

All-Russia Market Research Institute (VNIKI)

Igor Matveev, *Senior Researcher*

Presentation Topic:

Renewable energy sector in Europe: Status and prospects.

In December 2008 the EU adopted the Directive on the renewable energy sector promotion ("Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources")¹, which set the target of sourcing 20% of energy from renewable sources in the European Union. In accordance with Directive each member state in the EU is to evaluate its own renewable energy sources, determine the "clean" energy domestic demand up to 2020, set their own targets and present RES development national action plans (NAPs) by October 2009.

The European Commission places a priority on power and heat energy projects of EU in general and for individual regions (several countries with common borders).

The renewable energy development must also consider various factors, such as population density, other than renewable energy resources potential.

By 2012 at least 30% of new and newly refurbished buildings must include RES-based installations to reduce hydrocarbon energy consumption, and by 31 December 2014 it will be mandatory for all real estate of both public and private sectors.

The Renewable energy target in transport is to achieve 10% share of biofuels in total motor fuels consumption. The European Commission stresses that the production of clean fuels development should not adversely affect foodstuffs production and EU member states should strengthen cooperation in this energy sector. The medium term prospect of biofuels utilization in economy sectors is to achieve biomass plant efficiency in private and commercial sectors of over 85%, in industry - 70%.

The share of energy from renewable sources in the European Union countries,%

	2005	2020 ¹⁾
Austria	23,3	34,0
Belgium	2,2	13,0
Bulgaria	9,4	16,0
The UK	1,3	15,0
Hungary	4,3	13,0
Greece	6,9	18,0
Denmark	17,0	30,0
Ireland	3,1	16,0
Italy	5,2	17,0
Spain	8,7	20,0
Cyprus	2,9	13,0
Latvia	32,6	40,0
Lithuania	15,0	23,0

Luxembourg	0,9	11,0
Malta	0	10,0
Netherlands	2,4	14,0
Poland	7,2	15,0
Portugal	20,5	31,0
Romania	17,8	24,0
Slovenia	16,0	25,0
Slovakia	6,7	14,0
Germany	5,8	18,0
Finland	28,5	38,0
France	10,3	23,0
Czech Republic	6,1	13,0
Sweden	39,8	49,0
Estonia	18,0	25,0

¹⁾ Forecast.

Source: Euro Commission.

Some experts believe that upon reaching a 20% share of wind power in total power generation the stability of the entire power system dramatically decreases, therefore, unauthorized switching off may occur for some consumers.

Nowadays wind turbines in Europe operate at a 4 - 25 m/s wind speed, while the rotor makes 9 to 19 rotations per minute, depending on the model of wind turbine and other factors. If the wind speed exceeds critical value of 25 m/s wind turbine stops in order to avoid breakage or fracture. The first 20 - 60 kW wind power turbines had 20 m rotor installed, today they are 5 MW and 126 m respectively. There are over 1,5 thousand sea-based 2,5 - 3 MW wind turbines in the EU.

According to the European Wind Energy Association "EWEA", there was more than 8-fold increase in rotor diameter in 1980 – 2009, it amounted to (m): In 1980 - 15, 1985 - 20, 1990 - 40, 1995 - 50, 2000 - 112, 2005 - 124, 2009 – 126. In the nearest future Wind Turbine Specifications can reach the following parameters (diameter of the blades, m / installed capacity, MW): In 2012 - 150 / 7,5; 2015 - 178/10; 2020 - 252/10 - 20 .

European wind energy base case development indicators

	2020	2030
Wind turbines total installed capacity, MW	230	400
Land -/sea-based	190/40	250/150
Power generation, TWh / h	582	1155
Land -/sea -based	433/148	592/563
The wind power share in total power generation,%	14,3 – 16,6	25,2 – 34,3

Land -/sea -based	10,7 – 12,4/3,6 – 4,2	13,4 – 17,6/12,8 – 16,7
Total sector investments, bln euros	23,5	24,8
Land -/sea -based	14,7/8,8	8,3/16,5

Source: "EWEA".

Russia falls behind most countries in the world-scale renewable energy development, in spite of virtually unlimited renewable energy resources and sufficiently high sci-tech and industrial potential in the field.

Comparison of primary energy production in Russia with technical resource of renewables shows that the RES total technical resource in Russia exceeds the value of 24 bln tones of equivalent fuel (TEF) per year, which is 10 times higher than the total production of coal, oil, natural gas, and power produced by hydro and nuclear plants.

Today the RES-based power generation share (excluding hydro) is about only about 1% in Russia. In 2009 the total installed capacity of 50 major HPPs was 23,3 GW (before the accident at the Sayan-Shushenskaya HPP), and by 2020 this figure could reach 30%. According to the national action plan, in 2015 the share of RES should increase up to 2.5%, in 2020 –4,5%.

By 2020 the total installed capacity of biomass plants is estimated at 7850 MW, wind power plants -7000 MW, tidal energy - 4500 MW.

The gross and technically available wind resources are estimated at 320 billion and 0.8 billion TEF / year respectively and economic resource - 4 million TEF / year in Russia.

The gross (theoretical) potential of renewable energy – the annual energy volume contained in renewable energy sources provided its total transformation into usable energy; RES technical resources (capacity) – part of the gross potential transformed into usable energy, possible with the existing level of technology and environmental requirements compliance; economic potential of renewable energy sources - part of the technical potential transformed into usable energy, which is economically viable at a given level of prices for fossil fuels, heat and electricity, equipment, materials, transportation, labor, and other factors. Economic potential can equal to tens of percent of technical capacity, while increasing or decreasing depending on the world market conditions.

However, the world trend of renewable energy development within the past few years is their rapidly growing economic potential (for non-renewable energy sources this figure steadily decreases). According to "EWEA" the total capacity of wind turbines was approximately 11 MW in the early 2009. The figure was much higher in some neighboring countries of Russia (MW): Poland - 472, Ukraine - 90, Estonia - 78.

In Kaliningrad region wind park consisting of 20 225 kW windmills is in operation from 2002, but it is hampered by a number of reasons, some of them technical, so "clean" power generation has decreased from 5,8 to 4,7 kWh in 2007 - 2008 (total energy consumption in the region is approximately 4 TWh per year).

Local administration, due to its experience of wind turbines operation, is cautious with implementing wind power projects and considers the Kaliningrad nuclear power plant construction in order to meet the growing domestic power demand, as well as export energy to neighboring countries, although according to plan, the share of RES-based power generation in the region should be at least 5% by 2020

The joint project of "Vorkutaugol" and "Kominergo", wind farm, consisting of 10 wind turbines 250 kW each, near Vorkuta in the 90s was the start of wind power development in Northern Russia. However, due to temperature effects in the range from +35 °C down to -52 °C, lack of spare parts, trained personnel has led to a large number of equipment failures. As the result, seven wind turbines halted and the rest were in derated operation. Despite the difficulties, RusHydro estimated it economically feasible to create a 50 - 100 MW wind farm, with the 1 - 3 MW wind turbines, in the next few years in the Vorkuta region.

Russian-Ukrainian wind turbines were installed in Chukotka in 2001 - 2003, but they also failed the extreme modes of operation, in spite of special steel and low temperature lubricants. The volume of generated power steadily decreased in 2003 - 2008, and it amounted to 300 thousand kWh in 2009. The local administration is currently reviewing wind energy development project, and in the nearest future, the total windmills capacity of Chukotka could reach 300 - 400 MW, which fully meets the power demand in this region.

The wind power development in the country is constrained by lack of government subsidies for clean energy producers and bureaucratic barriers of putting in operation and grid connection.

In order to develop RES power generation the Government set some target indicators. Thus, in accordance with Government resolution № 1-p dated January 8, 2009 the share of RES in the energy balance of Russia should reach 4% by 2020. It should be noted that the EU energy policy set the target of increasing the RES share to 20% (in 2009 - about 7%).

According to "RusHydro" the construction of several wind farms is planned in the short-term outlook in the Leningrad region (75 MW), Kaliningrad (62 MW), the Republic of Kalmykia (300 MW), the Republic of Karachay-Cherkessia, in the Altai and Yakutia, as well as in close proximity to such cities as Krasnodar, Stavropol, Volgograd, Murmansk and Vladivostok, which will increase the total capacity of wind power plants to 6 GW in Russia.

By 2012, the Far East of Russia total wind power capacity could reach 36 MW, generating 95 million kWh of power (about 7% of total power consumption in Vladivostok). Japanese "Mitsui" and "J-Power" intend to take part in this project. The total wind turbines capacity in the Primorsky Krai can expand to 200 MW in the future.

In the Murmansk region the Netherlands Company "Windlife Energy" plans to build 300 million euro 200 MW wind farms.

Renewable energy resources in Russia

	I	II	III
(mln TEF/yr)			
Total	3093089	24221 ¹⁾	320
Small-scale Power Generation	402	126	70
Geothermal Energy	22,9x10 ⁶	11869	114 ²⁾
Biomass	468	140	69

Wind Energy	886256	2216	11
Solar Energy	2205400	9676	3
Low-potential heat	563	194	53

¹⁾ The 3 tidal power plants technical potential energy (Mezenskaya, Penzha, Turguskoy) is 253 TWh, or 83 million tones of equivalent fuel with the total power capacity of 109 GW.

²⁾ More than 100 °C high-grade fluid total reserves provide steam and water mixture equal to that of 1 GW geothermal power plants

Note - I - gross resource, II - technical resource, III - economic resource.

Source: "Data book on RES Resources and local fuels in Russia ", 2007

Distribution of wind energy resources on economic regions of Russia¹⁾

	I	II	III	IV	V	VI
Total	2606635	320199	6516,6	800,5	32,6	4,00
Central	28717	3528	71,79	8,82	0,36	0,04
North-West	173034	21255	432,58	53,14	2,16	0,27
Southern	70633	8677	176,58	21,69	0,88	0,11
Volga	94502	11609	236,26	29,02	1,18	0,15
Ural	646795	79452	1617,0	198,63	8,08	0,99
Siberia	605192	74342	1513,0	185,85	7,56	0,93
Far East	987762	121337	2469,4	303,34	12,35	1,52

¹⁾ Administrative divisions of Russia as of 2007

Notes: I - Gross wind energy resources, TWh/year, II – gross wind potential, mln. tones of equivalent fuel (TEF) /year, III - Technical resources, kWh/year, IV-technical resources, mln TEF /year, V - economic potential, kWh / year, VI - economic potential, mln TEF / year.

Source: "Data book on RES Resources and local fuels in Russia ", 2007

Russian wind energy industry is attractive to investors and total investments in the sector could reach about 10 billion euros by 2020 according to German analysts.

The most promising country areas are the region of the Baltic Sea, the lower Volga, the Caspian region, the lake Baikal and the Altai, Karelia and Tuva.

The installed capacity of Russian RES-based generating installations and generated electricity in 2008

	Installed capacity, MW	Electricity, GWh
Total	2186	8414
Small HPP	683	2800
Wind power plant	12	9,7
PV	0,02	0,02
Tidal power	1,5	0
Geothermal power	76	400
Biomass and biogas Plant	1413	5200

Source: "Energiewirtschaft 2008/2009 - Russische Federation, Gtai".

Investments to Russia RES sector forecasts, mln. euro

	2010	2015	2020	2009 - 2020
Wind	80	620	2200	9500
Hydro Energy (SHPP - up to 25 MW)	110	500	600	4900
Geothermal Energy	30	220	250	1600
Biomass	360	600	700	6400
Tidal Energy	0	0	9600	9600
Solar	0	0	0	60
Other	0	30	220	560

Source: "Energiewirtschaft 2008/2009 – Russische Federation, Gtai".

Conclusions:

1. The exhaustion of available productive hydrocarbon reserves and new energy technologies development, reorienting the global demand for alternative fuels after 2020 could mark the end of **“oil” era and the beginning of new energy way**.
2. The World and European energy development forecasts show RES share in world primary energy generation steadily increasing in the short and long term outlook.
3. Nowadays the most profitable of the renewable energy is the **hydro energy** (especially SHPP), **biomass and wind energy**.
4. Solar power requires significant investments; at the moment solar power energy (PV) remains one of the most expensive among the RES.
5. The increased use of renewable energy, regional and national policies in this area, legally regulated energy efficiency appliances, equipment, appliances and devices, as well as reduction of energy consumption will **inevitably lead to reduction of hydrocarbon energy demand** in industrialized countries in the medium term outlook.
6. The RES development can **accelerate the transition to new technological way** for OECD countries and a number of other economies of the world as well.
7. RES actively developing foreign countries provide **significant state support** to companies in this sector.

8. RES-based equipment operating businesses and individuals have their own economic incentives.

Suggestions for Russia:

1. Create a nationwide information-analytical agency for energy business support, including RES projects.
2. Increase Russian society awareness on the benefits of "clean" energy and energy conservation measures, including pre-schools, secondary schools, vocational schools, colleges and high schools.
3. Focus on the small and medium RES business development, as large companies already have their own corporate strategy and interests in this sector.
4. Actively use the one window access for foreign technologies promotion on the Russian market and take steps to provide existing and emerging research organizations and clusters with relevant information.
5. The necessity of using Bench marketing in Russia while supporting national venture capital and other companies, as well as RES-based generating facilities.
6. Priority introduction of RES-based generating plants should be performed simultaneously in the following sectors:
 - Power generation,
 - Heat generation,
 - State-owned companies and real estate,
 - MIC enterprises,
 - Russian military forces, including military combat and unconventional units,
 - Industry,
 - Private sector.