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ORIGINAL PAPER

Economic and legal regulation of the use and development of renewable energy sources

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Abstract
The study, through the prism of comparing various government practices, critically examines the problems of Russian legislation and policies in the field of renewable energy sources, such as problems of fragmentation, obsolescence and lack of legislation. The article examines the current legislation, which establishes incentives for the development of renewable energy. The research question consists in assessing the applicability of current international practices in the field of regulation of the use of renewable energy sources in the context of the modern Russian legal system. Through the use of comparative legal method, the study analyzes foreign experience and considers the possibility of its implementation in the national legal system. The conclusion is drawn on the main directions of improving the economic and legal regulation of incentives for the development of renewable energy in Russia. In addition, the international cooperation of countries in the field of renewable energy was carefully studied, and a conclusion was drawn on the insufficient regulation of the industry by international law. Conceptually, the law on renewable energy should be based on comprehensive international energy law. From a practical point of view, different paths can create individual rules or principles for renewable energy. It is legal norms that have become the object of research. The analytical framework used in this article is based on both qualitative and quantitative methodologies. The purpose of the article is twofold: to analyze the main legal aspects of the use of renewable energy sources in Russia and to evaluate the existing political context that affects their development and settlement. The practical significance of the work done is that the results obtained can be applied in the process of making legislative acts in the field of the use and development of renewable energy sources.

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Keywords Alternative energy sources · Development of renewable energy sources · Environmental protection · Economic and legal regulation · Renewable energy · The law on renewable energy

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1 Introduction

The world community started talking about the need to use and develop renewable energy sources at the end of the twentieth century (Hoffman & Dienes, 1985). Such activity is associated with an increase in the growth of energy consumption necessary for the development of production (Bondarenko et al., 2020; Lopez-Rodriguez & Navarro, 2016; Van der Welle et al., 2011). There is a likelihood of exhaustion of traditional sources of energy and, as a consequence, causing significant harm to the environment. Scientists around the world are actively engaged in finding a solution to the problem (Rowe et al., 2009; Sadorsky, 2009). As a result of many studies, they have come to the conclusion that renewable energy sources will help save the environment or minimize the negative impact on it (Lopez-Rodriguez & Navarro, 2016; Lupp et al., 2011).

Like any other industry, the use and development of renewable energy requires proper economic and legal regulation (Ling & Yumashev, 2018; Tsindeliani, 2019). To date, Russia has not adopted a separate law regulating this issue. Specialists working in this field are guided by a number of different legal acts, some of which have been adopted at the regional level (Borodin et al., 2019). However, the active development of scientific and technological progress requires the development of a special law.

Before exploring regulatory issues, it is necessary to deal with the subject of economic and legal regulation, namely with renewable energy sources.

Renewable energy is present in the environment in the form of energy, which is not a consequence of purposeful human activity; this is its hallmark (Inglesi-Lotz, 2016; Tükenmez & Demireli, 2012). In the technical literature, renewable energy is understood as energy resources that constantly cyclically renew energy value and can be converted into useful work (Kaltschmitt et al., 2007). A typical example of such a source is solar radiation with a characteristic repetition period after 24 h (Pylypova et al., 2019). It is also noted that renewable energy sources are sources based on continuously existing or those that periodically occur in the environment, energy flows (Salim et al., 2014).

An analysis of the normative definitions of renewable energy sources indicates the absence of a generally accepted definition of this concept. Thus, according to Resolution No. 33/148 of the UN General Assembly (1978), non-traditional and renewable sources of energy include solar, wind, geothermal, energy of sea waves, tides and the ocean, energy of biomass, wood, charcoal, peat, draft livestock, shale, tar sandstones and hydropower of large and small watercourses (UN General Assembly, 1978). The International Energy Agency (IEA) defines such sources as: energy derived from the sun, wind, biomass, geothermal, hydropower and ocean resources, as well as solid biomass, biogas and liquid biofuels (Heffron et al., 2016). That is, the definition of renewable energy is carried out through a list of its possible types, which from the point of view of the rules of legal technology cannot be considered successful.

The most intensively developing technologies and markets for renewable energy sources are in countries such as the USA, EU countries (Sweden, Austria, Finland, Germany, Portugal, Spain), Japan, China. Active action in this area was launched by Brazil and India. The increase in the value of shares of companies introducing renewable energy sources gives an additional impetus to the development of technological issues and their implementation in various fields of economic activity (He et al., 2016; Tang & Chen, 2016).

Germany is a pioneer in the use and regulation of renewable energy. Here, the possibility of using renewable energy was considered in the 70-80 s of the last century (Oschmann, 2010). In 2011, the federal government decided to change the policy of the energy

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economy, which was supported by all parties in the Bundestag (Steinhäusser, 2012). The "Energy Turn" (Energiewende) involves the rejection of the following energy sources:

- hydrocarbonic—phased;
- atomic—full (Heffron et al., 2016).

Instead, a shift to renewable energy is planned. The share of electricity generation based on renewable sources by 2025 should be 40–45%, by 2035—55–60%, by 2050—not less than 80%. These tasks were enshrined in part 1 of paragraph 1 of the Law "On the Expansion of the Use of Renewable Energy Sources" adopted in 2014 (Heffron et al., 2018). In August 2011, the Government adopted an amendment to the Law on Atomic Energy. The changes provide for a complete rejection of nuclear energy. Stations should be decommissioned by 2022. The prerequisite for such a decision was the accident at the Fukushima-1 nuclear power plant (Citelli et al., 2014).

Over the past decade, the average growth rate of solar and wind power generation amounted to 52.7% and 23.3%, respectively, while in the electricity sector as a whole—only 2.8% (BP, 2016). More than half of all new capacities in the world already come from wind and sun. This growth, along with a much greater emphasis on energy efficiency in all transport and other areas of end-use energy, will lead to a very significant reduction in oil and gas demand, which will provide a significant share of revenues for many energy exporting countries (Silva et al., 2013).

Russia was one of the first leaders in the development of renewable energy technologies, but for a number of reasons the country lost interest in their development, with the exception of large hydropower plants (Vasileva et al., 2015). Until recently, Russia has taken the more generally accepted path of developing fossil fuels and nuclear energy. Renewable energy is still often perceived in Russia as too expensive (Bass, 2018; Lakhno et al., 2014).

However, there is an increasing number of studies that conclude that some renewable energy sources are already competitive in many regions. The evidence suggests that their economy will improve even further. For example, a Bloomberg New Energy Finance forecast suggests that while coal and natural gas remain cheap, renewable resources will win the cost race (BNEF, 2016). It is also anticipated that by 2050, both Russia and the entire global economy can be fully provided with a range of affordable renewable energy technologies with net economic benefits (Jacobson et al., 2017).

The problem of introducing technology in Russia lies, first of all, in imperfect legislation. Concepts, strategies, programs, acting as the legal form for the implementation of energy policy, should clearly reflect the real situation in the development of relations, provide for specific achievable means of implementation in a clearly defined time frame. The legislation does not determine the mechanisms for implementing the energy strategy. In addition, it is noted that in Russia ineffective incentives are applied to business entities that are involved in the process of technology circulation, primarily due to the lack of information about the real needs of a particular business entity that embodies an individually defined technology (Hajiyev, 2019; Kulakov et al., 2016).

The renewable energy sector and the renewable energy economy in Russia are beginning to attract growing international scientific attention. However, the role, economic potential and political experience of RES in Russia is still understudied in comparison with many other emerging markets such as Brazil, China and India (Lanshina et al., 2018).

Modern research concerning the consideration of the RES sphere in Russia misses the main conclusion that at present Russian legislation contains a large number of standards that impede the proper application of their provisions. This is mainly caused by their

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political and economic orientation. At the same time, from a legal point of view, the issue is usually considered in passing. The research question of this study, due to its legal essence, consists in assessing the applicability of current international practices and International environmental agreements in the field of regulation of the use of renewable energy sources in the scope of the modern Russian legal system. Through the comparative legal method used in the study, foreign experience in the field of RES, in the context of the International environmental legal regulation, and the possibility of its implementation in the Russian legal system is being considered.

Today, there is no international document that regulates in detail and is binding in the field of use of renewable energy sources. At the same time, there are a sufficient number of international agreements in the energy sector and environmental protection, but they indirectly regulate the promotion and use of renewable energy sources.

This article has three main objectives. First, to understand the laws and policies of Russia in the field of renewable energy sources. Secondly, to identify the advantages and disadvantages of the existing legal framework through a comparative analysis of other state practices. Thirdly, submit proposals on the creation of a more systematic and effective system of legislation and policies in the field of renewable energy.

To achieve this goal, it is necessary to analyze:

- foreign legislation in the field of legal regulation of the use of renewable energy sources;
- regulations in force in Russia.

The tendencies of recent years that show the strengthening of Russia's dependence on hydrocarbons have added political components to the issue of providing Russia with energy carriers and require an early resolution of the issue of diversification of energy sources. It is obvious that for Russia the sphere of hydrocarbon production is extremely important and if hydrocarbons cease to be the driving force of the global economy, then Russia may face significant challenges associated with the loss of its markets.

2 Materials and methods

The development and improvement of renewable energy sources in the Russian Federation are due to the need to form a new energy model, diversify the technological base, fill the energy deficit and solve global environmental problems. Global demand for renewable energy sources (RES) is constantly growing.

For a comprehensive study of the issue of regulating the use of renewable energy, it is necessary to study the legislation of the Russian Federation in this industry in the broad sense (both laws and by-laws). The study examined the foreign experience of those states that are actively switching to renewable energy sources (Germany, China, the USA), as well as other countries of Europe and Asia, and the work of scientists dealing with the issue of economic and legal regulation of energy. International legal documents were also considered, as the international community is actively developing programs for regulating renewable energy by adopting declarations and other documents. In particular, the following documents were analyzed:

- UNGA resolutions;

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- UN Framework Convention on Climate Change;
- 1997 Kyoto Protocol;
- Protocol on energy efficiency and related environmental aspects;
- acts and practices of the International Renewable Energy Agency (IRENA).

The analytical framework used in this article is based on both qualitative and quantitative methodologies. The purpose of the article is twofold: to analyze the main legal aspects of the use of renewable energy sources in Russia and to evaluate the existing political context that affects their development and settlement.

None of these aspects can be studied separately from the historical development of the energy sector and the general economic situation in Russia. Therefore, a brief overview of the deployment of renewable energy in Russia is given, as well as the role of both the legal sector and renewable energy sectors in the Russian economy is considered. The regulation of the main technologies for the use of renewable energy sources and their competitiveness as well as the political instruments adopted in Russia to stimulate the development of renewable energy are analyzed. Finally, recommendations for lawmakers to guide regulatory methods toward the regulation of renewable energy sources in Russia are developed.

It is necessary to identify specific problems that confront the traditional regulatory oversight of the use and development of renewable energy sources and determine the forms of both horizontal and vertical regulation that can be adopted to achieve specific goals in this area.

This study relates to the legal context for the use of renewable energy. Thus, the focus is on the legal aspect. This means that it will not discuss in detail all the technical aspects related to renewable energy sources. The study will deal only with those points that are necessary to understand the legal context. The article will also not use the economic or any other approach, except the legal one.

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3 Results

3.1 Regulation of the use and development of renewable energy by national legislation

Worldwide energy consumption has changed significantly over the past 40 years. OECD countries have managed to reduce energy demand and partially replace coal with natural gas and renewable energy sources, while economic booms in Asia and Latin America have led to a rapid increase in energy demand and an increase in the share of coal in the final consumption of energy. The projected energy demand for the next 20 years varies considerably. However, many experts agree that the demand for nuclear energy will remain unchanged or even slightly decrease, the demand for oil and coal will fall more significantly, and the demand for natural gas and renewable energy will increase (Proskuryakova & Ermolenko, 2019).

Considering the outcome of the UN Climate Change Conference COP21, namely the creation of a new basis for decarbonization, these aspects are of great global importance, and a world of renewable energy sources with low carbon content is likely to emerge. Energy importing countries have a clear interest in renewable energy sources as a means of strengthening their economic security. Perhaps surprisingly, energy

exporting countries, including some OPEC countries (as, for instance, Saudi Arabia), are also showing a growing interest in renewable energy (Lanshina et al., 2018).

Despite the fact that initially Russia was one of the first leaders in the development of technologies for renewable energy sources, but for a number of reasons the country has lost interest in their development, with the exception of large hydropower. Until recently, it followed the more traditional path of developing fossil fuels and nuclear power. Renewable energy sources are still often perceived as too expensive in Russia. However, recently in many regions the interest in alternative energy is growing (Lanshina et al., 2018).

It would not be an exaggeration to say that it was after the adoption of the Kyoto and Paris agreements to the UNFCCC that Russia received a new impetus for the development of renewable energy sources and the production of solar power plants and wind power plants in the power sector began to develop in the country (Trifonov et al., 2019).

By signing the UN Framework Convention on Climate Change and the Kyoto Protocol, Russia has committed itself to limiting CO2 emissions and submitting annual emission inventories and national reports. Subsequently, the Paris Climate Agreement, approved in December 2015 and entered into force in November 2016, provides for the regulation of greenhouse gas emissions from 2020. This means that the country needs to explore various options for reducing greenhouse gas emissions (Proskuryakova & Ermolenko, 2019).

As can be concluded from the provisions of the Paris Agreement, in addition to environmental goals, the Paris Agreement also has political goals, which are reflected in the possibility of using levers of influence on developing economies, which can lead to negative consequences, for example, in the hydrocarbon production industry. During the 22nd Conference of the Parties to the United Nations Framework Convention on Climate Change (COP22), the representative of Russia stated that Russia had not considered hydrocarbons refusal as a way to reduce greenhouse gas emissions, within the framework of fulfilling its obligations in the medium term. At the same time, at the national level, Russia recognized the importance of reducing greenhouse gas emissions and is carrying out appropriate work in the field of adapting national legislation to international criteria (Bykovsky, 2017). However, subsequently the Paris Agreement was ratified by Russia. At the same time, it is still early to talk about positive consequences in regard to above, since the Russian authorities do not disclose specific steps to change the alignment of priorities in the field of reducing hydrocarbon production. On the one hand, the authorities finally understand that changes are necessary, and on the other, they continue to discuss the development of new oil and gas fields (Kovalenko, 2019).

Active development of renewable energy will contribute to the formation of innovative infrastructure (Bagheri et al., 2018; EBRD, 2018). Very often, the introduction of one type of innovation requires the introduction of other types. Thus, the introduction of technological innovations in the field of renewable energy should be accompanied by the necessary managerial, economic and legal changes. Therefore, when adopting new equipment or technology for development, it is often necessary to simultaneously plan the appropriate organizational restructuring. The more radical these technical innovations are, the greater the changes in organizational ties and norms they need. The two main consequences of introducing technological and environmental innovations in the field of renewable energy are considered.

Firstly, it is a revival in related industries. Based on international experience, such development is largely carried out in the format of small and medium-sized businesses and relates, first of all, to:

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- industries such as power engineering in terms of equipment for hydroelectric power plants, wind farms, thermal stations for the combustion of biomass and biogas, solar thermal power plants;
- development of photovoltaic converters, silicon wafers;
- production of auxiliary power equipment and the like.

Secondly, the development of renewable energy envisages an increase in the energy capacity of networks and the transition to smart grids. To implement alternative innovations and "smart grids," a balanced government incentive policy and appropriate legislative measures are needed.

Thus, by Order of the Government of the Russian Federation No. 1715-r dated November 13, 2009, the "Energy Strategy of the Russian Federation for the period until 2030" was approved (The Government of the Russian Federation, 2009). In accordance with this document, until 2020, it was planned to increase the share of renewable energy sources in the production of electricity from 0.5 to 4.5% (with the exception of hydroelectric power stations, whose capacity exceeds 25 MW). By 2030, this figure should grow to 7%, which will be about 80–100 billion kW/h per year. To date, it has not been possible to implement the planned. The share of electricity generation based on renewable energy is 1–2%.

The draft "Energy Strategy for the Period until 2035" has been published on the official website of the Ministry of Energy of the Russian Federation (The Ministry of Energy of the Russian Federation, 2014). It was noted that today the "green" energy in the country is not developed sufficiently. It is noted that in order to achieve these goals it is necessary to create all conditions for expanding the production of electric and thermal energy based on renewable energy sources.

Thus, the overarching problem associated with the poor development of renewable energy sources in Russia is the blurring of goals and the lack of pressure in their implementation.

In addition, renewable energy sources, although included in the broad plans and programs of the energy sector, however, this inclusion is more declarative in nature and not a serious impetus. The above programs although recognize the need and inevitability of the development of renewable energy and provide an economically feasible increase in government support for renewable energy; however, the documents show that fossil fuels and nuclear energy remain top priorities.

In 2017, the World Bank released Regulatory Indicators for Sustainable Energy (RISE) comparing the foundations of national policies and legislation in this area (World Bank, 2017). In the RISE section on renewable energy, Russia took 46th place among other countries with a score of 61 out of 100. RISE praised Russia's regulatory efforts in the field of renewable energy and gave it 100 points out of 100 for the legal basis for renewable energy sources. The disadvantages of Russian policy were the lack of a pricing and monitoring mechanism for carbon emissions (0 points), poor planning for expanding the use of renewable energy sources (31 points) and counterparty risks (49 points). It was also noted that Russia is characterized by the largest number of procedures (17) required to create a renewable energy plant connected to the network. Thus, obviously, it is possible to consider the efforts of Russia towards creating an effective legislative framework for regulating the functioning of renewable energy sources in a positive way; however, the implementation of legal regulation is rather weak due to traditional Russian investment problems, such as lack of trust among market participants and bureaucracy.

In general, in recent years, Russia has created the basis for the development of renewable energy sources, covering almost all segments of renewable energy sources, which

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is quite reliable and well integrated into the existing national energy system, which, unfortunately, cannot be said about the legislative system and the procedural aspect.

The Russian government provides some support for the use of renewable energy. This is provided for in Article 21 of the Federal Law of March 26, 2003 "On the Electric Power Industry" No. 35-FZ (The State Duma, 2003). The latter also establishes the rules, procedure and qualification criteria for generating facilities for the operation of which renewable energy sources are used. At the state level, the main policies are also approved in the field of improving energy efficiency, environmental protection and reducing costs associated with the extraction of energy sources.

However, measures to regulate the use and innovative development of renewable energy sources must be taken by state and local legislative bodies comprehensively, at different levels, taking into account the needs and capabilities of a single administrative-territorial unit.

The Law on the Regulation of Renewable Energy should be aimed at creating an exhaustive basis for the development of renewable energy systems (electric and non-electric). Architecturally, this can be represented according to Fig. 1.

The implementation of strategic tasks to regulate alternative energy in Russia in modern conditions requires the following:

- introduction of large-scale measures for investment and innovative development;
- implementation of antitrust measures;
- development of competitive relations;
- improvement of price and tariff policies by introducing an economically sound level of prices and tariffs, not only in the green energy, but also in related energy markets (for example, establishing the optimal ratio of prices and tariffs for energy received from traditional and alternative energy sources).
- Russia should establish a comprehensive complex of legislative mechanisms for renewable energy sources, based mainly on the law on renewable energy sources, and supplemented by other relevant laws and policies. In general, the system should look as follows (Fig. 2).

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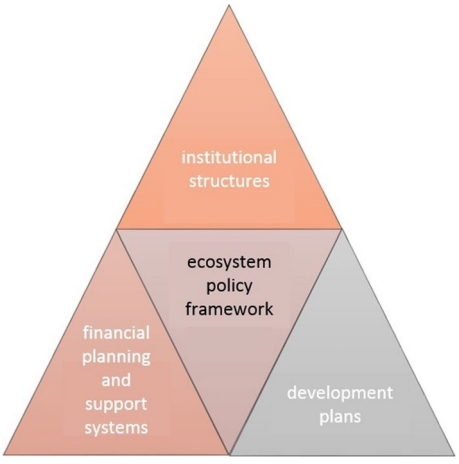

Fig. 1 Renewable energy legislation foundation

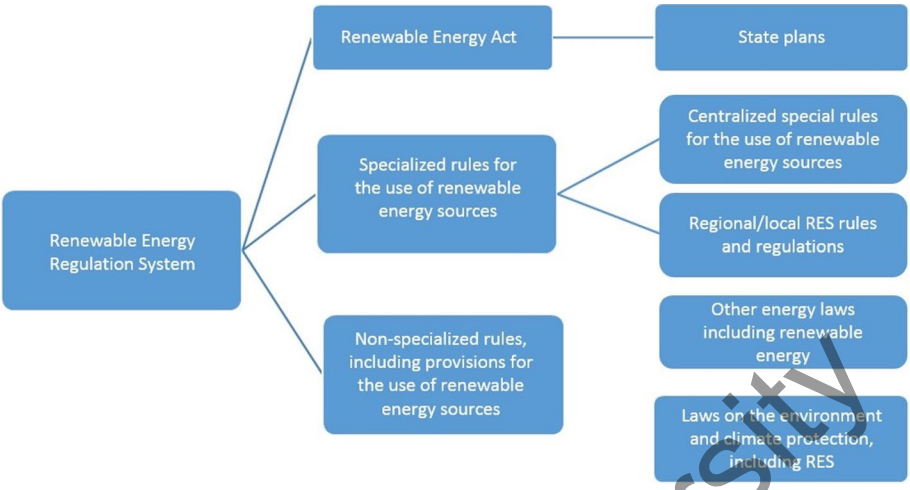

Fig. 2 Proposed system of legal regulation of renewable energy

In addition to the existing long-term priority measures, it is necessary to take medium-term priority directions at the national, sectoral and regional levels. They should be implemented through the formation and implementation of state target programs, state orders, regional, local innovation programs and individual innovation projects.

For example, to implement medium-term priority areas, the state should introduce the following measures:

1. develop innovative infrastructure;
2. the priority consideration of applications for inventions corresponding to medium-term priority areas of the national level;
3. direct budget financing and co-financing;
4. reimbursement of interest rates on loans received by business entities in banks;
5. partial compensation of the cost of production;
6. the allocation of subventions from the state budget to local budgets;
7. tax, customs and currency preferences.

3.2 International legal regulation of renewable energy sources

Despite urgent needs, international cooperation in the field of renewable energy is supported by only a few special international (mainly regional) standards and is carried out in the absence of an effective institutional base.

The 1997 Kyoto Protocol that extends the UNFCCC has been one of the first agreements to provide for joint state cooperation in the field of renewable energy. It should be emphasized that it mentions renewable energy sources in one case. Thus, in paragraph 1 of Article 2 (a) of the Kyoto Protocol, eight goals are set, among which:

- increasing the efficiency of energy use in certain sectors of the economy of states;
- conducting (including joint) research;

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- promoting development and implementation, as well as the widespread use of alternative and renewable energy sources, carbon dioxide absorption technologies and innovative, environmentally friendly technologies (UNFCCC, 1997).

Nevertheless, despite the absence of mandatory standards for the use of renewable energy sources, in practice, there was a reduction of 45 million tons of carbon dioxide in favor of the use of "clean technologies" according to the projects of the flexible use mechanism of the Kyoto Protocol. In addition, the Global Energy Efficiency and Renewable Energy Fund was established.

Thus, the UNFCCC and the Kyoto Protocol promote sustainable development, although none of them provides an obligation to use renewable energy sources.

For Russia, the Kyoto Protocol may not yet be acceptable. Restrictions on greenhouse gas emissions in Russia will most of all have an impact on such a fundamental industry as energy. Emissions of carbon dioxide above the norm entail billions of fines on the state, which can directly affect the economy. Contradictions arise here, because on the one hand it is necessary not to pollute the environment, but on the other hand, to bear certain economic losses.

At the regional level, international agreements have also been developed and adopted, among which the Energy Charter Treaty should be highlighted. This agreement was signed in December 1994 and entered into force in April 1998. This is the first and so far the only agreement that directly provides for the international cooperation of states in the energy sector. However, this act does not yet include binding norms in the field of alternative energy.

Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA) was adopted simultaneously with the Energy Charter Treaty at the end of 1994. PEEREA commits participating countries to develop and adopt clear program goals to improve energy efficiency and reduce the environmental impact of the energy cycle.

Interestingly, only one article 19 (1) (d) in this Treaty refers to the use of renewable energy sources, requiring states to pay close attention to improving energy efficiency, developing and using alternative energy sources, increasing the share of cleaner and safer fuels, and also the development and implementation of technologies and tools that reduce pollution.

A major breakthrough in the field of alternative energy was the creation of the International Renewable Energy Agency (IRENA).

The IRENA Charter was adopted to promote the use and sustainable development of renewable energy sources. In other words, the Charter has become the only instrument of international cooperation whose purpose is exclusively to promote the use of alternative energy. The charter states that IRENA member countries are strategic centers for multilateral action and international cooperation in the field of financing, technology and research in the renewable energy industry. A significant step of IRENA was the active consultative participation of all stakeholders in the field of energy (including private entities) in the provision of scalable renewable energy sources. However, with its favorable position in the global regulation of the use of alternative energy sources, this agreement apparently reduces the sovereignty of the state and national priorities, which is a serious drawback. Although the IRENA Charter is a hard-law instrument, the IRENA itself can be considered a "soft organization." This limitation gives rise to hope that a comprehensive approach to the renewable energy system (both hard and soft law) will have a greater impact than the traditional contractual focus.

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Interestingly, IRENA does not have any express or implied authority to establish international legal obligations for the use of renewable energy sources. This, accordingly, may limit the potential and role of this international organization.

Thus, all of the above international documents either indirectly regulate the use of renewable energy sources, or are advisory in nature. It should be noted that the creation of the International Renewable Energy Agency is already a certain progress in the field of alternative energy. At the same time, it is important to adopt an international document, mandatory in nature, in the field of renewable energy within the framework of this Agency. These international binding standards can to some extent limit the political interference of states.

4 Discussion

A large number of studies on the economic and legal regulation of renewable energy sources provide a detailed overview of the Russian regulatory framework in the field of renewable energy sources and compare the sensitivity of the project's profitability to various factors influencing the situation (for example, CAPEX, OPEX, inflation, discount rate, etc.) (Kozlova & Collan, 2016).

Another study concerning Russia examined the regulatory aspects of autonomous and hybrid solar and wind-diesel energy in Russia. Opportunities for autonomous investments after 2015, when the Russian government included this market niche in the support scheme for renewable energy sources in the retail market, were analyzed (Decree No. 47) (Boute, 2016).

Besides, the policy in the field of renewable energy in Russia is carefully studied, from setting goals to implementation, with an emphasis on the CRESS support scheme for renewable energy sources. In particular, there is a huge gap in implementation, which can be explained mainly by the depreciation of the ruble and stringent requirements for the content of the local project. It is emphasized that the relations of new companies engaged in green energy and large established corporate groups are an important factor for the former to achieve support and launch projects without delay (Bass, 2018; Smeets, 2017).

Thus, the Russian CRESS, in addition to the scheme adopted in 2015 to promote renewable energy in the retail electricity market, received quite serious attention among researchers. For this reason, there is a need to focus on assessing the competitiveness of renewable energy sources in Russia, as well as on the gap between the fairly reliable CRESS architecture and its rather weak implementation.

Ecuador's experts were seriously concerned about the need to switch to renewable energy sources. The need for a regulatory framework they announced several years ago (Cedeno et al., 2017). In 2013, the Government adopted the "National Development Plan for 2013–2017," according to which a gradual transition to renewable energy was planned by 2030 (Jacobson et al., 2017).

The issue of switching to renewable energy is also taken seriously in China. For the first time, the need for renewable energy was seriously considered in 1990 (Liu, 2019). It arose because of an acute shortage of fuel for agricultural needs. As a result, from 1990 to 2005, a number of legislative acts were adopted in the country regulating relations in the field of renewable energy use. The main one is the Law on Renewable Energy Sources of the People's Republic of China, adopted on February 28, 2005 (Hua et al., 2016).

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Chinese enterprises threw into the air a considerable amount of greenhouse gases, nitric oxide and many other harmful substances that negatively affected the environment. Therefore, the adoption of the above law was not enough to protect the environment (Dong et al., 2015; He et al., 2016). The country's leadership has developed 5-year, long-term and medium-term plans that establish the principles and goals of renewable energy development. For example, in accordance with the "Medium and Long Term Plan for the Development of Renewable Energy Sources," approved in September 2007 by the National Commission for Development and Reforms, it was stipulated that by 2010 the share of renewable energy had to be 10% of all energy consumed, and by 2020, this figure was expected to reach 20% (Zhang et al., 2017).

The effectiveness and efficiency of renewable energy sources have also been considered on the African continent (Obeng-Darko, 2019). However, unfortunately, this experience was not always successful. For example, Ghana failed to achieve its goals. The country's government has set itself the goal of achieving 100% electrification using renewable energy sources. They failed to get the expected results. Specialists have encountered problems such as a lack of:

- legislative framework;
- responsible authorities (persons) for achieving results in the field of RES implementation;
- an independent organizational structure;
- assessments by state regulatory authorities (Salim et al., 2014).

While analyzing the introduction of alternative energy sources and the legal regulation of this issue on the example of the experience of foreign countries, it is impossible not to mention Kazakhstan. This is a state that, by the number of minerals and their diversity, occupies one of the leading positions in the world (Yerkinbayeva, 2015). Most enterprises in the country operate on coal, gas and oil products. Despite this, the government understands that the following are of importance:

- promoting the development and maintaining the competitiveness of the Republic in the world market;
- saving natural resources;
- reducing the emission of greenhouse gases and other harmful substances that negatively affect the environment;
- the use of low-waste resource-saving technologies in agriculture and production;
- improving the environmental and socio-economic situation in the regions of the country (Teleuyev et al., 2017).

A good example of the development and use of renewable energy is Iceland. Today, in the country RES covers the needs of the population, enterprises and agricultural facilities by 85%. The share of fossil fuels (petroleum products) in 2011 was only 15%. In 2016, the country completely abandoned traditional energy sources, switching to renewable ones. Hydropower amounted to 75% and geothermal—25% (Lee & Logadóttir, 2012). A regulatory framework has been created that regulates relations in the field of renewable energy use. Landsvirkjun is a national energy company engaged in the development of energy in Iceland (Dumas & Bartosik, 2014).

Summing up, it can be said that over the past 10 years in the world there have been significant changes. Scientists from different countries have seriously taken up the issue of

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environmental protection and the need to switch to alternative energy sources. For some, it was a positive experience, and some, despite the efforts, failed to achieve their goals. Having studied all the advantages and disadvantages of foreign legislation in the field of regulation of the use and development of renewable energy sources, Russian legislators, together with scientists, will be able to develop more effective regulatory acts, taking into account the peculiarities of the regions of the Russian Federation.

5 Conclusions

The current situation of renewable energy requires immediate regulation. It is urgent to respond to these requirements with relevant laws and policies. Current study, evaluating the modern state of the Russian economic and legal regulation in the sphere of renewable energy sources gives reasons to state that the legal framework for renewable energy in Russia has limited effectiveness due to its fragmentation, obsolescence and poor performance.

Based on the international experience of legal regulation in the field of renewable energy sources, it can be concluded that state support for the development of renewable energy consists not only in increasing budgetary funds expenditures, but in creating favorable conditions for manufacturers and consumers of equipment that use the renewable energy sources. In addition, it should also be noted that the instability and unpredictability of legislation is a key problem for investors investing in RES. Investors depend on government support, which should allow them to ensure financial security of investments (just as investors in traditional energy depend on subsidies for minerals types of fuel) (Afanasyev & Shash, 2019).

The government needs to integrate the system of legislation and policies in the field of renewable energy sources, increase its practical applicability, provide sufficient financial support and rationally plan the production of renewable energy. Hopefully, with the help of these tools, it will be possible to provide more systematic and effective regulation for the development of the renewable energy industry. It is necessary to form a unified state energy policy aimed at the global innovative model of restructuring the energy market with a clear establishment of responsibility for the failure to fulfill the energy strategy.

To catch up with other countries, Russia will need to further improve its policies and legislation in the field of renewable energy, providing greater financial confidence and opening market doors in cost-effective ways. The introduction of European practice of incentives for the development of renewable energy will certainly lead to a rapid increase in the percentage of such energy in the country's overall energy balance. Such incentives include reducing the tax burden on the renewable energy sector (Tsindeliani et al., 2019), the spread of public–private partnerships, deregulation and subsidies for domestic manufacturers of renewable energy machinery and equipment.

The applicable RES legislation consists of certain hierarchical structures. The main objective of the renewable energy legislation is to create simple conditions for the development of green technologies. The problem is that the legislator does not always consider the basic mechanisms necessary for the development of this technology. In addition, the legislation currently in force has a large number of standards that impede the proper application of their provisions. In addition, the law does not contain standards that can positively affect the development of renewable energy sources. Although measures to stimulate the development of renewable energy have been identified, there are no mechanisms for their implementation. In further studies, it would be prudent to define a legal method of stimulating

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relevant market participants. The practical significance of the work done is that the results obtained can be applied in the process of making legislative acts in the field of the use and development of renewable energy sources.

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Availability of data and material Data will be available on request.

Declarations

Conflict of interests Authors declare that they have no conflict of interests.

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