putting into operation of power plants operating based on usage of renewable energy sources, by way of fixing of the sale price of the capacity on the wholesale market.

The legislation provides that by 2024 Russia will build wind power plants with aggregate capacity of 3.6 GW, and by 2030 the RES installed capacity gain may, in whole, total to 10 GW (Presnyakov, 2017).

When proceeding to implementation of energy policy aimed at expansion of energy production based on usage of renewable energy sources, one should remember that at some point our country successfully promoted audacious projects for development of alternative energy, and this experience needs to be used.

4. DISCUSSION

It should be noted that the issue of usage of alternative energy sources still remains to be a disputed one. Despite all advantages of usage of alternative energy, the expensiveness of this power production is one of the main obstacles to intensive development of the industry. Profitability of power production based on usage of alternative sources is significantly inferior to similar productions based on fossil fuel combustion. In case of even insignificant reduction of fossil fuel prices (as it has happened recently with the cost of oil, coal and natural gas) the interest in alternative energy drops. Therefore, development of alternative energy industry is impossible without control activities of the state.

The performed analysis of energy policy of several countries revealed that each country pursue their own goals when implementing such policy. For example, the USA incite to development of alternative energy sources on the levels of states, first of all, for the purpose of increase of the number of electric power suppliers and improvement of ecology in "richer" states that have switched to post-industrial development path.

China is the world's leader in supplies of equipment for power plants using alternative energy sources for electric power generation and heat production. This is, in many aspects, the reason of the country's efforts in implementation of these energy sources within the country as well.

Many countries of the world pursue the relevant public energy policy to incite development of alternative energy. But it is necessary to understand that countries have different prerequisites of alternative energy sources development. Several European countries, first of all Germany, by stimulating at the present development stage the usage of alternative energy sources, solve a problem of reducing dependence from energy carriers import. Russia does not face such a problem at the present moment.

Russia is rich of energy carriers. The country is among the world's leaders in production thereof (the 2nd place in oil production; the 2nd place in natural gas production; the 8th place in coal mining) (BP Statistical Review, 2017). The energy system of the Russian Federation was created based on major regional power stations (heating stations give more than 60% of electric power generation in the country). Major hydroelectric plants and nuclear power stations also operate in Russia. However, the share of alternative energy sources in the country's energy balance is still very small.

5. CONCLUSION

Russia is congruent with contemporary global processes in the energy field. However, we are earnestly convicted that the primary task of our country's energy policy in the context of availability of own fuel resources (oil, natural gas, coal) is ensuring reliable energy supply for consumers inside the country rather than advanced developments in the field of AES usage as such. Usage of alternative energy sources and development of related productions may only promote solution of this task.

Having analyzed the stages of Russian and German energy policies, the level of energy security of these countries, we assessed prerequisites for implementation of alternative energy sources in the Russian Federation. The main conclusion we made is that without the relevant public energy policy Russia will not be able to achieve significant successes in this field.

It appears that in the current situation building of power stations generating current on the base of alternative energy sources will only be reasonable providing usage of own scientific developments and production capacities of machine builders. It is not worth to purchase outdated equipment from abroad, as if often happens. Development of alternative energy engineering should promote the country's technological process.

We should remind the in Russia of 1990s, due to high internal prices for energy carriers, electric power and heat, many enterprises were forced to build their own power stations in order not to depend from centralized supplies. In market conditions and striving to maximize profit, the monopolists dictate prices in the areas of their influence. The attempt to liberalize energy sector resulted in that companies artificially segregated from the unified energy system started to unite, and the degree of the industry monopolization is increasing. Without doubt, implementation of alternative energy sources will promote diversification of energy suppliers. That is why the problem of profitability of electric energy production based on the alternative energy sources is of primary importance for private companies, in particular in certain Russian regions taking into account the country's vast natural and climatic differences and prerequisites to usage of alternative energy resources.

It is important to underline that creation of power plants based on implementation of AES may provide with energy certain outlying regions of the country. For Russia with its vast territory - 1/9 part of our planet's land, supply of energy carriers to outlying regions having no access to the unified energy system is a serious problem. We should remind that the available energy resources (oil, gas, coal) in Russia, though significant, but are exhaustible even in nearest future. Besides, in Europe technologies of energy production based on AES becomes more and more enhanced in the result of scientific and technological progress. It may appear that Europe will refuse from a part of supplies of fossil energy carriers from other countries (including Russia, if there are relevant recommendations from the USA), and in such a case our country will lose its advantage on European energy market in export of energy resources. That is why Russia is, no doubt, interested not only in searches of new importers of its energy resources, for example, in Asia, but also in searches of new energy sources, which could ensure both needs of its own economy, and the technological leadership in the world in future.

It should be reminded once more that Russia is obliged to fulfill all the international obligations. As the task of alternative energy sources implementation was set by international agreements the Russian Federation has ratified. This is not only the task of alternative energy sources implementation, but also a tangentially related task of reduction of harmful substances emission into air and water, and of nature protection in the context of the global climate change.

The alternative energy sources are important for development of Russian agriculture, as well, and will promote enhancement of the life of quality for rural population. Finally, in Russia a political will to solve problems of energy industry was noted. For example, the Energy Strategy of the Russian Federation for the period up to 2030 set a task of increasing the energy performance of the country's economy. And implementation of alternative energy sources is, no doubt, designed to help solving this task.

6. ACKNOWLEDGMENTS

The publication was prepared with the support of the "RUDN University Project 5-100."

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