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Financing improvement of renewable energy sources development in the Republic of Sakha (Yakutia)

Financiación de la mejora del desarrollo de fuentes de energía renovables en la República de Sakha (Yakutia)

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ABSTRACT:

In this article the study of modern trends in the development of renewable energy sources (RES) in the world has been conducted. The foreign and Russian experience of financing renewable energy sources has been considered. The theoretical aspects of financing the development of the RES has been analyzed, among which the need for state support for the use of specific RES financing mechanisms has been revealed. The assessment of the state of the modern Russian renewable energy market, as well as the need for the development of renewable energy sources in Russia and the Republic of Sakha (Yakutia) has been given. Proposals on stimulation the development of renewable energy in the Republic of Sakha (Yakutia) with the help of crowdfunding have been developed.

Keywords: renewable energy sources, electric power industry, electric power, production, consumption, the Republic of Sakha (Yakutia).

RESUMEN:

En este artículo se realizó el estudio de las tendencias modernas en el desarrollo de fuentes de energía renovables (RES) en el mundo. Se ha considerado la experiencia extranjera y rusa en el financiamiento de fuentes de energía renovables. Se analizaron los aspectos teóricos de la financiación del desarrollo de la RES, entre los cuales se reveló la necesidad de apoyo estatal para el uso de mecanismos específicos de financiación de RES. Se ha evaluado el estado del mercado moderno ruso de energías renovables, así como la necesidad de desarrollar fuentes de energía renovables en Rusia y la República de Sakha (Yakutia). Se han desarrollado propuestas para estimular el desarrollo de energías renovables en la República de Sakha (Yakutia) con la ayuda del crowdfunding.

Palabras clave: fuentes de energía renovables, industria de la energía eléctrica, energía eléctrica, producción, consumo, República de Sakha (Yakutia).

1. Introduction

"The basis of the mechanism to stimulate renewable energy was laid in developed countries in the 70s of the XX century as a result of the aggravation of the oil crisis. In the late 90-ies. interest in it was caused by global warming" (Ozhgikhin, 2012). Largely, it was the result of anthropogenic activities. It is a negative impact of burning traditional energy resources, which leads to an increase in the content of carbon dioxide in the atmosphere. Then, a decade later, the focus on renewable energy has been increased due to the sharp increase in world energy prices, including oil prices. One of the most important aspects affecting the introduction of renewable energy

sources is to attract financing for investments in the development of renewable energy projects. The purpose of the study is to develop proposals to improve the financing of renewable energy development in the Republic of Sakha (Yakutia).

In accordance with the stated purpose of the study, the following tasks were set and solved: theoretical aspects of financing the development of renewable energy sources were analyzed; current trends and problems of development of renewable energy sources in the Republic of Sakha (Yakutia) were evaluated; recommendations for improving the financing of renewable energy sources in the Republic of Sakha (Yakutia) were proposed (on the example of JSC Sakhaenergo).

2. Methodology

The work uses a world-promising financial mechanism for attracting investment for the implementation of investment projects of social importance as the use of renewable energy as "crowdfunding" ("Donation"), which is a way to attract financial resources from the general public. Typically, this mechanism is implemented on Internet sites where recipients post information about their project to raise funds (G. Khotinskaya, 2017). Crowdfunding allows you to attract the necessary funds without the participation of financial market structures, which greatly simplifies this procedure (Evdokimova S.S., 2015). The peculiarities of using effective methods of financing the development of renewable energy sources as a crowdfunding mechanism in Russia were identified by Russian scientists (Barinova, T.A. Lanshina, G.I. Khotinskaya, M.K. Sanina., 2007).

3. Results and discussion

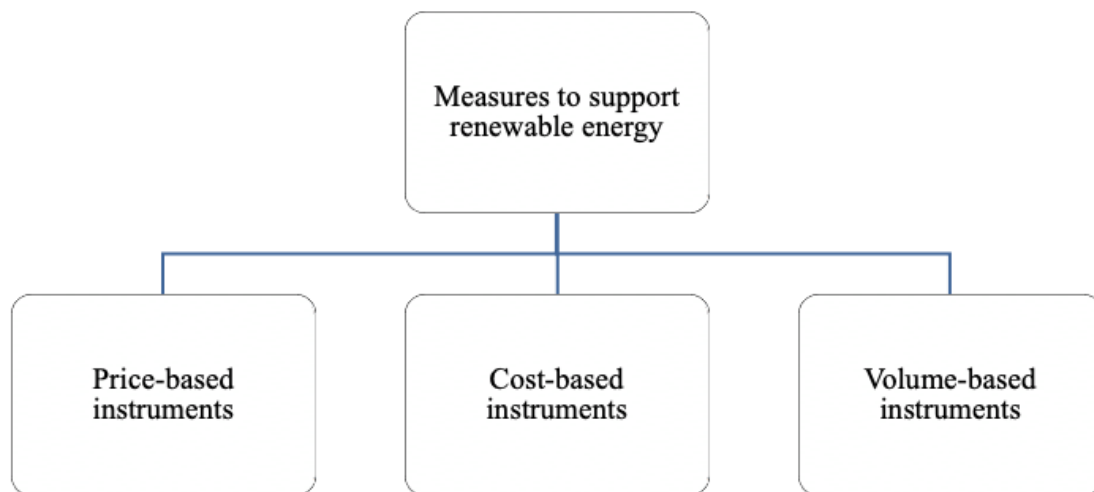
According to the Federal law on electric power industry, renewable energy sources (RES) include: solar energy, wind energy, water energy, including wastewater energy (except for the use of energy at hydroelectric power plants), tidal energy, wave energy of water bodies, including reservoirs, rivers, seas, oceans; geothermal energy using natural underground heat carriers, low-potential thermal energy of the earth, air, water using special heat carriers; biomass, including specially grown plants for energy production, including trees, as well as production and consumption waste, except for waste obtained in the process of using hydrocarbon raw materials and fuel; biogas, gas emitted by production and consumption waste in landfills of such waste, gas generated in coal mines (Federal Law of 26.03.2003 N 35-FL, 2003).

Solar and wind farms have added more power during a year than coal, gas and nuclear power plants. This achievement has allowed renewable natural resources to bypass coal and come out on top in the world in terms of installed capacity growth (Renewable energy came out on the 1st place in the world. 2016).

A press release published on the University's website says that according to the scientists from Stanford University, places where salt ocean water mixes with fresh water can become a source of production of a huge amount of renewable energy. When fresh water from coastal treatment plants is mixed with salty sea water, an electrochemical reaction takes place during this process in which energy is produced.

According to the analysis of foreign experience of the RES implementation, those countries that occupy leading positions in the use of the RES for many years supported their development with the help of a whole range of measures. At present, the RES support measures based on price, costs, volume should be recognized (figure 1) (Barinova, Lanshina, 2016).

Figure 1
Classification of renewable energy support measures



The main state measure to support the development of renewable energy is the implements based on the price of electricity (inclusion of investment allowances in tariffs, establishment of fixed tariffs for electricity and establishment of payment for power).

Fixing fares and price premiums manifested themselves in the US in the late 1970s and began to be implemented only in the 1990s., at first predominantly in Europe and then in other States, being the most popular instruments of state incentives for renewable energy (Barinova, Lanshina, 2016). A rather rare tool for the development of renewable energy since 2013 is the power fee, and it will be successfully used only in Russia.

Indirect methods to stimulate the development of the RES are groups of instruments based on costs (tax holidays, tax incentives, subsidies and grants for investments, subsidies from the state budgets of interest on loans and partial compensation of investment costs, high taxes and charges on fossil fuels and others).

Volume-based instruments are usually green certificates and renewable energy portfolio standards, as well as renewable energy quotas. In 2013, renewable energy portfolio standards were applied in 22 countries at the national level and in 54 States or provinces of the USA, Canada and India, tenders or trades were applied for the supply of electricity produced by the RES in 37 countries of the world (Statistical Yearbook of the world energy, 2017).

Within the framework of this program, the primary task is to transfer the power consumption of buildings and structures to renewable energy, due to the huge share of consumption (about 75%) in the energy balance of Europe. For this purpose, global tasks on the implementation of mini-power plants for "green energy" in buildings, when there is an excess of energy to give to the general grid of the energy system, are solved. In Germany, solar energy is developing at an accelerated pace, due to the government measures to support the development of VI. For example, the project "100,000 solar roofs Program", which is implemented at the Federal level, provides financial subsidies to German investors, and the project is the world's largest financing program in the field of solar energy (Korobova, 2009).

Based on the above, we can conclude that Russia can also attempt to launch energy programs for the development of renewable energy sources, which are successfully implemented in European countries.

Thus, the development of renewable energy sources should take place with the active participation of the state. Precisely because of the state support, the introduction of installations based on renewable energy resources in foreign countries is accelerating from year to year.

Let's take a closer look at the foreign and Russian experience of financing renewable energy sources. So, in recent years, we can observe how the exploitation of renewable energy sources (RES) is spreading at a steady pace around the world, as evidenced by the following data. In 2015, renewable energy came out on top in the world in terms of installed capacity growth among all types of fuel (Sanin, 2015). In 2016, the increase in global renewable energy capacity was a record 138.5 GW compared to 127.8 GW a year earlier (Renewables, 2017). The countries that leading in the world in their total installed capacity of renewable energy sources are China, the USA and Germany (table 1).

Table 1
Leading countries by installed capacity on renewable sources in 2016

| | | | | | |
|--|--|--|--|--|--|
| | | | | | |
|--|--|--|--|--|--|

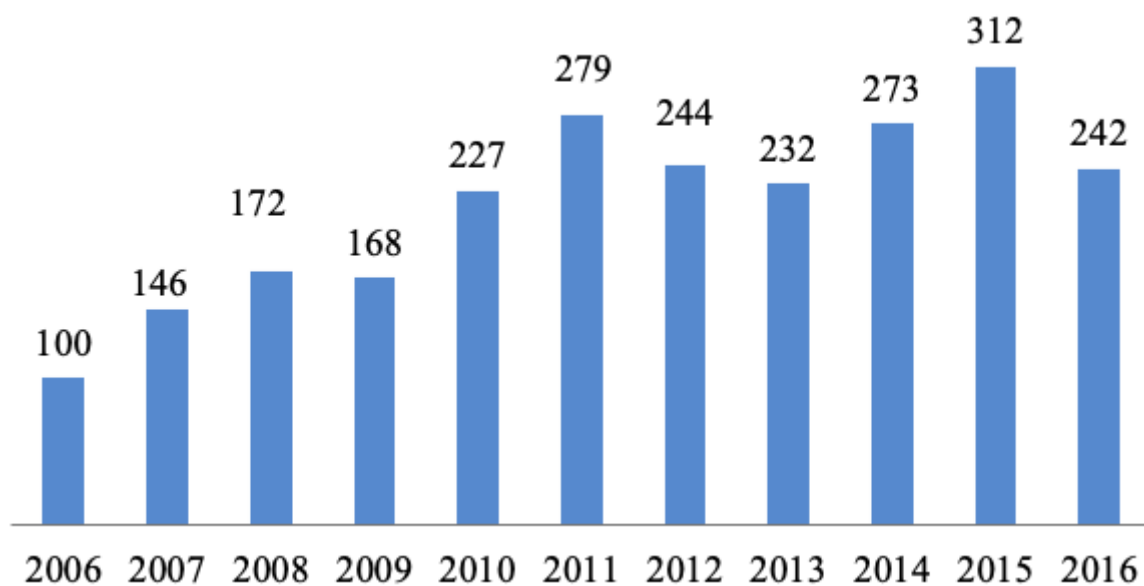
| Hydropower | Geothermal energy | Wind energy | Solar photovoltaic energy | Solar thermal energy | Energy derived from biomass |
|------------|-------------------|-------------|---------------------------|----------------------|-----------------------------|
| China | USA | China | China | | USA |
| Brazil | Philippines | USA | Japan | Spain | China |
| USA | Indonesia | Germany | Germany | USA | Germany |
| Canada | New Zealand | India | USA | | Brazil |
| Russia | Mexico | Spain | Italy | | Japan |

Source: Renewable Global Status Report, 2017

Russia has the most developed hydropower, Germany has the most developed wind, solar and biomass energy, the USA has the most developed solar, wind, geothermal and thermal energy based on biomass, and China has the most developed hydro, wind and solar energy.

In 2016 the investments in the sector decreased by 23% to \$241.6 billion compared to \$312.2 billion in the previous year, which is largely due to a decrease in the cost of installing capacity: average capital expenditures per megawatt of electricity in the solar and wind energy sector decreased by more than 10% (figure 2) (Renewables, 2017).

Figure 2
Dynamics of the investments in renewable energy sources in the world in 2006-2016, in billions of US dollars



Investment in renewable energy sources was almost double that in fossil fuels last year, mainly due to the wind and solar plants. As a result, the RES accounted for 55% of all new power generation capacity in 2016.

Now that the cost of introducing renewable energy technologies is at an all-time low, it gives investors a real opportunity to get more for less, says UNEP Executive Director Eric Solheim.

Investments in renewable energy in developed countries in 2016 decreased by 14% - to \$125 billion, in developing countries-by 30%, to \$117 billion in China, the volume of investments in renewable energy decreased by 32% - to \$78.3 billion, but over the previous 11 years there was a constant upward trend. The United States in 2016 reduced its investments in renewable energy technologies by 10% - to \$46.4 billion, Japan - by 56%, to \$14.4 billion, while Europe - increased by 3%, to \$59.8 billion [8].

According to the statistical Yearbook of world energy 2017 (Statistical Yearbook of world energy 2017), the leading countries in the share of renewable energy in electricity production (including hydro) are Norway (97.9%), New Zealand (84.0%) and Colombia (82.0%). While Russia switched to renewable energy sources by only 17.4% (Renewables, 2017). New Zealand (23.5%), Spain (23.5%) and Portugal (22.3%) are considered the world leaders in the production of electricity from solar and wind energy. In Russia, this figure is about 0.07%. It should be noted that in both lists is present. Active development of renewable energy sources in New Zealand is due to the

abundance of geothermal energy sources and significant resources for the development of wind energy. In 2018, New Zealand plans to abandon coal and switch to renewable energy sources by 90% by 2025 (Barinova, Lanshina).

It is worth noting that not only New Zealand is aimed at the maximum transition to renewable energy. Many States, including those whose budget is based on revenues from the sale of hydrocarbons, announced programs for the transition to clean energy. The Scottish government recently issued a press release outlining a full transition to renewable energy by 2020. Now the total capacity of renewable energy sources in the country is more than 500 MW, and this, in turn, provides about 60% of the total needs of the state. According to the plan published by Scotland, these figures should double by 2020, which will completely abandon the resources of traditional energy.

In addition to Scotland, China is preparing a large-scale project in this direction and intends to invest 361 billion us dollars (2.5 trillion yuan) in renewable energy by 2020. The goal of the program is to increase the share of renewable sources to 15% by 2020 in total electricity generation, which is equivalent to 580 million tons of coal. The use of coal has allowed China to make an industrial revolution, but now environmental considerations lead to the abandonment of the natural resource. China, like other countries in the world, is reorienting from coal to solar, wind, nuclear and hydropower (China will invest in renewable energy, 2017)

According to the data, we conclude that it is necessary to strive to increase the share of renewable energy sources in the energy balance of the country.

In 2013 and 2015, Russia introduced incentive mechanisms for the use of renewable energy resources in the wholesale and retail markets of electric energy and capacity (the wholesale market supports solar, wind and hydropower, the retail market supports all types of renewable energy).

In response to the adopted amendments to the Federal Law of 26.03.2003 No. 35-FL "On electric power industry" it became possible to introduce state support for renewable energy. This law was supplemented with the definition of renewable energy sources, it also provided for the possibility of supporting renewable energy resources by means of surcharges to the wholesale price of electricity (due to the green tariff), which was not implemented, or due to the power fee, which was introduced in 2013 (Barinova, Lanshina, 2016).

In 2013, the Russian Government adopted targets to increase the share of the RES in the country's energy balance to 2.9% by 2020 (except for HPPs with a capacity of more than 25 MW). Currently, the share of renewable energy sources in electricity production in Russia, excluding large hydropower plants, does not exceed even one percent (table 2).

Table 2
Main indicators of power plants of UES of Russia and isolated power systems taking into account renewable energy sources for 01.01.2018.

| Type of power plant | Electricity generation, million kWh | Share in electricity production, percentage | Share in total installed capacity, percentage |
|---------------------|-------------------------------------|---|---|
| TPP | 671 349,4 | 63,70 | 67,88 |
| HPP | 178 901,6 | 16,98 | 20,20 |
| NPP | 202 917,0 | 19,25 | 11,64 |
| WPP | 131,0 | 0,01 | 0,06 |
| SPP | 563,0 | 0,05 | 0,22 |
| All power plants | 1 053 861,9 | 100 | 100 |

Source: Barinova & Lanshina, 2016

According to the table 2, despite the high potential of the RES, the share of primary energy carriers (more than 60%) is occupied by fossil fuels in Russia. In 2009, Greenpeace published an

alternative scenario for energy development in Russia, which proved the possibility of generating 13% of electricity from renewable energy sources by 2020. According to the energy strategy Institute, the technical potential of renewable energy in Russia is about 24,221 million tons of conventional fuel per year, and the economic potential is 320 million tons of conventional fuel per year (Barinova & Lanshina, 2016).

In order to develop renewable energy sources in Russia, it is necessary to reduce subsidies to traditional energy. For example, Germany replaced nuclear power plants with wind and solar power plants, after the accident at the Japanese nuclear power plant "Fukushima-1" (Renewable energy came out on the 1st place, 2017).

In Russia, investment in renewable energy over the entire period from 2004 to 2014 amounted to \$1.7 billion. In the Russian Federation is among the 12 countries with the lowest investments (table 3).

Table 3
Data on countries with the lowest investments in renewable energy sources for 2004-2014, USD billion

| Country | Investment in renewable energy |
|------------------------|---------------------------------------|
| Russia | 1,7 |
| Albania | 0,5 |
| Belarus | 0,5 |
| Bosnia and Herzegovina | 0,5 |
| Serbia | 0,3 |
| Kyrgyzstan | 0,3 |
| Uzbekistan | 0,2 |
| Georgia | 0,2 |
| Kazakhstan | 0,2 |
| Macedonia | 0,2 |
| Armenia | 0,1 |
| Montenegro | 0,1 |

Thus, renewable energy sources already play an important role in the energy balances of many countries in the world, both developed and developing. In Russia, renewable energy is still at a developing stage of development. The RES financing for the introduction in the wholesale market, the power fee gave a huge impetus to the development of the RES, for example, for the period 2015-2018 in Russia, about 500 MW were built in more than 10 subjects of the Russian Federation, and 21 solar power plants with a total installed capacity of 1616 kW were built for the period 2013-2018 in the Republic of Sakha Yakutia.

Installation of new generating capacities based on solar energy is mainly in the southern regions of Russia, in the zone stretching from the Crimea and Krasnodar region to Buryatia and Zabaikalsky territory, including Nizhniy Don and the Caucasus, the Lower and Middle Povolzhie, the Southern Urals, the South of Western and Central Siberia, in addition, Autonomous SPP are being built in Yakutia (Degtyarev, 2019). Currently, SPP projects cover more than 20 subjects of the Russian Federation. The main part of solar energy projects is managed by several leading

groups of companies: "Hevel", "Solar Systems", "T-Plus", "Fortum", "RusHydro", "EuroSibEnergO" (Degtyarev, 2019).

There is no full cycle of production in solar energy at the same time in Russia. In the production of a significant part falls on imported components and raw materials (shortage of solar flint), therefore, a separate support system for small Autonomous energy on the domestic production and technological base is required (Degtyarev, 2019).

The company "RusHydro", which is a leader in energy production based on renewable sources. Both "RusHydro" and "Sakhaenergo" companies' efforts (Republic of Sakha (Yakutia) 21 solar plants of which 6 are stand-alone (with drives) are commissioned and operated in the Upper Amga, Batamai, Uchugei, Toyon Ary, Yuran, Tokko, and the rest are working in network mode (Nifontova, 2019). Since December 2018, a wind farm with an installed capacity of 900 kW has started operating in the village of Tiksi.

But the most powerful solar power plant of all of these is Batagai SPP which is located above the Arctic circle with an installed capacity of 1 MW. In 2016 it was listed in the Guinness Book of records as the northernmost solar power plant in the world.

Popel O.S. believes that on the basis of the previous development there was a stable belief that Russia has inexhaustible reserves of energy resources (Popel, 2008). According to Bezrukikh, the illusion that the energy crisis in Russia is impossible on the basis of high availability of fossil fuels was formed in the country (Bezrukikh, 2014). The belief that traditional energy is always relevant and paramount was formed.

In addition to the obstacle which is the meaning that the priority of oil and gas as key energy resources in domestic consumption, the low level of renewable energy development in Russia is associated with the following factors:

- There are no special programs that subsidize projects based on renewable energy sources;
- Low prices for traditional energy resources and produced electricity;
- High cost of the equipment;
- Relatively small number of qualified personnel;
- There is no environmental impact claim on the state government from society in the country.

Moreover, the disadvantages of alternative sources include low efficiency, which is usually characteristic to solar panels, volatility (depending on weather conditions and time of day), expensive repairs and maintenance (wind turbines).

The RES, in fact, are non-traditional technologies, they have an innovative nature. In general, on the one hand, the number of innovative projects is increasing. On the other hand, there has been a reduction in the issuance of Bank loans in the context of limited resources, which leads to the search for other sources of financing. Hence the emergence of alternative forms of financing such as public-private partnerships, crowdfunding and project financing.

Crowdfunding is a mechanism of attracting financial resources from the masses of people for the implementation of various projects, usually this mechanism is implemented on the Internet sites where recipients post information about their project (Khotinskaya, 2017). Crowdfunding allows you to raise the necessary funds without the participation of financial market structures, which greatly simplifies this procedure (Evdokimova, 2015)

Let's consider the creation of a crowdfunding platform in the Republic of Sakha (Yakutia) for social business projects (on the example of the project of JSC "Sakhaenergo" on renewable energy sources).

The creation of a crowdfunding platform in the Republic of Sakha (Yakutia) is due to the fact that only the population of the Republic can be interested in the introduction of renewable energy sources in the region, based on the desire to reduce electricity tariffs, improve the environment and develop the economy as a whole. For this project let's take a look the following data.

As part of the innovative development program in 2016, "Sakhaenergo" implemented projects for the construction of solar power plants in the following settlements [61]:

- SPP - 80 kW with the cost 9.4 million rubles in Delga settlement of Olekminsky district;
- SPP - 20 kW with the cost 3.4 million rubles in Indah settlement of Olekminsky district;
- SPP - 36 kW with the cost 12.2 million rubles in Verkhnyaya Amga of Aldansky district.

The investment program and the energy saving program of JSC "Sakhaenergo" provide for the construction of renewable energy facilities for the period 2018-2019, which are shown in table 4:

Table 4
Data on construction of renewable energy facilities for 2018-2019

| Year | Construction of renewable energy facilities |
|-------------|---|
| 2018 | SPP-25 kW in Bakhany settlement of Zhiganskiy ulus; SPP-20 kW Bestyakh settlement of Zhiganskiy ulus; SPP-25 kW in Khatynnax settlement of Srednekolymskiy ulus; SPP-60 kW in Ebyakh settlement of Srednekolymskiy ulus; SPP-90 kW in the Sakkyryr settlement of Eveno-Bytantayskiy ulus. |
| 2019 | SPP-30 kW in Abyiy settlement of Abyiskiy ulus; SPP-25 kW in Isit settlement of Khangalasskiy ulus; SPP-25 kW in Kytly-Dura settlement of Khangalasskiy ulus; SPP-60 kW in Aleko-Kyuel settlement of Srednekolymskiy ulus; SPP-30 kW in Argakhtakh settlement of Srednekolymskiy ulus; SPP-25 kW in Swatai settlement of Srednekolymskiy district. |

Source: Annual report of JSC "Sakhaenergo" in 2016

Based on the above information, we can say that the 36 kW solar power plant is the most expensive of those that was built during the project in 2016. Its cost was 12.2 million rubles.

It is necessary to create conditions for the development of crowdfunding to implement the project, namely, to form a legislative regulation in this area. In January 2018, the Bank of Russia published a draft law "On alternative ways to attract investment (crowdfunding)". According to Denis Duraskin, who is, in turn, the lawyer of the leading firm BGP Litigation, specializing in complex business protection, and informant of Forbes, this bill is focused not so much crowdfunding as crowd investing, because it regulates raising funds exclusively for investment purposes, whereas by means of crowd funding is mainly financed non-profit projects. Since the company "Sakhaenergo" will have a project in relation to renewable energy sources, the "donation" crowdfunding model is more suitable for it. This type does not provide for any remuneration and is used in socially significant projects, which is the project of construction of renewable energy facilities.

Due to the fact that investment platforms and not crowdfunding platforms will be regulated in accordance with the mentioned draft law, the issue of crowdfunding control at the legislative level remains relevant.

We will try to form a legislative regulation in this area, using the successful experience of European countries in practice (table 5). The table summarizes the features of crowdfunding in European countries (Khotinskaya, 2017). Now it is necessary to identify the most suitable features of crowdfunding for the Russian realities, which can be adopted for our country.

Table 5
Features of crowdfunding in European countries

| Country | Features of crowdfunding |
|----------------|--|
| Britain | Crowdfunding market control by the Financial Supervisory Authority (FCA). Created crowdfunding platforms go through a strict authorization process. |
| Estonia | There is an Institute of digital virtual residence (e-citizenship). The identification procedure requires the submission of biometric data from the applicant to obtain an analogue of the Estonian ID-card with an electronic chip. |
| Spain | Restrictions on the maximum amount of use of equity and debt crowdfunding (for one project restrictions up to 2 million euros for non-accredited investors, 5 million |

Source: Khotinskaya, 2017

From the presented methods of regulation of this mechanism, the best option for Russia is to control the crowdfunding market as in the UK. According to the CBR project "On the alternative ways of attracting investments (crowdfunding)", the Bank of Russia will exercise control over crowdfunding in the country (Federal Law No. 259-FL of 02.08.2019, 2019). But as it already mentioned, it will be regulated by investment platforms, not crowdfunding. Control for crowd platforms can also be sent to the Central Bank, but this control needs to be tightened, as in the bill: it can be reduced to more demanding registration procedure created platforms that, in a strict order will be required to ensure the security of payments with Bank cards by using a secure connection.

Let's move on to the practical side of the project. It is believed that the average amount of fees of one project is 300 thousand rubles, the average size of donations of one thousand rubles. It appears that, in order to achieve the goal, it is necessary to attract 300 people. At the same time, we must remember that out of 1 thousand people who read about the project, only 100 people will contribute money. Therefore, at least three times as many people should know about the project. It is extremely difficult to do this at the level of one region of the Russian Federation. However, provided that the control over crowdfunding will be fixed at the legislative level, we believe that this funding mechanism will be able to attract the population of the Republic.

Let's make hypothetical calculations that will demonstrate how this project will be implemented in reality. According to statistics, the population of Yakutia in 2016 amounted to 959,7 thousand people Only half of them, approximately 481 thousand people live in places (cities, towns) where there are between 10 and over 50 thousand people who most likely have access to the Internet (table 6).

Table 6
Data on the distribution of cities and urban-type settlements by population for 2016

| Quantitative grouping | Cities, towns | City district, municipal district part which includes city | Number of people |
|-------------------------------|----------------------|---|-------------------------|
| Over 50 thousand people | Yakutsk | GO "Yakutsk City" | 307 911 |
| | Neryungri | Neryungri | 57 247 |
| From 10 to 50 thousand people | Mirny | Mirny | 35 376 |
| | Lensk | Lensky | 23 660 |
| | Aldan | Aldan | 20 700 |
| | Aykhal (town) | Mirny | 13 962 |
| | Udachniy | Mirny | 11 835 |
| | Viliuisk | Vilyui | 10 975 |
| Total | | | 481 666 |

Source: Official materials of the Federal State Statistics Service, 2017

Suppose of that number of people the half majority (approximately 55%) are the able-bodied population of 264 thousand people. One third of this number is theoretically able to invest – 88 thousand people. On, talking about how many of them can know about crowdfunding through media and by "word of mouth" - presumably 30-40% of people from 88 thousand people. Thus, it comes out about 33 thousand people, of which, most likely, only 50% (16.5 thousand people) decide to donate to a particular project 500-1000 RUB. Let's rank which part, for example, will

give 500 rubles, and another 1 thousand rubles. We believe that only 30% will be able to finance the project with a thousand rubles, and the remaining 70% will most likely contribute only 500 rubles.

Based on the calculations presented in table 7, we get about 10 725 000 rubles. This is enough for the construction of a solar power plant, thereby proving the effectiveness of the implementation of projects through crowdfunding.

Table 7

Calculation of the total amount of donations for certain donation sizes and number of people (option N 1)

| The sum of donation | Number of people | | Total amount of donation |
|---------------------|------------------|-----------|--------------------------|
| | in % | in people | |
| 500 rubles | 70 | 11 550 | 5 775 000 |
| 1 000 rubles | 30 | 4 950 | 4 950 000 |
| Total | | 16 500 | 10 725 000 |

But it is worth taking into account those people who will be able to donate less than 500 rubles and only once, investing only in one project. Let's make calculations from 100 rubles for 70% of people from 16,5 thousand people whom we revealed as a result of the calculations given above. 1 thousand rubl. Is the average size of donations will leave for 30%. (table 8).

Table 8

Calculation of the total amount of donations for certain donation sums and number of people (option N 2)

| The sum of donation | Number of people | | Total amount of donation |
|---------------------|------------------|--------|--------------------------|
| | in % | in % | |
| 500 rubles | 70 | 11 550 | 1 155 000 |
| 1 000 rubles | 30 | 4 950 | 4 950 000 |
| Total | | 16 500 | 6 105 000 |

Compiled by the authors.

As a result, we get about 6 105 000, a figure is almost twice smaller, but since this will be a renewable energy project hosted by "Sakhaenergo", it can be noted that this amount is already impressive and can amount to 40-50% of the cost of building a renewable energy facility. The enterprise can finance the remaining part of the sum from its own resources. It should be borne in mind that these are extremely underestimated expected figures. We believe that if in reality there are more people willing to help in the development of such innovations, the necessary amount of funds will be collected in full.

4. Conclusions

The study showed that the development of renewable energy in Russia, in particular in the Republic of Sakha (Yakutia), may face difficulties in attracting investments and investors. One of the most effective forms of attracting the necessary funds for the development of the RES is crowdfunding. To implement investment projects for the development of renewable energy, it is necessary to create conditions for the development of crowdfunding, namely, to formulate legislative regulation in this area at the federal level. It was revealed that this type of financing could be suitable for the implementation of renewable energy projects, including JSC "Sakhaenergo".

It is necessary to have the state support in development of the RES in Russia, the willingness of Russian energy companies to introduce renewable energy instead of traditional energy, particularly improving the financing of renewable energy and changes in the legal framework for the development and use of renewable energy. In this regard, it is very important to use the world experience of countries that successfully use different types of renewable energy.

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