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Regulation of Incentives for Use of Renewable Energy at the Level of Regional Legislation in Federal States, Using the Russian Federation as an Example

Anna Kirichenko ¹, Ksenia Kirichenko ²  and Evgeniy Kirichenko ^{3,*}

¹ Department of Electric Engineering, Thermotechnics and Renewable Energy Sources, Kuban State Agrarian University named after I.T. Trubilin, 350004 Krasnodar, Russia

² Physical Chemistry Department, Kuban State University, 350040 Krasnodar, Russia

³ Department of Public and International Law, Kuban State Agrarian University named after I.T. Trubilin, 350004 Krasnodar, Russia

* Correspondence: lbc@yandex.ru; Tel.: +7(905)403-05-03

Abstract: Effective use of renewable energy requires a system of energy legislation that meets modern challenges. Although, in large countries, climate and socioeconomic factors in different regions can significantly vary and can affect the regional legislation regulating renewable energy sources, careful reproduction of good practices and successful experiences of other regions are a good basis for the development of legislation. The comparative method of legal research was the main method used to achieve the objectives set in this study. Based on the results, a number of recommendations were developed to consolidate and expand the powers of regional regulators in the field of renewable energy, to include an economic assessment of the effectiveness of state programs, to use tax incentives for renewable energy projects, and to introduce restrictions on the use of petroleum products. Recommendations were also made to improve regional legislation on renewable energy sources in terms of legal techniques. Further development of this study would contribute to the improvement of regional legal regulation and would accelerate the transition to “green” energy.

Keywords: regional legislation; national legislation; energy law; renewable energy source; lawmaking; environmental law



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1. Introduction

Reliable, safe, and cost-effective energy supply is one of the key factors for the development of any region and any state as a whole. The fuel and energy crisis in Lebanon that began in the fall of 2021 and led to power and heating outages throughout the entire country (Kassem 2022) can serve as a clear illustration of the possible negative consequences of a too dense dependence on traditional energy sources (fossil fuel) and the fact that achieving energy security with their help can be difficult.

At the same time, the record high gas prices in the summer of 2021 were also partly due to the unexpectedly low-power output from renewable energy sources (RES). The use of any tool, even a very effective tool, without understanding the mechanism of its work can also lead to negative consequences. In addition to engineering knowledge, the effective use of RES requires a system of energy laws that meets modern challenges (Mehta et al. 2022). The legal regulation of renewable energy should not be restricted to the regulation of procedural questions. For example, one analysis (Liu et al. 2022) showed that combining the impact of governance structure with renewable energy investment and fiscal decentralization offered more substantial effects in terms of optimal renewable energy transition. The legal regulation of renewable energy should also motivate the consumer to choose RES as a source of energy (Kyriakopoulos 2022), and the investor to choose RES as an investment asset (Ländner et al. 2019). The introduction of any new technology is

a process of overcoming, and sufficient legal regulation aimed at stimulating the use of RES allows the state to facilitate this process (Tsangas et al. 2022). Challenges in transition to renewable energy sources faced by Peru and partially caused by the deficiencies in the regulatory framework have been discussed by (Campodónico and Carrera 2022), and the ambiguous regulatory frameworks is cited as one of the challenges faced in transition to renewable energy sources in Ghana by (Atuguba and Tuokuu 2020).

In small states whose territories are entirely located in one climatic zone, there is no need to form RES regional legislation. In unitary states, even those that occupy a large area that may span different climatic zones, it is often not possible to form regional legislation due to the rules of the country's administrative-territorial structure. However, decentralized unitary states, as well as states with autonomous administrative divisions with a special status, face the same tasks in this matter as are faced by federations (Zhou 2020).

In federal states that occupy a large area, not all regions of the federation are equally suitable for the introduction of RES into their energy system. It depends, first of all, on climate parameters and on resource potentials: insolation (Efthymiou et al. 2022), wind speed, water, soil and air temperatures, geothermal resources, the presence of rivers suitable for the construction of small hydroelectric power plants, seas and oceans suitable for the construction of wave and tidal power plants (Bello-Ontiveros et al. 2022), and the biomass on the territory of the region. In addition, the relief of the area is a significant factor, since a multi-level and complex terrain makes it difficult to lay pipelines and power lines. It is also necessary to consider settlement and development density, the number of small- and medium-sized consumers located at a distance from the main energy networks, and the presence in the region of large power plants that independently cover the needs of the region.

The idea of leaving questions of RES and energy regulation, in general, in the jurisdiction of the regions of the federation is debatable (Alvarez et al. 2021). Moreover, there are supporters of the need to form a supranational energy law, and, of course, federalization opposes this. This approach is aimed at reducing the risks of global energy crises and correcting the environmental pollution situation. However, renewable energy export may face criticism for weakening the national energy sovereignty (Hansen and Moe 2022).

Despite the current international affairs situation and some internal features associated with the limitations of federalism, the Russian Federation is a good subject for considering regional RES policy. The Russian Federation is a vast territory covering many climatic zones. Its regions are diverse in terms of relief, economic, demographic, and other indicators significant for RES. In addition, due to the presence of large reserves of raw hydrocarbon materials, large hydroelectric power plants, and nuclear power plants, the question of introducing renewable energy sources into the energy balance of the Russian Federation is associated with the environmental agenda and movement towards "carbon neutrality". It is also important, for the purpose of this study, that it is related to the fulfillment of the needs of consumers in certain regions where there are obstacles to providing them with energy from traditional sources.

The purpose of this study is to analyze the current regional legislation of the Russian Federation that regulates RES-related topics in order to develop recommendations for improving the norms of specialized regional legislation.

2. Methodology

For the purposes of this study, an analysis was performed of the regional regulatory legal acts that govern the topics related to RES in the regions of the Russian Federation. It was assumed that the most important factor influencing the effectiveness of regional legal regulation in a region was the powers of the authorized bodies of the region. Accordingly, the main subjects of analysis were the system of bodies formed in the regions that govern the topics related to RES in accordance with these regulatory legal acts; the powers of these bodies; the procedures of their interactions with each other, with regional authorities, with producers and with consumers of energy; as well as their responsibilities. Moreover,

insufficient counsel from experts with technological knowledge creates the possibility of mistakes in legal regulation, therefore, attention was paid to the correct use of terms, physical quantities, and their adequacy to the goals set.

To analyze the regional legislation for each of the regions, two interconnected systems were built. The first system included hierarchically structured acts adopted in the region on RES topic. The second system included hierarchically structured bodies involved in the RES legal regulation of the region.

From the texts of normative acts, lists of questions were determined that covered the legal regulation of the region, the principles of law underlying the legal regulation, and the powers of the relevant bodies and officials. The measures that regional regulators can apply, as well as the time limits for making decisions and taking actions, have been systematized. An analysis was conducted of the correctness of the use of terms and the numerical values of physical quantities. We checked whether the legislator took into consideration the design features of power plants, as well as the nuances of the processes of their construction, commissioning, scheduled maintenance, emergency repairs, decommissioning, and dismantling. The expenses of the regions were also assessed in terms of funds spent on the implementation of programs for the development of RES in the regions.

An example of comparing policies and status can be found in an article by (Hua et al. 2016) which discussed renewable energy development in Australia and China using such comparison parameters as the governance structures in both countries, management mechanisms in terms of funding and incentive support, grid-connected renewable energy grid, and coordination between different levels of governments in both countries. An analysis of energy transition processes based on a comparative mapping of African renewable energy policies in 34 countries was discussed in (Müller et al. 2020).

To analyze the potential of RES in the regions, data from several sources were used. The gross potentials of solar, wind, and geothermal resources were taken from RES GIS maps (GIS 2022). It should be noted that solar radiation potential is marked on the maps in kW·h/m² per day, and wind energy potential is marked in MW·h/year. For further calculations, the potential of solar energy attributed to a horizontal surface was used as independent of the orientation and type of installation; for wind energy, the potential at a height of 100 m was chosen since most Russian wind farms use a wind turbine mast height of about 100 m; and geothermal powers were omitted from the calculations due to their small contribution. Hydropower resources for the regions were obtained from the reference book (Voznesenskiy 1967), however, it should be taken into consideration that, for small rivers the value of the gross potential was negligible relative to the solar and wind potentials of the regions, and the potentials of bioenergy resources of the studied regions were also too small relative to solar and wind potentials.

For an easier comparison, technical potential should be used, since it reflects the part of the gross potential, of which the conversion into useful energy is expedient at the current level of technical development. It can be calculated as the share of the energy of the source that can be converted into mechanical work, and for the Russian conditions, the typical values of the coefficients of performance are: 0.6–0.7 for hydropower, 0.3–0.4 for wind energy, 0.3–0.35 for solar thermal energy, 0.15–0.3 for solar photovoltaics, and usually not higher than 0.3 for bioenergy (Lukutin et al. 2008). The sum of products of gross potential by each source and the corresponding coefficient is the approximate technical potential of the subject.

There is also a more objective way to determine technical potential that involves the use of special equations for each of the energy sources, which consider the specifics of the installations operating on it (Equation (1)) (Electricity Council of Commonwealth of Independent States 2022):

$$Pot_{tech} = Pot_g \cdot (E_{fsu} \cdot N \cdot E_{f_{inv}} \cdot E_{f_{tr}} \cdot C_{ter}) \quad (1)$$

where Pot_{tech} is the technical potential (millions of kW·h/year), Pot_g is the gross potential (millions of kW·h/year), E_{fsu} is the efficiency of a single unit (dimensionless), N is the number of units, $E_{f_{inv}}$ is the efficiency of an inverter, $E_{f_{tr}}$ is the efficiency of a step-up transformer, and C_{ter} is a territorial coefficient reflecting the share of the total area of the considered territory where the units can be placed.

The ratio of technical potential (calculated by Equation (1)) to gross potential gives a new coefficient that usually differs from the coefficient listed above and is lower than it. For example, for hydropower, the new coefficient is in the range 0.3–0.5; for wind energy, it is in the range 0.05–0.1; for solar thermal energy, it is in the range 0.05–0.1; for photovoltaics, it is in the range 0.01–0.1; and for bioenergy, it is usually equal to 0.4.

However, this approach considers the entire area of the region, and therefore, results in the region being evaluated not by the actual efficiency of using the share of RES potential but by the area of the region, since the total RES potential increases with the area. In reality, it is impossible to even come close to covering any significant area of a region with RES installations, and therefore, if the installed capacity of two regions is close, this method of assessment overestimates the region with a smaller area.

A calculation of the fraction of technical potential in specific energy generation can be used as a method of evaluation free from the disadvantage related to unequal area of the regions (Equation (2)):

$$F_{tech} = E / Pot_{tech} \quad (2)$$

where F_{tech} is the fraction of technical potential (dimensionless), E is the annual RES energy yield (millions of kW·h/year), and Pot_{tech} is the technical potential (millions of kW·h/year).

3. Legislation in the Regions

3.1. Selection of the Regions for Analysis

Before discussing the legal regulation of renewable energy in the regions of the Russian Federation, it should be noted that the provision of paragraph “i” of Article 71 of the Constitution of the Russian Federation, which puts “federal energy systems” under the jurisdiction of the Russian Federation, hangs over it like the sword of Damocles. To date, this does not prevent the development of regional legislation, largely due to the fact that there is no definition of the concept of “federal energy systems”. The question of the need to close this gap was raised in 1998, when the Government of the Russian Federation submitted a draft of federal law on “federal energy systems” to the State Duma. The project was withdrawn from consideration in the first half of 2000 and, despite some manifestations of interest from the scientific community, a full return to this question did not happen. The regions of the Russian Federation have been adopting regional legislation on the electric power industry, energy conservation, and renewable energy sources for almost three decades since the adoption of the constitution. These acts are valid, not void of legal force, and no one has been able to successfully challenge their constitutionality. This allows us to assert that, in the current Russian legal reality, the regions can regulate renewable energy through their regulatory legal acts, despite the existence of a constitutional provision that could potentially prevent this, and at the moment, there are no reasonable grounds to assume that the situation may change.

There are more than fifty regions in the Russian Federation, and an analysis of the legislation of each of them seems redundant. Some of them do not have sufficient RES resource potential, and some do not have socioeconomic characteristics suitable for RES. There are only two regions among the regions with suitable characteristics that have specialized RES regional legislation. Two regions are not enough for analysis, therefore, the legislations of several other regions were also additionally studied.

To select the regions whose legislation were the most rational to use as additional subjects of study, we used the regional investment rating in the field of renewable energy compiled by the non-governmental non-profit “Russia Renewable Energy Development Association” (RREDA) organization (Rating 2022). The rating is formed on the basis of expert assessment of the investment attractiveness of a region in the field of renewable energy.

The rating uses 33 indicators divided into six categories: resource potential, infrastructure potential, investment potential, legal regulation, implementation of current investment programs, and openness of the region and the involvement of the administration. Each of the categories and each of the indicators is assigned its own weight depending on the significance for the investment attractiveness of the region. The RREDA experts evaluate the region by each of the indicators, then, the indicators are summed up according to their weight within the categories, after which the categories are summed up taking their weights into consideration. After the points are calculated, the regions are compared according to the ratings obtained within the categories and according to the final score. The rating seems objective enough to become a starting point for the analysis of regional RES legislation.

One of the top ten regions in the above ranking has adopted separate regional legislation on RES ([Legislative Assembly of the Krasnodar Krai 2004](#)) and this region is Krasnodar Krai which is in tenth place. Exactly half of the regions have regional legislation on energy conservation and energy efficiency. The current practice in Russia of placing events dedicated to RES in state energy saving programs illustrates that RES topics can be regulated by acts on energy saving and energy efficiency. In addition, the norms contained in regional legislation on investment policy, land relations, liability for administrative offenses, environmental protection, and conservation of biological diversity can be tools to encourage the use of RES. It should be noted that the division of regions into those that have adopted specialized laws and those that have regulated RES topics by using laws on related topics exists not only in the Russian Federation but also in other countries. For example, in the United States, the laws of the states of New Jersey, Washington, and New York are devoted to RES, and a number of states, such as, for example, Illinois, have included RES regulation in their “clean energy” laws. This is a broader concept ([Allegretti et al. 2022](#)), but RES is an important part of it. The same applies to the division by target indicators of power output. By 2045, Washington State expects to receive energy resources only from clean energy, and by the same date, Hawaii plans to receive all energy exclusively from RES.

The existence of a law on renewable energy precisely in Krasnodar Krai is justified. In Krasnodar Krai, there are sufficient values for the parameters of insolation, wind speed, soil, and air temperatures, and therefore, power plants based on all these energy sources can operate efficiently. A large number of mountain rivers in some areas explains the relevance of small hydroelectric power plants. A developed agro-industrial complex and a large number of small- and medium-sized farms also make it possible to efficiently use biogas power plants. In addition, Krasnodar Krai is a region with a large area and high settlement and development density, without the population concentrated around a couple of large settlements, which, together with the agrarian orientation of the region, leads to the emergence of a large number of consumers located at a distance from the main energy networks.

In addition to the regional legislation of Krasnodar Krai, in the Russian Federation, there is another regional legislation on renewable energy, which is the regional legislation of the Republic of Sakha (Yakutia) “on renewable energy sources of the Republic of Sakha (Yakutia)” No. 1380–3 dated 27 November 2014 ([State Assembly 2014](#)). Yakutia is not one of the traditional leaders in RES but it is third in the ranking of regions of non-price zones of the wholesale market and isolated energy systems ([Republic of Sakha 2022](#)). Yakutia has a very specific energy system; 40% of the region’s territory is located beyond the Arctic Circle, only 36% of the territory is covered by central energy supply; 15% of the population lives in the uncovered territories; and the issue of supplying the population with heat and electricity is one of the priorities of the regional administration. As a result, despite the fact that RES installations make up less than 1% of the total installed capacity of installations in the region, their use in the decentralized energy supply zone is more in demand than the use of RES-based installations in the country on average.

3.2. Yakutian Law on Renewable Energy: The Case of Peat Use

Unfortunately, there are shortcomings in the regional legislation of Yakutia and not much useful experience that could be effectively replicated. However, in some aspects, it surpasses the regional legislation of Krasnodar Krai. An interesting nuance is that the law is called “on renewable energy sources...”, but is also devoted to the regulation of using peat as an energy source. According to the UN documents ([UN General Assembly 1978](#)), peat can be equated with renewable energy sources, including the matters of legal regulation. Here, the region of the federation is at odds with federal legislation. In the Russian Federation, in 2016, changes were made that equated peat as an energy source with renewable energy sources in terms of state support measures, however, in December 2020, amendments were made to cancel this provision ([State Duma 2020](#)). The explanatory note to the draft law, drawn up by the Energy Committee of the State Duma (lower house of the Parliament of the Russian Federation), stated that, in the current regulation model, peat power plants can compete effectively with other thermal energy sources, which might be achieved by factors that include introducing energy-saving technologies, using integrated solutions for the multi-purpose processing of peat fuel, improving the technical and economic performance of generating capacities and, as a result, lowering the selling price of electricity. Thus, peat was excluded from support measures aimed at renewable energy not because of the desire for carbon neutrality, but because economic conditions made it inappropriate to maintain additional incentive measures. As a result, the fact that the regional authorities of Yakutia did not exclude peat from their law on RES is an example of proper federalization. It seems to consist, precisely, of the use of the mechanisms provided to the regions for regulating RES taking into consideration the characteristics of their territory.

3.3. Analysis of Declaratory Provisions

Let us analyze the laws of Krasnodar Krai and the Republic of Sakha, article by article, in order to highlight the advantages and the disadvantages of both regions. The first article on both the regional legislation of Krasnodar Krai and the regional legislation of the Republic of Sakha (Yakutia) is devoted to definitions of terms. The main term, “renewable energy sources”, in both cases, is copied from the federal law “on electric power industry” dated 26 March 2003 and is defined as “solar energy, wind energy, water energy (including wastewater energy), except of energy of pumped-storage hydroelectricity, tidal energy, wave energy of water bodies, including reservoirs, rivers, seas, oceans, geothermal energy using natural underground heat carriers, low-grade thermal energy of the earth, air, water using special heat carriers, biomass, including plants specially grown as an energy source, including trees, as well as production and consumption wastes, with the exception of wastes obtained in the process of using hydrocarbon raw materials and fuels, biogas, gas emitted by production and consumption wastes in landfills of such wastes, gas generated in coal mines”.

However, already with the second term, “non-renewable energy sources”, two different approaches have been taken. The regional legislation of Krasnodar Krai defines non-renewable energy sources through enumeration as “gas, oil, coal, shale, peat”, and the regional legislation of the Republic of Sakha (Yakutia) as “energy sources not listed in the paragraph on renewable”. The second approach seems to be more rational as it does not leave a gray area. Either the energy source is specified in a specific paragraph of the law and refers to RES, or it is not specified and does not apply, and, in the case of two closed lists that do not cover all possible energy sources (since this is practically impossible), there is room for manipulation, which is undesirable.

Articles about the subject of regulatory law are also somewhat different. The regional legislation of Yakutia includes the following points:

- (1) Study of the potential of renewable energy sources and its distribution on the territory of the Republic of Sakha (Yakutia);

- (2) The use of renewable energy sources or peat and the resulting electrical and thermal energy for use by consumers;
- (3) Organization of accounting in the field of the use of renewable energy sources or peat in the manner established by the legislation of the Russian Federation and the legislation of the Republic of Sakha (Yakutia);
- (4) Economic incentives for the use of renewable energy sources or peat.

The regional legislation of Krasnodar Krai contains identical provisions on the study of potential, organization of accounting, and economic incentives. However, the provision on the use of RES is formulated more specifically as “the priority use of renewable energy sources and the resulting electrical and thermal energy for autonomous use by consumers”. In addition, the subject of regulation has been expanded with the item “creation and application of cost-effective technologies, production of equipment for the use of renewable energy sources and acceleration of scientific and technological progress in this area”, the presence of which seems to be of fundamental importance. The presence of this clause in the subject of regulation creates a legal foundation for the region to finance not only incentives for existing energy producers from renewable energy sources and the construction of new installations, but also scientific research, the formation of a production base for installation components, and the development of appropriate software within the framework of programs for the development of renewable energy sources. Government subsidy policy for improvement of the innovative performance of renewable energy enterprises was discussed for China by (Xu et al. 2022).

The approach to declaratory articles also differs between these two regions. For example, the regional legislation of the Republic of Sakha (Yakutia) contains an article with the objectives of the law, and the regional legislation of Krasnodar Krai contains the basic principles of state policy in the field of RES on the territory of the region. It is good practice to include both such articles in the text of the law. An article with goals facilitates the teleological interpretation of the norms of the law, and outlines the vector for the development and improvement of the law. The article with the principles creates the necessary restrictions, which must be checked for compliance with all the norms adopted within the framework of the regional legal regulation on RES.

3.4. Analysis of Enshrined Powers of Authorities

Articles about the powers of the bodies of the region and local governments also have a number of differences. For example, in Krasnodar Krai, the head of the region does not have any authority in the field of RES, and in Yakutia he (or she) approves state programs aimed at the development of RES. In Krasnodar Krai, this authority is assigned to the highest executive authority of the region. The powers of the legislature of the region also differ. In both regions, he (or she) can adopt the regional laws in the field of RES, but in Yakutia, he (or she) is also endowed with control powers and can monitor their implementation, and in Krasnodar Krai, the provision of benefits in the manner determined by law is separately prescribed. These powers both seem to be not quite correctly formulated. The parliamentary control exercised by the regional parliament should be regulated by a separate act and should apply to any laws adopted by it, so this power simply does not need to be clarified. The granting of benefits by the parliament of the region, if it is carried out by adopting a regional law fixing these benefits, also does not need additional consolidation. If it is their direct provision which is discussed, then, according to the logic of the mechanism of separation of powers, this is the authority of the executive branch.

The key difference in the powers of the supreme executive body is the presence of the provision in the regional legislation of Krasnodar Krai that it “defines the authorized executive body of the Krasnodar krai in the field of the use of renewable energy sources in the Krasnodar krai”, whereas the regional legislation of the Republic of Sakha (Yakutia) does not mention the authorized body at all. The approaches both do not seem to be the most appropriate. The development and use of RES is long-term work. In this case, the presence of a specialized body is highly desirable, but it is necessary to, at least, determine

exactly which of the already existing bodies will be authorized to carry out this work, and it is necessary to fix this, together with the corresponding powers of this body, directly in the regional legislation on renewable energy. This is a standard practice and is done in the law on energy saving and energy efficiency in a number of constituent entities of the Russian Federation, but both considered regional legislations on renewable energy ignore it.

3.5. Analysis of Additional Good Practices Included in Regional Laws

In further analysis of these regional laws, it is possible to note in each of them a few more examples of good practices that are suitable for extension to other regions. For example, the regional legislation of the Republic of Sakha (Yakutia) stipulates the creation of a fund to support the development of RES in order to financially support the policy of the republic in the field of RES among the measures of state support. The creation of similar funds is discussed in (Karatayev et al. 2021). The sources of financing the fund are the savings resulting from the implementation of measures to replace the used non-renewable energy sources with renewable energy sources, the republican budget funds corresponding to the cost savings obtained as a result of the measures to replace the used non-renewable energy sources with renewable ones, and the federal budget funds provided as subsidies.

The regional legislation of Krasnodar Krai directs allocation of priority places for the use of RES, which seems to be a good practice. These priority places include zones of decentralized energy supply, where, due to low population density, the construction of traditional power plants and high-voltage power lines is economically unprofitable or practically unfeasible; zones of centralized energy supply where, due to the unsatisfactory condition of networks or a shortage of power or energy, there are frequent disconnections of consumers of electrical energy leading to significant economic damage and negative social consequences; settlements and places of mass recreation of the population where, due to harmful emissions into the atmosphere of industrial and urban boilers running on organic fuel, a difficult environmental situation is created; settlements, places of temporary residence of people (seasonal work and recreation), where there are problems of heating, electricity, and hot water supply of individual housing and temporary buildings. It was also noted that RES is the preferred source of energy supply in specially protected natural areas. Such lists of priority places could be formed in each of the regions, since they are not universal and may take into consideration the specifics of the region. For example, three regions of the Russian Federation: Irkutsk Oblast, the Republic of Buryatia, and Zabaykalsky Krai are located around a unique natural object of world importance, i.e., Lake Baikal. At the same time, Zabaykalsky Krai is included in the list of regions leading in the introduction of RES. The removal of traditional power plants beyond the defined region exclusion zone around the lake and the provision of energy precisely from renewable sources at a certain distance from the shore of Lake Baikal could be an example of a regional initiative to select priority locations for RES facilities on the territory of a region of the federation.

By continuing to analyze the legislation of other regions of the Russian Federation that do not have specialized laws on RES and by collecting norms on their various legal acts, a number of rational proposals that should be considered as additions to the laws on RES can also be found.

The law “on certain issues of legal regulation of environmental protection and conservation of biological diversity in the territory of the Astrakhan oblast” in Article 4 “Powers of the government of the region” contains the power to “impose restrictions on the use of petroleum products and other types of fuel, the combustion of which leads to air pollution in the relevant territory, as well as stimulating the production and use of environmentally friendly fuels and other energy sources”. Giving regional authorities the power to establish restrictions on the use of petroleum products is the most appropriate approach for regional legislation on renewable energy, but they do not contain them. The laws “on energy saving” of the analyzed regions also do not contain such provisions, even if RES are also included in their subject of regulation.

3.6. Analysis of Information Support

The regional legislation of Krasnodar Krai also contains an article on information support in the field of RES. Unfortunately, it is limited to listing the types of information support, without fixing the responsible bodies, mechanisms for encouraging and stimulating, and so on. The law refers to the following types: discussion of programs for the use of RES and projects for the creation of installations for the use of RES, preparation of demonstration projects for the use of RES, organization of exhibitions of equipment and technologies used in the field of RES, providing consumers of energy resources with information on the use of RES, and advocacy of the use of RES.

In general, all information support can be divided into two categories: intended for investors and intended for consumers. The first three proposed items belong to the first category, and the last two belong to the second category. Unfortunately, neither the law “on renewable energy” of Krasnodar Krai nor other regional laws on renewable energy and energy conservation considered within the framework of the study take this difference into account and do not offer fundamentally different approaches to conducting information support activities depending on their target audience. For example, the second category of information support intended for consumers could include informing about the possibilities and prospects of renewable energy from childhood, such as teaching children in modern schools to separate waste collection, and the first category of information support intended for investors could include informing about successful cases of investing in power plants based on renewable energy in the region.

It should be noted that the list of types of information support from the regional legislation of Krasnodar Krai on RES is significantly inferior to the list from the law “on energy saving” of the same region. In addition to the methods listed above, it provides for the creation and operation of a state information system in the field of energy conservation and energy efficiency. It is not entirely clear what prevents the creation of the same information system in the field of renewable energy, given that the regulatory body of the region has data on all power plants. Delving even further into the regional legislation and looking at the types of information support for energy saving in Stavropol Krai, a requirement was found that “Information included in the state information system in the field of energy saving and energy efficiency is subject to mandatory placement on the official website of a specially authorized body executive power of the Stavropol kraï in the field of energy saving and energy efficiency in the information and telecommunications “Internet” network and update at least once a quarter”. If the state information system is intended not for internal use, but for informing, then, the approach proposed here with access through the Internet on the official resource and indication of the mandatory update frequency seems to be the most appropriate. Expansion of legislation on information support of RES in the regions should be carried out in this direction.

The law “on energy saving” also provides for such types of information as the organization of media broadcasts in thematic television and radio programs; information and educational programs on activities and methods of energy saving and energy efficiency, about outstanding achievements, including foreign ones, in the field of energy saving and energy efficiency; and other relevant information in this area by the authorized executive body of Krasnodar Krai in the field of energy saving and energy efficiency. It can be assumed that such educational activities are covered by the clause on “propaganda of the use of renewable energy”, but if one already has a more detailed description of the type of information support provided for by one regulatory legal act, then, it is inappropriate to ignore it in another law, limiting itself to a less specific wording.

3.7. Recommendation on Mandatory Enshrining of Regulatory Body and Its Powers

Summing up the intermediate result, it can be noted that the numerous technical shortcomings of the considered regional laws on renewable energy reduce their effectiveness, preventing them from revealing the full potential of regional legal regulation. The absence of full-fledged norms that establish the regulatory body of the region in the field of RES and

fix its powers is the most significant mistake. The vagueness of authority and responsibility devalues any other regulation.

Based on the methods used in regional legislation on the regulation of adjacent relations, several different approaches can be proposed to correct this problem at the level of an individual region. The first approach implies enshrining in law the creation of a new regulatory body, including the procedure for its formation, powers, and responsibilities. The second approach is to assign the relevant powers to the already existing state bodies of the region of the federation, and prescribe the need to create on its basis a special structural unit responsible for renewable energy. The third is to establish the power of the executive authority of the region to determine the regulatory body, but to prescribe in the law itself its powers and responsibilities, as well as the obligation to form a specialized unit.

The insufficient effectiveness of the current law of Krasnodar Krai “on the use of renewable energy sources in Krasnodar Krai” is emphasized by the fact that, having favorable climate features, the region is inferior to a number of others both in terms of the total installed capacity of RES installations and in terms of the percentage of energy produced by RES. In the previously mentioned independent RREDA ranking, this region ranks only tenth. Thus, the mere fact of the existence of a specialized regional law, without properly enshrining the powers of the regulatory body in it and solving a number of other problems, does not provide the region with special advantages in terms of development rates over regions where there are only laws “on energy saving and increasing energy efficiency” or, in general, there are no thematic legal acts.

3.8. Recommendation on Additional Power to Optionally Impose Restrictions on Use of Fossil Fuel Based on Experimental Federal Law

There is also an experimental federal law in the Russian Federation that gives individual regions additional powers, some of which could significantly expand the options of regions in stimulating the use of renewable energy sources. This is the federal law “on conducting an experiment to limit greenhouse gas emissions in certain regions of the Russian Federation”. This is a completely new law whose entry into force only commenced on 1 September 2022, and therefore, we cannot judge its effectiveness by results, however, it is already possible to evaluate the rules of law contained in it in terms of their applicability to RES legislation. Today, the experiment includes only one region, Sakhalin Oblast, but the law allows other regions to be included in it, and, most importantly, it is not necessary to include regions with great climate features in the law aimed at achieving carbon neutrality, it is enough to borrow its individual mechanisms.

In particular, the powers granted to the legislative and executive bodies of a region by Article 12 of the law, “Economic and financial mechanisms to stimulate the reduction of greenhouse gas emissions and increase their absorption” are of greatest interest. According to this article, tax benefits may be established for regional regulated organizations by the laws of the regions of the Russian Federation. A regional regulated organization, in the context of this law in accordance with its Article 2, is a legal entity or an individual entrepreneur engaged in economic and other activities that result in greenhouse gas emissions on the territory of the region participant in the experiment which (who) is added to the list of regional regulated organizations by the supreme executive body of the region of the Russian Federation participant in the experiment. Thus, the region receives the right to compile lists of organizations whose activities are related to the emission of greenhouse gases, and to stimulate them by introducing tax incentives. Similar rules that would be applied by regions for organizations that are medium or large consumers of heat and electricity in association with their transition to RES could make a significant contribution to stimulating the use of RES. The economic stimulus measures used today are aimed primarily at investors and energy suppliers. Additional support of consumers would invite them to explore the possibility of switching to renewable energy, if tax incentives covered a significant part of the primary costs caused by changing the energy supply system. For individual consumers, such as peasant farms, this could be a strong incentive to switch to energy self-sufficiency

through biogas plants. Off-grid consumers who have been forced to use diesel generators are already interested in switching to more efficient and safe energy sources, but additional cost-effective support would allow them to accelerate the transition to RES. In addition, this may prompt a number of medium and small consumers to consider whether it would be a better solution for them to use the funds released from the tax incentive to jointly invest in the construction of a RES plant that would cover their collective needs. The interplay of renewable energy investment efficiency, shareholder control, and green financial development in the context of China was discussed by (Wang and Zhao 2022).

Additionally, according to the law “on conducting an experiment to limit greenhouse gas emissions in certain regions of the Russian Federation”, the highest executive authority of the region has the right to establish subsidies related to the reimbursement of costs for the production of goods, implementation of works, and provision of services, in order to achieve carbon neutrality by the region. Here, it seems important that such a formulation opens up opportunities for shifting the focus in favor of the development of industrial infrastructure. The same method is applicable in RES. Nowadays, in the Russian Federation, the main tool for stimulation of the development of its own infrastructure is the federal government-established target indicators for the degree of localization within the territory of the country of production of the main or auxiliary generating equipment used in the generation of electricity using RES. For 2022, the value of this indicator is 65%, and there is a very detailed and well developed algorithm for calculating the degree of localization. This is a mandatory requirement of a project for the construction, reconstruction, or modernization of a generating facility to be able to participate in investment competitions. It is desirable to supplement this mechanism with subsidizing of the industries whose products are aimed at creation of RES installations. In the regions that will be included in the experimental law, this will be possible without the adoption of additional regulations, since most of these industries fall under the requirement of “production of goods to achieve carbon neutrality”. However, it is not advisable to wait for the inclusion of other regions in this experiment, since, even without the inclusion, it is possible to vest their executive bodies with similar powers in relation to industries revolving around RES.

3.9. Recommendation on Target Indicators Based on Analysis of State Programs

In addition to regional laws, regional state programs have become an important tool for stimulating the development of RES in the regions of the Russian Federation. In a number of regions there are regional programs dedicated to energy saving, in which special subprograms are devoted to RES, while in other regions these are separate activities within the framework of programs to improve energy efficiency, develop electricity sector and industry, and develop housing and communal services.

Some of the problems associated with the provisions of these programs regarding the promotion of the use of RES are caused by the previously discussed legal regulation shortcomings at the level of the laws of the region. There are several examples of such problems.

One of the disadvantages of such state programs is that activities that are not related to RES are also being added and the funding is spent on them. In Rostov Oblast, the subprogram titled “Expanding the use of renewable energy sources” included an event to design an autonomous power supply complex based on a gas turbine and diesel power plant running on natural gas. In addition, over time the “use of reversible heat pumps for heating and ventilation using soil as a heat accumulator”, “organization of additional heating and hot water supply using solar collectors”, and “expansion of the use of secondary energy resources as energy sources and (or) renewable energy sources” disappeared from the subprogram and, in their place, came the “development of the coal industry”, which was not related to RES and included, among other things, the purchase of a diesel locomotive.

Another problem is that in the absence of norms prescribed at the level of the law of the region, it remains possible to apply a mechanism in which the target values are revised to adjust to those actually already achieved. In Rostov Oblast, the original version of the

program to expand the use of renewable energy, approved in 2012, aimed to increase the share of RES up to 4.5% in the energy balance of the region by 2020; however, in 2014, the program was revised setting the target at 1.68%. This value corresponded to the share of RES energy in the region at the time of the changes. Thus, in 2020, it was possible to report on the successful implementation of the program, although since 2012, there has been an increase in the share of RES from 1.62 to 1.68%. In addition, individual events that were originally announced in the program were removed from it in the course of making changes. These shortcomings have not become fundamental for the development of RES specifically in Rostov Oblast, and today, the region has constant growth in the installed capacity of RES power plants and an increased share in total generation. Nevertheless, this illustrates that the lack of fixing at the level of the law leaves room for manipulations with targets and action plans.

Challenges also arise with respect to accounting for the extent to which the subsidies allocated under the programs correspond to the declared targets specifically in the field of renewable energy. In Volgograd Oblast, within the program framework of “energy saving and energy efficiency improvement in the Volgograd Oblast”, the plan is to reach the value of the installed capacity of RES generating facilities of 515 MW by 2024. The region has shown significant growth, and during the program, the installed capacity increased from 32 MW to 230 MW. However, it is impossible to establish how this is related to the success of the program, since the relevant section of the program provides all the subsidies and benefits only for enterprises engaged in gasification, and in the list of objects, the construction and reconstruction of which is funded under the program, there is not a single RES installation. All expenses planned for RES were calculated for the period up to 2021.

Among the target indicators of a program, there might be items that are almost meaningless due to the lack of specificity. For example, in the state program of Orenburg Oblast there is a point on “the number of publications on methods of operation and technologies in the field of energy saving and energy efficiency improvement”, which indicates three publications for each year of the implementation of the program. However, no details about the sources, level, scope, and accessibility for the reader of these publications have been set.

Another problem arises from the fact that each program can set its own indicators for achievement of its goals. A number of regions set the indicator as the installed capacity of generating facilities operating on the basis of RES, others set the fraction of RES-generated energy in the total energy generated by the region, and still others use both indicators. The greatest problems arise when one method is used in the target indicators for the entire program, another method is used in the indicators for the activities at different steps in the program, and the interim reports contain the indicators for activities, making it challenging to judge how closer target indicators for the entire program are fulfilled. In Krasnodar Krai, the share of RES in total generation should grow in the course of the implementation of the state program, but at the same time, it is unclear how it is planned to be achieved, since an increase in the capacity of RES generating facilities is not planned from 2018 until the very end of the program, and the program does not include the decommissioning of traditional installations.

As a result, assessment of the effectiveness of the impact of programs on a real shift in the use of RES in a region is significantly challenging due to the use of different indicators, due to easily (by an act of the executive authority) made changes to the program in the form of target action plan adjustments, and due to the lack of connection between the declared measures and financial support.

The previously proposed rigid consolidation of the powers of the regulatory body by regional legislation can solve this challenge. To do this, it is necessary to oblige the body to set targets for the development of RES in the region and empower it to check regional programs for compliance with set targets. The interested body, whose employees constantly monitor the situation with RES in the region, would block changes to state regional programs that would hinder the development of RES in the region, would control financing, and would also assist in the implementation of measures. Currently, the bodies responsible

for the implementation of such state regional programs do not always coincide with the body that regulates RES in the region, and this also complicates their implementation.

The evaluation of the effectiveness of programs is also complicated by the fact that, in none of the regions considered during the study, the ratio of the funds spent on the implementation of the program to some indicator of the actual achieved results was not measured within the framework of the report on the implementation of the program. That is, what can be approximately called the economic efficiency of measures for the development of RES in the region is not measured.

3.10. Recommendation on Calculation of Economic Efficiency Based on Act on Competition of Investment Projects

At the same time, as in a number of previous cases, the necessary legal mechanisms in regional legislation have already been created and they can be distinguished and reproduced. In Ulyanovsk Oblast, a competition was held for the selection of investment projects to include RES generating facilities intended for the sale of electrical energy (capacity) on retail markets in the scheme of the prospective development of the electric power industry of the Ulyanovsk region for 2021–2025. The competition itself was held in 2020 and it is too early to judge its effectiveness, since to date, no new RES power plants have been introduced in the region, but separate tools for evaluation of applications could be used for other purposes.

The main selection criterion in the competition held in Ulyanovsk Oblast was the amount of capital costs for the construction of 1 kW of installed capacity of a RES generating facility which was calculated as a percentage of the limiting level. In the Russian Federation, the limiting level is established by the Decree of the Government of the Russian Federation “on the main directions of state policy in the field of improving the energy efficiency of the electric power industry based on the use of renewable energy sources for the period up to 2035” and is set only for generating facilities based on wind energy (109232 RUB/1814 USD/1775 EUR), photovoltaic conversion of solar energy (99072 RUB/1645 USD/1609 EUR), and small hydropower plants (146000 RUB/2425 USD/2372 EUR). For generating facilities operating on the basis of other RES, the maximum values of capital costs for the construction of 1 kW of installed capacity of a generating facility in the Russian Federation are not defined.

Due to the problems already described earlier, in the current state of regional programs, it is difficult to assess whether they even correspond to the maximum values of capital costs or conditions that, within the framework of the competition, provided the maximum score, that is, capital costs for the construction of 1 kW of installed capacity to be 80% of the limiting one or less. However, if we take a straightforward approach and divide the amount allocated for the program to expand the use of renewable energy sources in Zabaykalsky Krai by the expected increase in the installed capacity of renewable energy facilities, then the result will be RUB 149,000 (approximately USD 2475 USD, EUR 2421), which is more than the limiting value for installations of any type. In Volgograd Oblast, if we compare the declared target value with the amount of expenses for financing the program, we get a quite satisfactory value of RUB 68,000 (approximately USD 1129, EUR 1105) for an increase of installed capacity on 1 kW.

At the same time, it should be considered that different regions have different climate features and resource potentials and, accordingly, the technical potential, the calculation of which was used for the purposes of the study and presented in the Methods, also differs. As a result, with a significant difference in the technical potential of the regions, it seems unfair to expect the same result in an increase in capacity per unit of currency spent. Here, the federalization can be used for benefit and a specific correction factor can be introduced for each region. To calculate the factor, the technical potential of RES per unit area in the region, calculated in $\text{kW}\cdot\text{h}/(\text{m}^2\cdot\text{year})$, should be used. All the necessary data for calculations are in the public domain, and the highest executive authorities of the region can use them.

4. Conclusions

Although, in large countries, climate and socioeconomic features in different regions can significantly vary and affect the legislation regulating renewable energy sources (RES), careful reproduction of good practices and successful experiences of other regions are a good basis for the development of legislation. Large federations, consisting of a large number of regions with a sufficient degree of independence, develop a large base of legislative choices and organizational decisions, and in this way, the best of which can subsequently be reproduced throughout the regions.

In accordance with the purpose of this study, i.e., to develop recommendations for improving the norms of specialized regional laws on RES by analyzing the norms of RES regulatory law in the regions that have most successfully introduced RES into their energy systems, a number of conclusions were made about the directions for the development of regional legislation on RES.

The key condition for increasing the effectiveness of RES regulatory law by using a specialized regional law is the mandatory enshrining of the regulatory body, its powers and responsibilities in the law. These powers should include setting target indicators for the development of RES in the region and checking the approved thematic programs of the regional government for compliance with the established targets. In the course of the audit, it is necessary to exclude the possibility of adding events that are not related to RES to the programs dedicated to RES. The regulatory body should also carry out an economic assessment of the effectiveness of regional government programs based on capital costs for the introduction of new capacities. It is also recommended to add the power to optionally impose restrictions on the use of petroleum products and other types of fuel that, when combusted, leads to air pollution.

The highest executive and the highest legislative body of the region should be able to use tax incentives for consumers who have switched to RES, and should introduce subsidies to compensate for the costs of production of goods, implementation of work, and provision of services aimed at development of RES in the region.

A number of less significant recommendations, the observance of which would improve regional legislation, can also be highlighted, but they are not of such fundamental importance. For example, it is recommended that regulatory law should not be limited to the construction and operation of installations. It should include the creation and application of cost-effective technologies, the production of equipment for the use of RES, and the acceleration of scientific and technological progress in this area. The law should also simultaneously address its question and reflect the principles of the state policy of the region in the area of renewable energy. Good practices seem to include regulatory consolidation of the creation of a RES support fund, allocation of priority places for the use of RES in a region, and creation of a state RES information system with access to it via the Internet.

Constantly exchanging experiences in legislative choices in the field of RES between the regions of the federation would contribute to improving the quality of legal regulation and, as a result, would accelerate the transition to a new, “green” energy, to achieve carbon neutrality and to improve the quality of life of the population of the region, and, if the question is considered more globally, of the whole country and worldwide.

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