Perspectives of the wind energy market in Russia

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"Yes, mankind is moving towards „green energy", this is without doubt the main road of development, the right direction. The demand for renewable energy is growing in comparison to traditional energy sources"

V. Putin, the President of the Russian Federation,
The World Energy Congress, 10/10/2016

Cover photo: Wind turbine Ghre 50 kW in wind farm 200 kW Amderma Village (Nenets Autonomous Okrug). The transport accessibility is very limited in the region (installation was in August 2016), wind turbines work in a cold climate, therefore special adaptation measures are envisaged for them according to the IEA Task 19 Wind Energy in Cold Climate (e.g., painting blades in black).

ABSTRACT

The project «Perspectives of the wind energy market in Russia» aims to improve the understanding of opportunities and existing barriers that characterize the wind energy sector, within the broader context of Russia's international climate change commitments. The focus of the study lies on grid connected but also on isolated regions of Russia.

Recently, the wind power market in Russia has got some momentum for a dynamic growth and in summer 2016 the first 700 MW of wind projects were announced to be built over the next three years. According to the Government Decree №449, 3.35 GW of installed capacity will be installed by 2024 – 4.5 GW in 2030. To show the context, the total power capacity in Russia equals currently 236.3 GW.

This research shows that there are numerous barriers in the wind energy market which remain to be addressed. The main findings are based on analysis of data obtained in interviews amongst key stakeholders of the Russian wind power sector. Based on the opinions of these stakeholders, the main barriers for the Russian wind power industry of today are:

- a general lack of investments and investors which is primarily related to an insufficient and intransparent remuneration scheme and the small market volume but also to the macroeconomic situation in the country.
- a significant number of weaknesses in the regulatory framework, including land use issues, standards etc.
- challenges with grid connection.

The retail market has been analyzed in particular with regard to barriers in the remote and isolated regions of Russia. In principle, wind power could substantially reduce the macroeconomic cost of the power supply in these regions. However, there is only a rather small number of wind power projects in this market which is characterized by a lack in the regulatory frameworks, a lack in cost transparency and poor infrastructure.

The study concludes with recommendations on how the identified barriers can be addressed. The main task will be to create an attractive environment for investors by introducing a remuneration system allowing to invest and by defining a market size volume similar to other leading wind markets – China, Germany, India or the USA each have recently seen annual installations in the range between 2'000 and 30'000 MW. Creating a sizable market also includes the task of improvin the existing standards, introducing a state territory planning program for wind energy projects and starting state participation in pilot projects in remote and isolated regions on a massive scale. To create more transparency for potential market participants would also be an important and general task.

In order to tackle the identified barriers in a comprehensive way, it is proposed that the Government of Russia, in consultation with the main stakeholders, develops a "Wind Roadmap for Russia" which may include a strategy for grid connected wind farms as well as the off-grid sector.

CONTENT

INTRODUCTION

In 2016, the Russian Federation together with 118 countries, all in all responsible for 75 per cent of global emissions, signed the Paris Agreement. This outcome of the UN Climate Change Conference COP21 in Paris was adopted by consensus on 12 December 2015. The Paris Agreement decides to keep "the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change". The key commitment with regard to renewable energy deployment is to achieve a greenhouse gas neutral energy supply globally by 2050, which, in fact, is solely possible with a global energy supply based on close to 100% renewable energy [1]. Although the agreement was formally approved by Executive Order of the Russian Government of 14.04.2016 (Nr.670-r), ratification by the Duma is still pending.

Russia, as well as most other countries, can only achieve its obligations under the condition of an accelerated development of renewable energy. The possibilities of its wind power market are enormous, as Russia provides the world's largest wind energy resources [2, 3, 4] and basically all the required industrial capacities.

In early 2017, the global wind capacity stands close to 500 GW [5] with China, the USA, India and Germany being the leading countries. Today, the wind sector has created more than one million jobs still showing a very dynamic growth in more and more world regions, such as Latin America and Africa.

In addition, 2017 is the Year of the Environment in the Russian Federation [6]. Its implementation is planned in order to draw public attention to the issues of environmental development in Russia, the conservation of biological diversity and maintenance of ecological safety. Since the development of ecological safety, especially in isolated regions of Russia´s far north where the fragile Arctic environment is facing major dangers such as climate change and direct pollution, depends largely on the energy sector, the development of wind energy in Russia should become an imperative and irreversible process.

However, following hypothesis is underlying this study: Only if the Russian wind power sector overcomes the identified, severe economical, technical and regulatory barriers, it can achieve a significant market size and be one of Russia's key elements to fulfill the Paris Agreement. This study focuses on the clarification of this hypothesis. In order to propose possible explanations and solutions to this hypothesis, the study provides a survey amongst various participants of the wind power market in Russia including representatives of the industry as well as experts from governmental and non-governmental organizations.

Chapter 1.
CURRENT STATUS AND FRAMEWORK CONDITIONS FOR WIND ENERGY IN RUSSIA

HISTORICAL REFERENCE

Russia's wind power development comes with a rich history [7]: Yet in the 1930s, the country had the world's first wind energy research center. Between 1914 and 1918, the Russian scientist N.E. Zhukovsky and others developed a theory of windmills and wind blade behavior in an airstream. The theory introduced a basis for today's wind engineering, the Zhukovsky-Betz limit defining the maximum coefficient of wind energy use of a wind turbine.

In 1931 a pilot wind turbine D-30 was constructed near Balaklava, with a rotor diameter of 30 m and an asynchronous generator with 400 kW capacity. At that time, no similar project existed in the world. Just as unique on the global scale might has been the production of more than 40'000 wind power mills with a capacity of 50-100 kW in the 1940s and 1950s which were used in large farms (kolkhozes and sovkhozes).

After the energy crisis of 1973, the state program of wind energy development lead to the development of new Megawatt wind turbines and mass production of wind turbines of 100-300 kW. At the end of the 1980s, a new domestic wind turbine "Raduga 1" with a capacity of 1'000 kW was designed and constructed. Due to low oil prices and the change of the social and political situation of the 1990s the idea of wind energy development faded to the background paralzying the whole wind industry sector for the time being.

To date, wind power plays practically no role in Russia's power supply, nor encounters Russia itself amongst the leading countries in that matter. So far only few wind farms with installed capacity of over 1 MW have been built in Russia: Today, according to a report [8], the installed wind capacity in Russia at the middle of 2016 amounted to 11 MW all of which were built before the year 2013. Wind farms, built under Russian administration, are shown in Table 1 [2].

Wind farm	Location	Technology	Current status
Kulikovskaya VES* 5.1 MW	Kaliningrad region	21 wind turbines: - 20 Vestas 225 kW - 1 WindWorld 600 kW	Six turbines are beyond repair and recovery, and for remaining ones, major overhaul would be required. The wind farms will be closed.
Anadyrskaya VES 2.5 MW	Chukotka AO	10 WT-250SM 250 kW	Seven of these turbines require major repairs

Table 1 – The list of wind farms in Russia

* - wind farm

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Wind farm	Location	Technology	Current status
Elistinskaya VES 2.4 MW	The Republic of Kalmykia	2 Vensys-62 1.2 MW	The planned wind farm project with total capacity of 150 MW is suspended for an indefinite period
VES Tukpildy 2.2 MW	The Republic of Bashkortostan	4 Hanseatische AG ET 550/41 550 kW	Due to the shortage of electricity in this region, there are plans to increase the installed capacity of this wind farm.
Zapolyarnaya VES 1.5 MW	The Komi Republic	6 WT AWE-250C 250 kW	The wind farm does not work and is planned to be sold

Russia does currently not have much practical experience with megawatt-sized wind turbines. Overhaul is required for most of the few installed wind turbines.

However, in the past few years, following the global trend, the Russian government made first steps to support the development of wind and renewable energy, codified in the amendments of 4.11.2007 in the Federal Law of 26.03.2003 № 35-FZ "On Electric Power Industry"[1]. Based on that Law, the Non-profit Partnership "Council for Organizing Efficient System of Trading at Wholesale and Retail Electricity and Capacity Market" ("NP Market Council") was established. This organization, on a membership basis, brings together electricity sellers and buyers that are wholesale market entities (including renewable energy and wind power) taking part in the circulation of electric power on the wholesale market. It also pairs up companies operating the commercial as well as technological infrastructure of the wholesale market and other companies of the electric power industry.

The Government Decree of 28.05.2013 Nr. 449 "On the mechanism of promoting the use of renewable energies in the wholesale electricity market and power" was approved as another important step: A requirement for mechanisms was introduced to work with renewable energy projects in the wholesale electricity market, including regulations to develop renewable energy until 2020. Following this Decree, approximately 20 amendments, regulations, programs and Government Executive Orders were published to refine target indicators. In summer 2016, the Government Decree Nr.1634-r "The scheme of the territorial planning of the Russian Federation in the field of energy" was issued, according to which 15 wind farms with a capacity bigger than 100 MW and a total capacity of 4.5 GW shall be installed in Russia by 2030 – while the 2024 target of 3.35 GW remains valid.

The development of renewable energy in the retail market of Russia is carried out in accordance with the programs of the energy efficiency in these regions, and the local authorities are taking over the role of the "NP Market Council", e.g. by organizing tenders. The main documents in the retail market are the Government Resolution of 04.05.2012 Nr. 442 (ed. on 10.11.2016) "The rules of functioning of retail electricity markets" and the Federal Law of 23.11.2009 Nr. 261 "The improvements on energy saving and energy efficiency in the retail market" (energy service contracts). In addition, there are local energy efficiency laws in some isolated regions.

The energy infrastructure of isolated regions is based on a stand-alone power supply ("off-grid") mainly consisting of diesel power plants with one or more diesel generators. The number of diesel generators in these isolated areas is about 900,

[1] Full legal framework of the wholesale and retail market are given in Table A.1 of Annex A

with total capacity of more than 500 MW; diesel power plants produce about 2.5 billion kWh, which equals the consumption of approximately 1 million tons of diesel fuel per year (to substitute diesel power completely with wind power would require a wind capacity of 1000-2000 MW plus storage, depending on the specific sites.) There are cross-subsidization in these regions and procedures how to cover the difference between the real generation costs (up to 2.5 $/kWh) and the actual rate for the customers (3-4 cent/kWh) have not been worked out yet [2]. However, the Russian Government has recently announced that installations for self-consumption (smaller than 15 kW) will benefit from regulatory improvements, details to be announced by spring 2017 [9].

Currently a few functioning stand-alone wind-diesel hybrid systems are in operation (Table 2)[2].

Table 2 – List of stand-alone wind-diesel hybrid energy systems in Russia

Location	Wind	Diesel
The Bering Island (Kamchatka)	550 kW (2 Vergnet GEV-C with unit capacity of 275 kW)	1168 kW
The Ust-Kamchatsk village (Kamchatka)	first stage: 1 Vergnet GEV-C (capacity of 275 kW in the version for cold climates); second stage: 3 wind turbines Komai KWT 300 (unit capacity of 300 kW)	8 MW
The Novikovo village (Sakhalin region)	450 kW (2 turbine with unit capacity of 225 kW)	N/a
The Republic of Tatarstan	Ghrepower FD 12-30/11 (30 kW)	N/a
The Amderma village (Nenets Autonomous Okrug)	200 kW (4 arctic version turbines Ghrepower-50 with unit capacity of 50 kW)	800 kW

Table 2 – List of stand-alone wind-diesel hybrid energy systems in Russia

[2] Information from the official websites of LLC "Activity", JSC "Peredvizhnaya Energetika" and LLC "VTR Engineering" [10 - 12]

Chapter 2.

RUSSIA'S WIND POWER PLANS FOR THE NEAR AND LONGER TERM FUTURE

The Russian legislation has set the goal to reach 3.35 GW of installed wind power by 2024 (Table 3 includes the planned annual additions) and 4.5 GW by 2030, and the first concrete steps have been taken to achieve this target.

Table 3 – The target volume indicators for installed generation capacity (MW)

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year	2017	2018	2019	2020	2021	2022	2023	2024	Sum
Wind	200	400	500	500	500	500	500	150,2	3351,2*

*The figure 3351.2 GW takes into account already built stations and those that were to be built in 2015-2016

Tenders[3,4] are conducted by the "NP Market Council" every year in order to achieve these objectives (tenders held in summer, on an annual basis). In summer 2015 and 2016, tenders were invited in the wholesale market. Wind farms with a total capacity of approximately 700 MW were awarded out of the 3.35 GW announced to be installed by the year 2024. In total, there are 30-40 companies active in the Russian wind power market (see table in Annex C), but only three project developers that were successful in the first bidding round, unfortunately the actual successful bidding prices were not publicly available:

- Rosatom State Atomic Energy Corporation (Rosatom) won 610 MW, installation plan: 150 MW in 2018, 200 MW in 2019, 360 MW in 2020;
- 51 MW by ALTEN Ltd (Falcon Capital a.s., The Republic of Kalmykia);
- 35 MW by JSC "Fortum" (Ulyanovskaya region).

IRENA's REmap project proposes a total installed capacity of 24.3 GW for the year 2030, part of which is for export. This is substantially higher than the current, official target, and may increase the needed investors' interest in the Russian wind power market.

However, the interest in wind energy appears now also in the business landscape and an increasing number of domestic and international companies have started some kind of wind related activities (overview in Annex C). Next to the State Corporation "Rosatom" with total project pipeline of 610 MW, another state corporation "Rosnano" is planning to invest more than 10 billion rubles (170 million €) in wind energy, as announced by the company's board chairman Anatoly Chubais at the International Congress REENCON-XXI in October 2016. According to Chubais, the generation cost of wind energy in Russia will be equal to the generation cost of fossil energy by 2024[5] [13]. As of the end of November 2016, a new agreement between SC

[3] Details of the tender procedures and additional requirements like localization, qualification and certification of the equipment are shown in Figure B.1 and are described in Annex B

[4] At the time of publication of the report in Russia, the first stage of tenders in 2017 was held. The total volume of new construction for 2018-2022 is almost 2.5 GW. In addition to the already well-known actors, the Italian company Enel S.p.A was added [RAWI].

[5] This remark is of course not taking into account externality costs of fossil fuels, externality benefits of wind power, subsidies etc

"Rosnano" and JSC "Fortum" was concluded, which includes the installation of wind farms with a total capacity of several hundred megawatts in the next few years. In this regard, negotiations are underway for the design of the second stage of a wind farm in Ulyanovsk region with total capacity of 300 MW [14].

Chinese energy service provider Sinomec and the government of the Russian the Republic of Karelia have signed an agreement to cooperate on the development of the 60 MW wind farm in Kemsky District [15].

Localization

In summer 2015, the Russian Government approved Executive Order Nr.1472-r, defining basic wind energy targets until 2020. The indicators for the period until 2020 are deemed invalid, yet the target of 3.35 GW by 2024 is still considered a priority. In addition to defining target volumes of new capacity, the Decree also regulates the requirements for the degree of local content requirements (so called "localization") in the Russian Federation (production of main and auxiliary equipment used in renewable energy systems, see Table 4).

Table 4 - Target level of localization for main and auxiliary wind turbine equipment

	Year	Level of localization, %
Wind equipment	2016	25
	2017	40
	2018	55
	2019 - 2024	65

Table 4 - Target level of localization for main and auxiliary wind turbine equipment

The aim is to develop domestic industrial manufacturing capacities, open research centers and promote the innovative growth of the industry in the country [16].

It should be noted that these requirements might make it difficult for foreign players to enter the Russian market. The relatively high localization targets adopted in 2013 and the absence of the necessary production facilities made it difficult to fulfill the requirements. Subsequently, the indicators were adjusted and the positive changes have started in recent time. In the opinion of the Russian Association of Wind Industry (RAWI), there are today companies within Russia which can supply the equipment needed to reach the 65% local content. One example for international cooperation is the memorandum of intent signed by the Ulyanovsk authorities, Finnish energy company Fortum, Rosnano-group and Dongfang Electric Wind Power Co. Ltd (DEW) to create the production facility for wind turbine blades in the region as part of the Fortum project of a 35 MW wind farm. From the latest news of the energy market: Finnish energy company Fortum (member of RAWI) and Rusnano-group agreed to establish the Wind Energy Development Fund in Russia. At the same time, Fortum is reserved 28 points in the Ulyanovsk region as the place of power supply to the grid (50 MW for each), that is, the total capacity of wind parks can reach 1400 MW in the future.[6]

[6] Igor Bryzgunov, RAWI President, comments: "According to studies conducted between 2013 and 2015 on behalf of the Russian Association of the Wind Industry (RAWI), the localization level of 65% for industry is achievable. 21% of this level is design and construction work as well as installation of a wind turbine at the selected location. The remaining components are 44%: 18% for blades, 13% for the tower, 5% respectively 15% for the generator (without/with gear), 2% for the hub, 8% for the inverters, 4% for the transformers, etc. Russian industrial enterprises are ready to produce all these components. For example, three companies are ready to produce blades, six factories can make towers, two companies can make generators, two companies can produce transformers, two companies can manufacture inverters. With regard to the high degree of localization, the task of producing 100% of the components of a wind turbine in Russia is not difficult. In addition, three global companies, the world's leading wind turbine manufacturers, already have their plans to localize the production of wind turbines in Russia at enterprises that are partners in the local market."

Chapter 3.
RESULTS OF THE STAKEHOLDER SURVEY: THE KEY BARRIERS, SUGGESTIONS AND RECOMMENDATIONS

Factors complicating the development of wind energy

In order to get a better understanding of the actual situation and the specific factors determining the growth of the wind market, a survey was conducted amongst wind power practitioners. First, there was an electronic survey undertaken: 13 experts (Annex D) filled out an online questionnaire. For this survey, factors were identified in advance, based on general experience from other markets and on input from Russian and international experts (advisory group in Annex D). Measures were also proposed which could be useful to overcome the identified barriers.

In the online questionnaire, interviewees were asked to rate various factors as follows:

Q1 – Do you think there exists a barrier with respect to this factor?

Q2 – Have you faced this barrier in your project?

Q3 – Barriers seriousness assessment (calculated as the arithmetic mean, where 1 is absolutely not important, 5 is very important).

Table 5 - Barriers Identification

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Type*	General factors	Q1		Q2		Q3
		Yes	No	Yes	No	
F	Lack of investments	8	5	7	6	4,3
F	Macroeconomic situation in the country	10	3	8	5	4,2
F	Tariff-setting mechanisms for the purchase of energy	7	6	4	9	3,7
R	No coordination between other stakeholders (institutional, manufacturing company, financial etc)	5	8	7	6	3,4
F	Unstable currency exchange rate	6	7	7	6	3,3
R	Lack of state industry standards	3	10	4	9	3,3
I	Difficulty connecting to the grid	5	8	5	8	3,3
R	No coordination between government departments & agencies	6	7	6	7	3,2
R	Difficulties with land allocation or during the competitive selection	5	8	4	9	3,2
R	High degree of equipment localization	1	12	3	10	3
I	Impact on the power system stability	2	11	4	9	2,8
R	Availability of wind resource data	2	11	2	11	2,5

* - some of the factors are categorized as F=financial, R=regulatory, I=infrastructure and grid

Table 5 - Barriers Identification

Type	Factors related to off-grid applications	Q1		Q2		Q3
		Yes	No	Yes	No	
F	Weak state project support	10	3	7	6	4,5
I	Infrastructure	9	4	8	5	3,8
I	Lack of equipment adapted to harsh environments	6	7	7	6	3,7
I	Availability of qualified personnel	5	8	6	7	3,6
R	Difficulties with local authorities	6	7	3	10	3,4
F	Cross-subsidies	2	11	2	11	2,9
-	Absence of evaluation of the effectiveness of renewable energy projects techniques	3	10	2	11	2,8
F	Complex system of taxation in the regions	3	10	1	12	2,6
-	Social factors (culture, organization at village)	3	10	3	10	2,5
-	Abundance of natural resources in the region	1	12	1	12	2,1

* - some of the factors are categorized as F=financial, R=regulatory, I=infrastructure and grid

Table 5 shows the responses in summary. Factors are ranked according to the degree of seriousness from the most important to the least important. Responses show clearly that financial barriers are seen as the main challenges for wind power investment in Russia.

In-depth analysis of barriers and possible solutions

In the second phase of the empirical research, open interviews with 16 experts were conducted in order to get a deeper understanding (list of experts in Annex D). These interviews were based on the results of the questionnaire and the factors identified as most important.

1. Financial barriers

For market stakeholders, financial factors represent the most important barriers, as those factors were rated as most serious. The decisive question is how will the invested capital be returned to the investor?

Hence, this barrier is mainly a result of the attractiveness of potential investments which is related to the expected return (according to sources [2, 3], the IRR of current projects equals to 12% since the beginning of 2017). As there are no fully realized wind power projects yet and the financial results of the auctions are not publicly available, it is difficult for new players to understand the attractiveness of the market. So, after all, the survey indicates that remuneration of electricity and power from wind is key and that the current system could be improved, in particular as the current auction system is not easily accessible and in particular it is not transparent enough for all potential investors.

Another problem results from the requirement in the wholesale market to provide backup capacity for stable power supply. However, excessive duplication of renewable energy by traditional generation is economically and technically unjustified.

However, the lack of investment has also been caused by the general economic development of the recent years. The macroeconomic situation complicates the process of finding a foreign partner or investor. For some companies it is difficult to enter the Russian market which also makes it difficult for the domestic industry that is still relying on knowhow and technology imported from abroad. Instable currency exchange rates have also been described as a relevant barrier in particular for foreign investors.

For investors, it is also important to understand how far they can do business in the future. However, there is no clarity at all of what could be the market in the longer term, after 2024 respectively 2030. This makes it difficult to invest e.g. in manufacturing as it would require a stable demand over many years.[7]

2. Infrastructure and grid

The technical problems with grid connectivity[8] and related issues, including overflows of reactive power, are still not resolved although such problems have been addressed in all of the major wind markets. The requirement from grid companies is to provide power at 50 Hz in full synchronization with the system; in case of sudden changes, shutdown of the wind generators is required.

3. Regulatory barriers

Most of the gaps in the regulatory framework are related to the absence of practical experience so that the related rules and regulations have not yet been created or adjusted. For example, according to some interviewees, there is a problem with design standards for manufacturers of wind turbines. There is a delay in transferring internationally adopted standards into national standards, e.g. GOST R 54418-2014, which is equivalent to the old standard IEC 61400 of 2010.

The land issue, even in Russia with an area of more than 17 million km^2, is a major challenge due to the high land prices in some regions. Big wind farms occupy quite a large area, although the actual land use for the wind turbine foundations is rather small. In spite of this, it has been reported that there are difficulties to "convert" agricultural land into the "industry" land for the construction of wind farms. In this context, in addition to the high price, developers have reported to face administrative barriers, particularly in the European part of Russia.[9]

The required degree of equipment localization has already been described above (Chapter 2). It is seen as laborious and time consuming to currently fulfill the required shares, but given a sizable market has been reached, it should be possible to set up the needed capacities in the country.

4. Barriers to off-grid installations

According to the answers to the questionnaire, the most significant barrier for investment in wind power of isolated areas is the "weak state support", which can also be described as a primarily financial barrier. It is mainly the result of a lack of transparent tariff-setting mechanisms, which should be based on full-cost calculations – today, prices for consumers in remote areas are far below the actual generation cost. In general, there is a weak awareness of wind technology and its characteristics and benefits amongst governmental decision-makers, partly also because of a rather small number of pilot projects in the regions. In consequence, it is difficult to interact with local authorities.

Another restraining factor that characterizes the isolated areas is national and regional infrastructure. In the Far North, the problems of transportation are caused by highly dispersed settlements and poor traffic infrastructure. The transport period for many

[7] Igor Bryzgunov, RAWI President, comments: "In the period from 2013 to 2015, changes were made in the legislation on support of renewable energy at the request of market participants, in particular, wind power, that contributed to the launch of the market. In particular, the requirements for localizing components were improved and the capital costs for the construction of the wind farm were linked with the level of the "currency basket". After these changes, state support through power supply contracts became possible. The Russian wind energy support scheme has passed the test of time and, that is very valuable, does not require the allocation of funds by the Ministry of Finance, but is actually financed by the energy market participants. Therefore, under Russian conditions, the power supply contract is most convenient and acceptable. At the same time, in terms of financial barriers, an instrument like direct government funding would be disastrous for the industry, as it would lead to corruption."

[8] "NP Market Council" notes that the technical aspects of the construction and installation of power lines, coordination of power distribution projects and the direct inclusion of the object in the layout of objects can take two years

[9] Igor Bryzgunov, RAWI President, comments: "According to the land law, it can not be said that the competence of transferring land to industrial lands is too complicated, it only requires a qualified approach. Moreover, regional administrations are interested in attracting investors, while energy-deficient regions are interested in generating electricity."

Northern regions is only two up to three months per year and is carried out on temporary, poor roads. Under these conditions, the delivery of overall equipment is a general challenge. For example, a 200 ton crane should have been used for the installation of wind turbines in the Ust-Kamchatsky village, which would have had to be delivered from Petropavlovsk-Kamchatsky, 450 km away.

The lack of domestic equipment adapted to harsh environments should be seen as a related but separate issue. There are only few wind turbines in the world which have been adapted to cold climates zones although this market is potentially quite large as cold climate zones include, next to Russia, large areas of Northern Europe and North America.

Another barrier, associated with the qualification and availability of staff, is a task for the universities. Today, specialized departments for renewable energy do not exist, and professional and vocational training is conducted within the structure of the Russian Academy of Sciences (RAS) and only at a handful of universities. With a growing industry, a training and education structure needs to be established as well.

How to overcome the barriers: Suggestions

As part of the electronic questionnaire, interviewees were also asked to rate the factors how to overcome the barriers (Table 6):

Q4 – Which suggested measures could help?
Q5 – Suggestions seriousness assessment (the arithmetic mean, where 1 is absolutely not important, 5 is very important).

Table 6 – Suggested measure identification

Suggested measure	Q4		Q5
	Yes	No	
Overcoming financial barriers e.g. through state funding	11	2	4,4
Improving the legislation to allow for connection to the grid	8	5	4,3
Improving financial mechanism for the implementation of projects	13	0	4,2
Ensuring accessibility and integration of the grid	8	5	4,1
Improving coordination between stakeholders	6	7	3,9
Developing new local standards	4	9	3
Improving the requirements for the recognition as a qualified facility	3	10	3
Reducing the degree of localization	2	11	2,5
Suggested measure related to off-grid	**Q4**		**Q5**
	Yes	**No**	
Public-private partnerships	12	1	4,2
A more flexible system of financing projects in these regions	8	5	4,2
An increase in funding for research on Arctic development projects	8	5	3,9
An increase of tax credits	8	5	3,9
Attracting foreign partners	6	7	3,6
Improving infrastructure	6	7	3,5

Table 6 – Suggested measure identification

Table 6 shows the responses in summary. Factors are ranked according to the degree of importance, from the most important to the least important.

Overcoming financial barriers

The interviewed experts widely agree on the immense need of finding a solution to financial barriers. E.g. by increasing the investment attractiveness of wind power projects or by additional state funding. This first option could be possible to realize on the income side by setting up accessible and transparent support schemes, and on the debt side, by enabling lenders to get debt at reasonable interest rates and with provisions against major macroeconomic risks, including currency exchange rates. As one important problem remains the lack of transparency in the current auction system. As results of the auctions are not publicly available particular newcomers (e.g. foreign investors) can have problems to understand the attractiveness of the remuneration scheme. While direct state funding displays another possible option it should only be implemented in a transparent, efficient and effective way.

Of course, any kind of state support requires meticulous preparing by the project developers and investors in accordance with highest international due diligence standards. Domestic as well as international wind energy associations may play a role in supporting building capacities in this area by conducting training workshops etc.

Besides, in the longer term, a higher degree of localization of the wind power supply chain may reduce certain financial risks and cost as well.

Overcoming infrastructure and grid barriers

In principle, a lot can be learned from countries more experienced in wind power, as all the problems have already been solved elsewhere and some national grids, e.g. in Denmark, can cope with average wind power shares of 40 % and more. Harmonization of Russian grid standards with international standards is a long and laborious process. To correct existing deficiencies, the system operator of the unified energy system needs to cooperate with private companies that offer specific expertise based on whichever changes to the Rules for Electrical Installation and the Industry Standards might be required.

Overcoming regulatory barriers

Firstly, barriers related to standards need mainly to be addressed by the Russian government, in particular by updating existing national standards in accordance with latest IEC standards. Consultation of industry stakeholder will allow this process to be smooth and not to miss important aspects.

Land legislation is difficult to change in accordance with the needs of wind energy, however, the vast territory of the country creates the possibility for investors to "bypass" local problems by moving to neighbouring regions, where there are more available areas, lack of electricity or lower prices to find. Such strategy may create a kind of competition between regions increasing their attractivity for wind investors. At the same time, the existing state land planning scheme currently includes only wind projects above 100 MW, and should be amended so that scheme wind farms with smaller size can be added as well having less difficulties to obtain the necessary permissions. There might be special wind farm areas included in the nationwide scheme, without excluding other regions.

Secondly, some of the regulations which caused delays on qualification and localization of equipment have already been improved, e.g. as of today, a qualification conclusion is not required for the accredited banks any more.[10]

Another implemented proposal is a delay in the implementation of standards for the degree of localization: some companies have requested a postponement until next year while maintaining the level of localization at the level of 2016. The Government is preparing a draft document, which, with the localization degree of the current year, prescribed in the last Decree (Nr.1472-r of

[10] Government approved Decree No. 610 of May 23, 2017 "On amending the rules of qualification of the generating company object, functioning on the basis of renewable energy" with clarification of localization of individual elements of wind turbine.

28.07.2015), will consider the official delays for a year before and six months after.[11]

In general, a transparent and comprehensive approach is very useful to overcome these barriers. Today localization and qualification requirements are no longer barriers but may serve as useful guidelines, which help to establish a strong domestic Russian wind industry. Some more concrete definitions are currently under preparation by the government but, eventually, the practical experience will tell whether it will be feasible. In any case, the Russian government should stay flexible and adjust these requirements if they turn out to be detrimental.

Overcoming barriers for off-grid installations

Although the off-grid sector in Russia is relatively big, there are only few systems running based on wind, as described, mainly due to a lack of knowledge about wind farms work and due to tariff mechanisms in these regions. A major way to obtain more knowledge about the benefits of off-grid wind systems would be to deploy a major pilot project program. As long as there are no well-known examples of cost-effective projects, wind power industry in isolated areas will not develop although wind power in principle could supply power at much lower cost than the current systems which are based on diesel generation.
Part of such a pilot project program should be the implementation of various finance models, e.g. government grants, public private partnership etc. Of course, in the long term this sector will only flourish once the hidden subsidies for diesel based generation becomes visible and have to be paid for by consumers. In this case, many would certainly opt for lower-cost wind based power supply.

Such pilot program should be accompanied by research and development work of leading universities so that there can be an increase in innovation along with manufactured products becoming competitive.

As mentioned earlier, regulatory improvements for micro-scale self-consumption as announced by the Russian government may become an important driver of the off-grid market [9].

Infrastructure problems are more acute today, but may be solved based on sophistic planning and logistics, e.g. delivery of equipment in remote regions by the Northern Sea Route, sometimes even by helicopter.

An overview of the main barriers and the recommended solutions are summarized in Table 7.

[11] Igor Bryzgunov, President of RAWI, comments: "Recently, RAWI has proposed to the Ministry of Energy of the Russian Federation to establish an interdepartmental working group under the Ministry. Such working group should be include the participation of representatives of the business community, leading wind turbine manufacturers and of other organizations with expertise in this area. The main aim would be to update the current legislation and to eliminate a number of requirements in the legislation that do not take into account the specifics of renewable energy investment."

Table 7 – Results of the Study

Barriers	Suggested measure
Financial	Improving the financial frameworks including more government support, directly or indirectly, transparency, offering attractive tariffs, accessible capital, public-private partnership.
	Capacity Building: Improving the professional level of project development, development of out-of-the-box (turnkey) solutions.
	Work with localized equipment.
	Spreading information about market opportunities, e.g. via national and international associations
	Transparency, openness and a clear policy perspective beyond the year 2024: the intention to develop renewable energy after 2024, and set ambitious targets for the period up to 2030-2035.

Table 7 – Results of the Study

Table 7 – Results of the Study

Barriers	Suggested measure
Financial	Training seminars on financing wind power projects and participation in conferences for the exchange of experience with other wind power markets.
	Accounting for financial risks in the development of legal framework.
	The development of financial models that take into account the economic specifics of renewable energy investment
Grid & Infrastructure	The development of spatial planning program for renewable energy projects, according to which wind power should be developed at first in areas with higher demand and where there is a high wind resource potential. A comprehensive wind map of Russia would be useful.
	"Competition" amongst regions for investment and for investors.
	State-of-the-art methods of grid regulation and wind turbine technology.
	Updating of wind atlas using additional input data (data from masts, satellite, the Merra, etc).
Regulatory	Harmonization of Russian and international standards (unification of the IEC and GOST).
	Cooperation with the private sector on the specific features of renewable energy standards.
	New solutions for the problematic points (design of foundations and access roads to wind turbine, windfarm, power redundancy, etc.).
	Reducing delays in the classification and localization.
	Development of amendments to the existing regulations (for localization of wind turbines components, delays with the procedures, etc.).
Off-grid	New methods of Federal Antimonopoly Service for isolated areas
	Construction of pilot projects with different types of support.
	The development of the industry for jobs.
	Innovations in the "northern" wind power (grants, projects, special programs) and development of the Arctic region.
	Application Ros installation methods, use of helicopter delivery.
	Development of equipment adapted to harsh climatic conditions.

Achieving a comprehensive approach: Wind Roadmap for Russia

There is a widespread opinion about the need for a better coordination amongst of all market stakeholders (Annex D), which may result in a comprehensive "Wind Roadmap for Russia". Such a roadmap might result from a consultation process between the relevant government agencies and the relevant stakeholder groups, in particular actual and potential investors. Such process could be based on existing activities, including those of the existing national and international associations, and in particular similar to the broader work carried out under IRENA's REmap project in consultation with Minenergo. Eventually such measures may include regional development programs, support the inclusion of renewable energy projects in Russia's overall energy strategy and define a clear, long-term development plan for the next 15-20 years.

This may also answer those respondents who referred to the fact that the representation of the private sector participants should be strengthened and more unified, as it already is common sense in other countries. Such functions may include the establishment of training centers, training of personnel and support of individual wind power projects as well as the general legal frameworks. Of course, the private sector is currently in its infancy and will only grow and be able to coordinate its activities once there are sizable investments.

Chapter 4.
CONCLUSION AND PROSPECTS

As the Russian wind industry has been more than just dormant over the past years the country encounters itself way behind the global trend of a booming wind power sector. However, recent tenders can be interpreted as promising and serious steps that can possibly result in wind farms with an overall capacity of 700 MW being built in Russia over the near future. Although, in order to establish a sizable and internationally competitive wind industry, a much larger volume will be required.

As mentioned earlier, the potentials of Russia's wind power market are enormous. The country has the world's largest technical wind energy potential which, according to more recent but still conservative estimations, ranges between 8 and 36 TW [2, 4]. The main reasons why these resources have been widely untapped yet were described in detail in this report.

However, there is an increasing interest in Russia, on government and business side, to deploy wind and other renewable energy on a large scale. According to this study, currently there are several serious barriers in the Russian wind market, in particular in terms of financial, grid & infrastructure, as well as regulatory aspects. Furthermore, the study identified barriers in areas with isolated power supply.

In order to increase the investment attractiveness of wind power projects in Russia, the Government needs to address these issues and to consolidate a clear position on the development of the industry in the long term. In addition, deeper partnership between non-governmental actors such as "NP Market Council", RAWI, the World Wind Energy Association, Russian universities or other international universities and research institutes of wind energy, Russian and foreign companies will help to accelerate the development of wind energy market in Russia.

Market participants in Russia need to coordinate a common approach to the development of wind energy in the country, which should result in the design of a "Wind Roadmap for Russia".

Based on a comprehensive national strategy: What could be a realistic scenario for Russia? In the mid-term, according to an estimation of IRENA's REmap project, the total capacity of wind farms in Russia could reach 23.3 GW by 2030 (without remote generation [17]). This would be enough to cover around 10 % of Russia's power supply and could create close to 50'000 jobs in the wind sector, based on international experience (WWEA's own estimation). Although such a target might present itself as rather optimistic and ambitious, the fact that China has been installing yearly in average more than 20 GW of new wind capacity, and in 2015 alone installed 33 GW certainly proves its realistic approach. In the same time, other major wind markets like Germany, India or the USA have seen annual installations of 2 to 6 GW.

For the Russian wind sector, there are several pathways possible in order to acquire the necessary expertise and technology [18]:

- Foreign companies may be invited to invest in the country, introduce their knowledge and build their manufacturing hubs in Russia. This approach may be the fastest way of introducing state-of-the-art technology in Russia.

- Russian companies may start cooperation with foreign companies either by purchasing licenses or by forming joint ventures. This allows Russian companies to acquire the needed know-how quickly and still leaves room for own technologies, based on international cooperation and knowledge exchange.
- Russian companies, based on the still existing know-how at Russian universities, may develop their own technology. Such approach may take longer but will give full ownership of the technology to domestic companies without paying license fees etc to international partners.

For all three options, there are good arguments, as briefly outlined. Countries like China have tried all of them successfully. It is simply important to understand that the government should allow the private sector to try out different ways and enable market competition. Already today, foreign and Russian companies can be found in every one of those three described paths.

In addition, the creation of a comprehensive windmap of Russia would be useful, being then backed by a wind measurement campaign across the country.

Off-grid and isolated regions

The currently installed electricity generation capacity in the isolated regions is 6 GW [2]. There is no doubt that most of this, maybe even all of it, may be substituted by renewable energy based hybrid systems within 15-20 years [3]. Taking into account the rich wind resources, especially in the far North, wind will certainly play a key role although solar energy will also cover a substantial share - together with small hydro, bioenergy and, in some regions, geothermal energy. Most certainly, the complete energy supply in Russia, in particular of the remote areas, could be covered with a combination of all renewable technologies. Such substitution would save hundreds of millions of € per year, compared with today's diesel generators. Depending on the improvement of the legislative framework, the total capacity of wind turbines in isolated regions may reach from 1 to 5 GW by 2030 – and even 10 GW in the long term. Such expansion would go hand in hand with the establishment of a worldwide leading industry specialized in off-grid electrification in cold climate. Such specialized industry may soon become world leading and might export to other markets in Europe, North America or Asia.

Overcoming the existing barriers currently holding the Russian wind market back, would open the doors not only to comply with Russia's international commitments like the Paris agreement – and eventually convert the complete energy supply into one that is fully renewable energy based.

In the long term, Russia may even export these vast resources to other countries. One very interesting option could be based on the existing gas pipeline infrastructure: In its remote territories, Russia could generate large amounts of hydrogen in huge wind farms, synthesize it and send it to Europe or East Asia through the existing gas pipelines. With such an approach, Russia could secure its position as an energy supplier also in the long run – by exporting "wind gas" instead of fossil gas.

Whether off-grid or larger wind farms: If Russia manages to kick-start its wind industry in the next few years, re-vitalising its traditional wind sector based on available technical and industrial resources, then Russian wind power faces a bright future contributing to long-term wealth and prosperity in the country, creating hundreds of thousands of jobs and securing Russia's position as a powerhouse of the world.

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Annex A.

LEGAL FRAMEWORK OF WHOLESALE AND RETAIL MARKET

Table A.1 – Legal framework of wind energy market

Table A.1 – Legal framework of wind energy market

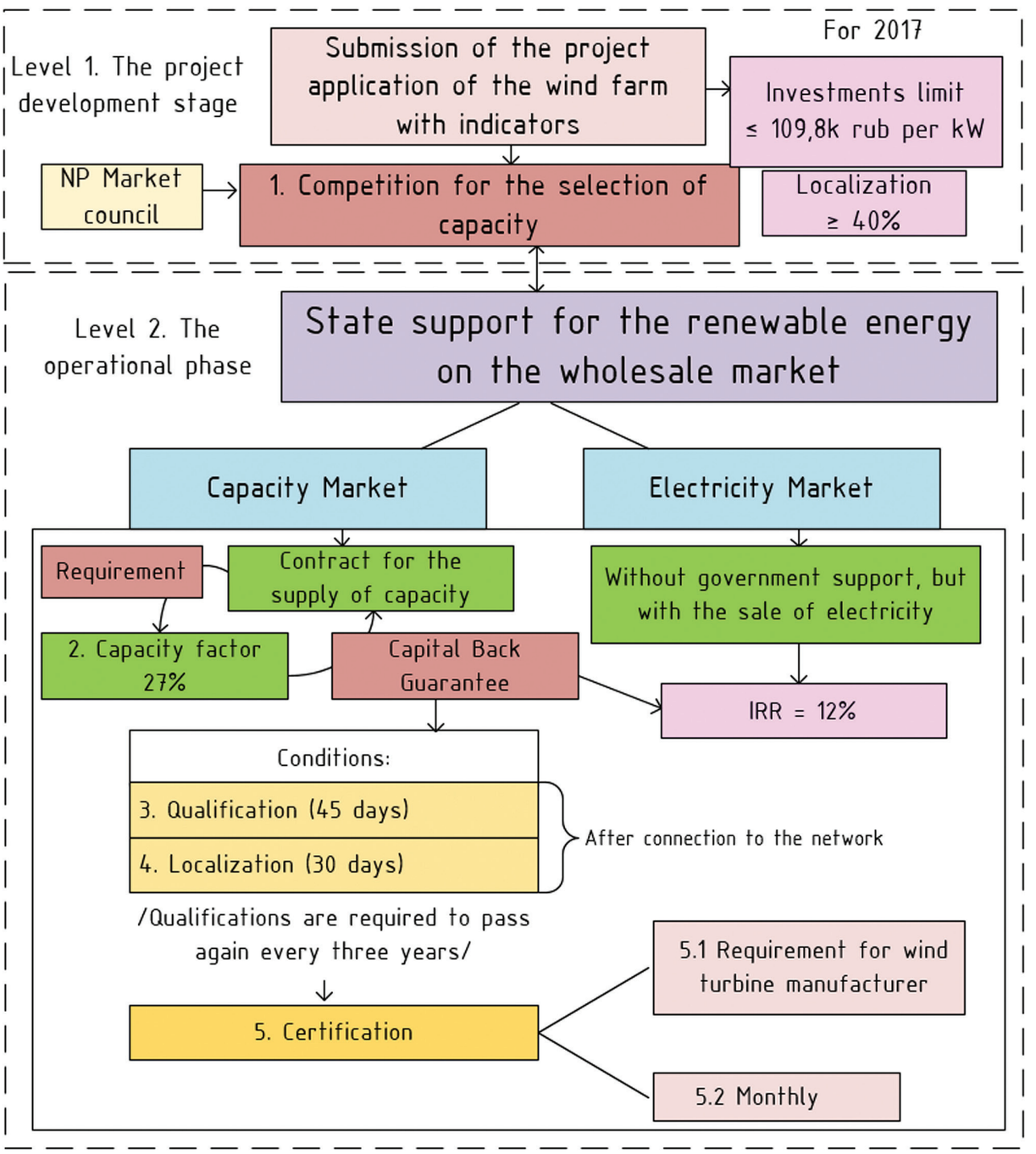
Document	Content
Wholesale market	
Federal Law Nr. 35-FZ of 26.03.2003 (ed. on 4.11.2007)	Definition of measures to accelerate the development and role of the state in the implementation of support facilities based on renewable energy
Government Decree Nr.1172 of 27.10.2010	Rules of functioning of the wholesale electricity and capacity market
Government Executive Order Nr.1-R of 08.01.2009	Approval of the state policy in the sphere of energy efficiency of electric power based on the use of renewable energy, which set the target to achieve 4.5% of renewable energy (20% of which would be hydropower) in 2020, but later this target was decreased to 2.5%
Government Decree Nr. 449 of 28.05.2013	Mechanism of promoting the use of renewable energy in the wholesale market, according to which the requirements were introduced to work with renewable energy in the wholesale market and the rules on the development of renewable energy in the country by 2020
Government Executive Order Nr.1472-r of 28.07.2015	Adjustment of the main targets prescribed in the 449th Ordinance, until 2020
Government Executive Order Nr.1634-r of 01.08.2016	The scheme of territorial planning of the Russian Federation in the field of energy, according to which 15 wind farms with a unit capacity of at least 100 MW and a total capacity of 4.5 GW will be installed in Russia by 2030
Government Decree Nr.426 of 03.06.2008 (ed. on 19.09.2016)	Procedure for the qualification of the generating facility operating on renewable energy sources
Order of the Russian Ministry of Industry and Trade Nr.1556 of 08.11.2014	Approval of the procedure for determining the degree of localization in relation to renewable energy sources to create its competitive capacity of production of multi-megawatt wind turbines
Government Decree Nr.719 of 17.07.2015	Criteria with regard to localisation for correlating domestic and those foreign products which are not yet available in Russia
Government Decree Nr.117 of 17.02.2014	Rules for keeping the register and issue certificates
State standard GOST R 54418-2014	Requirements for data communication between the components of wind power plants, such as wind turbines and facilities management and data collection (SCADA)

Document	Content
Government Executive Order Nr.354-r of 28.02.2017	Last amendments to the Decree Nr.449.
Resolution of the Government of the Russian Federation No. 610 of 23.05.2017	Amendments to the qualification of the generating facility based on RES and the specification of the localization of individual elements of the wind turbine.
Retail market	
Government Decree Nr. 442 of 04.05.2012 (ed. on 11.10.2016)	The rules of functioning of retail electricity markets
Federal Law Nr. 261 of 23.11.2009	The improvements on energy saving and energy efficiency in the retail market (energy service contracts)
Government Decree Nr. 47 of 01.23.2015	The promoting of using of renewable energy sources in the retail market
Order of the Federal Tariff Service Nr. 20-E of 6.08.2004	The instructional guidelines for the calculation of regulated tariffs and prices for electric (thermal) energy in the retail market
Order of the Federal Antimonopoly Service (FAS) Nr.900/15 of 30.09.2015	The guidelines for the establishment of the extreme (minimum and (or) maximum) levels of tariffs for electricity (power) from renewable energy facility in order to compensate for losses in grid
Government DecreeNr. 1178 of 29.12.2011 (ed. on 05.10.2016)	The pricing in regulated prices (tariffs) in the electric power industry
Government Decree Nr. 823 of 29.12.2012	The schemes and long-term development programs of electric power industry
Government Decree Nr. 850 of 20.10.2010	The criteria for granting subsidies from the federal budget in the order of compensation cost of technological connection of renewable energy facilities with installed capacity less than 25 MW.

Annex B.

THE PROCEDURES FOR OBTAINING THE CONTRACT FOR THE SUPPLY OF POWER

Figure B.1 – The procedures for obtaining the contract for the supply of power



1. Currently to take part in the tenders, developer must have either guarantor, which is generating company with a minimum capacity of 2.5 GW, or a financial guarantee from a bank as an additional 5% of the project cost. A bank may provide a credit for the developer , which otherwise the guarantor may give. After passing the tenders, the winning project moves to the phase of construction and operation.

2. In the capacity market, as state support until 2024, the capacity supply contracts (CSC) have been introduced, as a contract for 15 years. Therefore, the implementation of CSC ensures a return on capital. To profit from operating wind farm, the minimum value is set at a benchmark capacity factor of 0.27. The implementation of this indicator is not penalized if the capacity factor is bigger than 75% of this value (0.2 – 0.27), from 50 to 75% a fine is imposed (capacity factor of 0.14 – 0.2), and below 50% there is no payment at all. Performance of CSC is guarantee of the return of capital to the investor with IRR = 12%. In addition, the investor makes a profit from the sale of electricity (in the Market of Electricity without additional state support).

3. Qualification means that the object is recognized as a renewable energy, for which there is a special form of state support (capacity supply contract). Qualification procedure is not required procedure. Without it, the project can get the same remuneration like conventional power generation. "NP Market Council" checks the project documentation and the wind farm on the criteria (entry of the object, belonging to the renewable energy, the ability to generate electricity, grid connection, etc.) for the recognition of the qualified object in accordance with the approved protocols. "NP Market Council" inspects the mandatory list of documents and the actual examination of the object in place. The confirmation procedures are done by a commission composed of six people, which include representatives of the Ministry of the Industry and Trade, the "NP Market Council" and the Ministry of Energy (according to Decree 449). After checking, the object is added to the registry. The qualification procedure must be repeated every three years.

4. The Ministry of Industry and Trade needs to confirm the degree of localization. Both procedures take place in parallel (from the date of connection to the grid): for qualification, the period is 45 days, for localization, it is 60 days.

5.1 Besides, for the commissioning of the wind farm in Russia the manufacturer must hold type certification of the machine. After this, the machines can be used for the construction of the wind farm.

5.2 After connecting to the grid and once the project feeds into the grid, the project is required to transmit monthly output data to OJSC "Trading System Administrator (ATS)" in order to obtain green certificates (this procedure is called monthly certification). In accordance with the generated energy of the past month, the project receives the renewable energy premium from the market regulator.

Annex C.

THE LIST OF COMPANIES OPERATING IN THE WIND ENERGY MARKET IN RUSSIA

Table 1 - List of companies/organisations involved in the wind energy market in Russia (as of December 2016)

Table 1 - List of companies/ organisations involved in the wind energy market in Russia (as of December 2016)

Company/organization	Location	Stage of involvement
RAWI	Domestic	Deep involvement in all projects
Russtandart Standart organization	Domestic	
The Ministry of Industry and Trade	Domestic	
The Ministry of Energy	Domestic	
"NP Market Council"	Domestic	
Projects resulting for the tender of summer 2016		
"Priyutninskaya VES" 1 stage, 51 MW, The Republic of Kalmykia		
Falcon Capital a.s.	Foreign	Investor
LLC "Alten"	Domestic	Development and Ownership
JSC "Project company of Kalmykiya"	Domestic	Project company
Lahmeyer International	Foreign	Engineering company
FWT Production GmbH	Foreign	Manufacturer
LLC "GK Windfarm Simbirskiy", 35 MW, Ulyanovskaya region		
JSC "Fortum"	Domestic	Investor
Dongfang Electric	Foreign	Manufacturer
LLC "Activity"	Domestic	Engineering company
CJSC "TEP Engineering"	Domestic	Project company
3 wind farms, 150 MW, The Republic of Adygea		
State corporation "Rosatom"	Domestic	Investor
JSC "OTEK"	Domestic	Wind farm ownership and operation
JSC "WindOGK"	Domestic	Developing of 26 wind farms 610 MW in next three years
LLC "Activity"	Domestic	Engineering company (wind measures)
Lagerwey GROUP B.V.	Foreign	Manufacturer
JSC "AtomEnergoMash"	Domestic	Industrial base

Company/organization	Location	Stage of involvement
23 wind farms, 460 MW, Kranodar Krai		
State corporation "Rosatom"	Domestic	Investor
JSC "OTEK"	Domestic	Wind farm ownership and operation
JSC "WindOGK"	Domestic	Developing of 26 wind farms 610 MW in next three years
Lagerwey GROUP B.V.	Foreign	Manufacturer
JSC "AtomEnergoMash"	Domestic	Industrial base
Others developers and investors in wholesale market		
LLC "Russian wind"	Domestic	Planning 280 MW projects
LLC "SOWITEC Russia" (SOWITEC group GmbH)	Foreign	Several projects in different regions at different development stages (wind farm 55 MW in Kurgan region)
CJSC "Wind generating company"	Domestic	Planning several projects wind farms with capacity 116 MW
LLC "WENT Rus"	Domestic	Planning two wind farms (400 MW)
LLC "Complex Industry"	Domestic	Planning seven wind farms (105 MW)
LLC "Wind energy systems" (WES)	Domestic	Planning wind farms (1099 MW)
LLC "Wind Nr.5"	Domestic	Planning two wind farms (100 MW)
LLC "RosWEU"	Domestic	Localization of the megawatt-class wind turbine
PJSC "RusHydro"	Domestic	The largest investor in hydropower
LLC "INTER RAO Engineering"	Domestic	Planning
Enel Russia (Enel S.p.A.)	Foreign	Declared their intention to invest in wind energy
IFC International Finance Corporation	Foreign	Got away from the Russian market
State Corporation " Rusnano"	Domestic	Declared their intention to invest in wind energy
CUBE-Engineering GmbH	Foreign	Monitoring of wind with Russian companies
Aerodyn Energiesysteme GmbH	Foreign	Engineering services for wind energy projects
Windlife Energy BV	Foreign	No clear information available
LLC "INFRA Project Russland"	Foreign	No clear information available
Especially in isolated areas (WDPP – wind-diesel power plant)		
LLC "VTR Engineering"	Domestic	Engineering of wind farm in Nenets Autonomous region (200 kW)
LLC "Activity"	Domestic	Engineering of wind farm in the Far East (1,3 MW)
Manufacturers planning the production of wind turbines		
JSC "Kirov Plant"	Domestic	Planning of purchase license
LLC "Russian wind"	Domestic	Planning of purchase license

Table 1 - List of companies/ organisations involved in the wind energy market in Russia (as of December 2016)

Table 1 - List of companies/ organisations involved in the wind energy market in Russia (as of December 2016)

Company/organization	Location	Stage of involvement
Siemens AG	Foreign	Planning
Gamesa Eolica	Foreign	Planning
Vensys	Foreign	Selling of license
General Electric	Foreign	Planning
MTOI	Foreign	Planning
Company planning to manufacture wind turbine components		
Prüftechnik Dieter Busch AG	Foreign	Different components of wind turbines
JSC "Power Machines"	Domestic	Generator production
NPP "Don technologies"	Domestic	Different components of wind turbines
HK Kompozit	Domestic	Manufacture of composite materials
JSC "Tjazhmash"	Domestic	Foundry (tower, nacelle)
LLC "TEMZ"	Domestic	Generator production
FRECON A/S	Foreign	Equipment of mechanical structures of wind turbines
LLC "OMZ-Spezstal'"	Domestic	Manufacture of steel
Concern "RUSELPROM"	Domestic	Concern of machine-building plants
SEC "Windek"	Domestic	Development of generators for wind turbines
LLC "WDM- technique"	Domestic	Development of generators for wind turbines
JSC "Avangard"	Domestic	Products from composite materials
CJSC «Terminal Tolyatti»	Domestic	Logistics on the river Volga
East Wind Brokers	Foreign	Design, production of components, logistics and maintenance of wind turbine
JSC "ROTEK"	Domestic	Design, production of components, logistics and maintenance of wind turbine
JSC "Tolyatti's transformer"	Domestic	Transformer production
LLC "Petrozavodskmash"	Domestic	Foundry (tower, nacelle)
Grid company		
JSC "Yantarenergo"	Domestic	Kulikovskaya VES (Kaliningrad region, owner)
PJSC "RAO Energy systems of East"	Domestic	Projects of LLC "Activity" in Far East

Annex D.
THE LISTS OF PARTICIPANTS OF THE PROJECT

1. Advisory group

Viktor Elistratov, Prof. SPbPU
Igor Bryzgunov, RAWI
Andrey Konechenkov, Vice-President WWEA, CIS Wind Committee
Eugeni Nikolaev, Russian Windpower
Deger Saygin, IRENA
Konstantin Wolf, Sowitec

2. The list of organisations that participated in the electronic survey

- LLC "Russian wind" (Moscow);
- REC "Renewable energy" Peter the Great Saint Petersburg state polytechnic university (St. Petersburg);
- VES "Dzhengutaysky wind farm" (The Republic of Dagestan);
- The Ministry of Industry and Trade of the Russian Federation (Moscow);
- Prüftechnik Dieter Busch AG (Germany);
- CUBE-Engineering GmbH (Germany);
- NPP "Don technologies" (Novocherkassk);
- LLC "VTR Engineering" (St. Petersburg);
- Kaliningrad State Technical University (Kaliningrad);
- FWT Production GmbH (via LLC "FWT Rus", Moscow);
- JSC "Kaliningrad Generation Company" (Kaliningrad);
- NPO SOWITEC Rus (Germany/Russia).

3. The list of organisations that participated in the personal interviews

- The Russian Association of Wind Power Industry RAWI (St. Petersburg);
- REC "Renewable energy" Peter the Great Saint Petersburg state polytechnic university (St. Petersburg);
- The Ministry of Energy of the Russian Federation (Moscow);
- The Ministry of Industry and Trade of the Russian Federation (Moscow);
- IFC International Finance Corporation (Moscow);
- "NP Market Council" (Moscow);
- JSC "Kaliningrad generating company" (Kaliningrad);
- JSC "Power Machines" (St. Petersburg);
- FWT Production GmbH (via LLC "FWT Rus", Moscow);
- LLC "Russian wind" (Moscow);
- LLC "INTER RAO Engineering" (Moscow);
- PJSC RusHydro (Moscow);
- JSC "Kirov Plant" (St. Petersburg);
- LLC "Activity" (Moscow);
- LLC "VTR Engineering" (St. Petersburg);
- AO OTEC (Moscow).

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Stefan Gsänger, secretary general, World Wind Energy Association
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WWEA
World Wind Energy Association

World Wind Energy Association (WWEA) is an international non-profit association embracing the wind sector worldwide, with more than 600 members in around 100 countries. WWEA works for the promotion and worldwide deployment of wind energy technology. WWEA provides a platform for the communication of all wind energy actors worldwide; advises and influences national governments and international organisations; enhances international technology transfer.
http://www.wwindea.org/

RUSSIAN ASSOCIATION OF WIND POWER INDUSTRY

Russian Association of Wind Power Industry
https://rawi.ru/en/

POLYTECH
Peter the Great St.Petersburg Polytechnic University

Peter the Great St. Petersburg Polytechnic University
http://english.spbstu.ru/

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This analysis does not provide a complete answer to all questions the Russian wind sector is facing today, but it suggests a number of steps to possibly accelerate and scale up wind power deployment in Russia.

All information about wind farms, targets, as well as recent developments in the industry, are taken from official documents of the Russian Government, or from other public sources respectively from information gathered during the survey. This study is based on information collected during the period of June to December 2016. There are permanent changes related to the Russian wind energy market and its regulatory frameworks and hence soon after publication of this study, smaller parts of the information given might not be valid any more although the main conclusions are still relevant.

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