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Future of Renewables in Russia
Key Points and Comments

Prepared by Grigory Dudarev,
managing director, Evli Russia

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1. Where We Are?

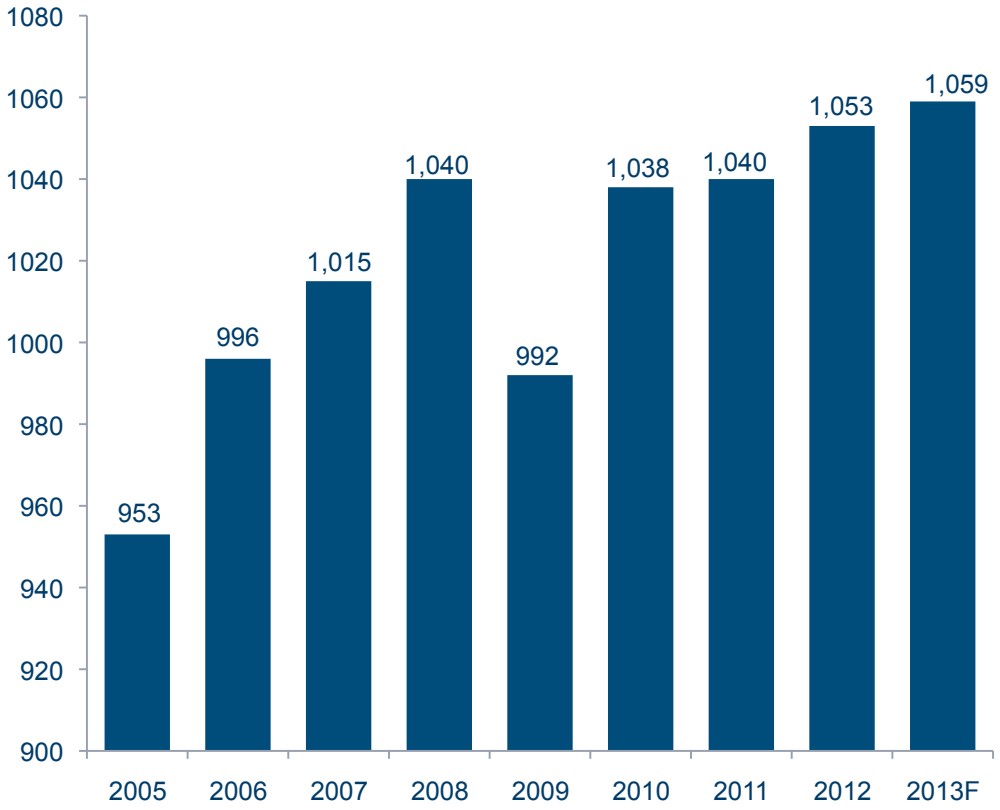
Introduction to the Subject

1. Electric Power Generation in Russia

Old Paradigm Still

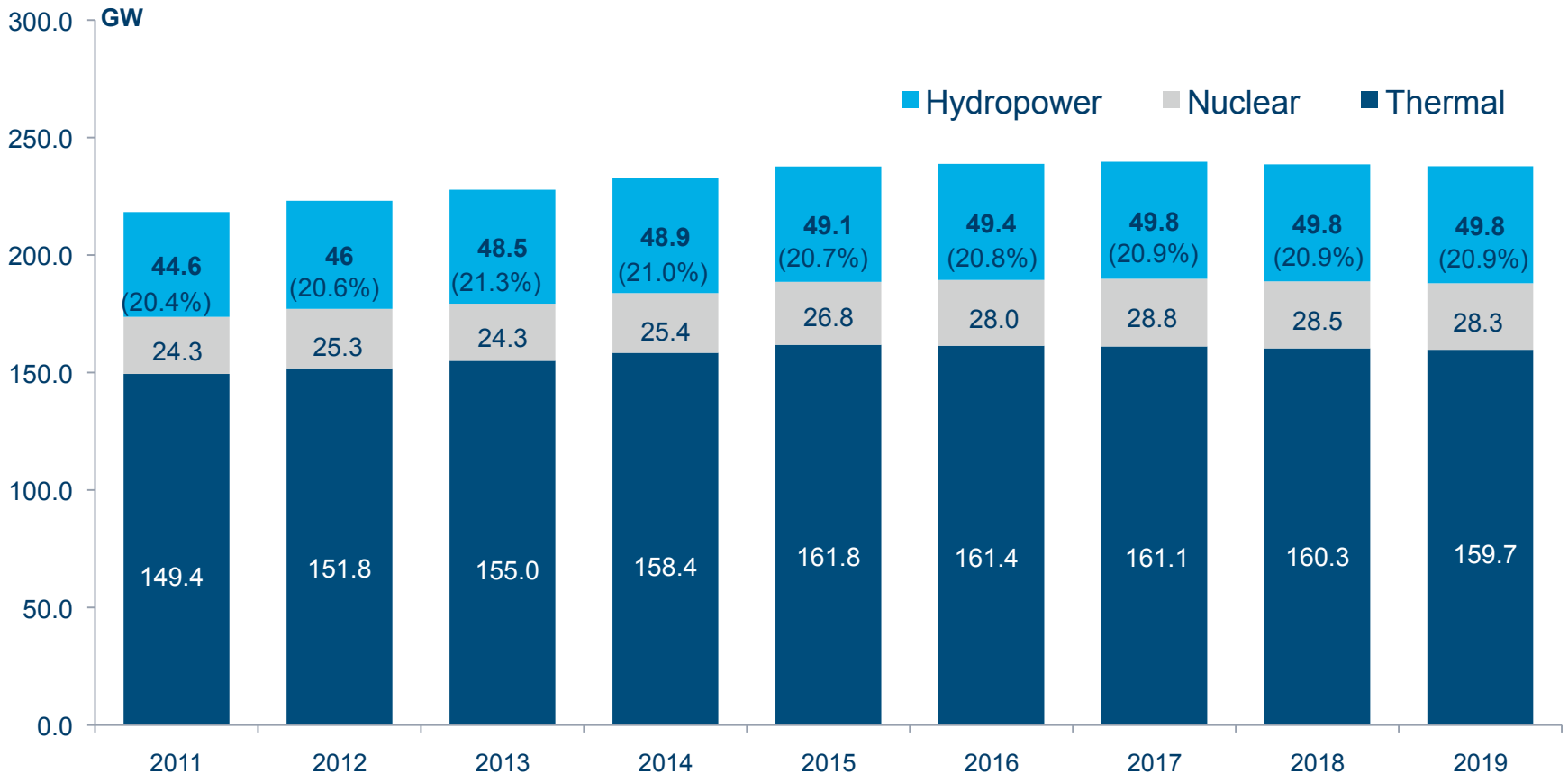
- **One of the Biggest Electric Energy Markets in the World**
- **Old Paradigm** - concepts developed in the industrialization period of Soviet times
  - **Concentrated generation**, **unified grid** (only 60% of regions in fact connected) and **long distance transmission**.
  - **Neglect of efficiency** in all aspects.
  - **Older**, conventional **technologies**.
  - **New Investment is Still Focused on Old Allocation Principles**
- **Low Efficiency of the Installed Base**
  - Most of the generating facilities run at low utilisation rate.
  - Major capacity bottlenecks in distribution,
  - Inefficient consumption and usage.
- **Major Investment Challenge in Transmission**
- **Major Operational Safety and Reliability Risks**
  - Aging and deteriorating maintenance
  - Inefficient supervision and management

Electric Power Production in Russia in 2005 – 2013, bn kWh



1. Hydropower – The Largest Source of Renewable Energy

Mid-term Forecast of Installed Capacity in Russia (Unified Energy Systems, 2013-2019)



Source: Ministry of Energy of Russia.

1. Efficiency Matters

Green power developments are limited by poor installed capacity utilization

Type of energy generation, Russia	Average Coefficient of Installed Capacity Utilization
Thermal Power Plants	52.9%
Large Hydropower Plants	40%
Small Hydropower Plants	~45%
Wind Generation Plants	~15-30%
Solar Generation Plants	~10-15%

Source: Materials of CISOLAR-2013 conference

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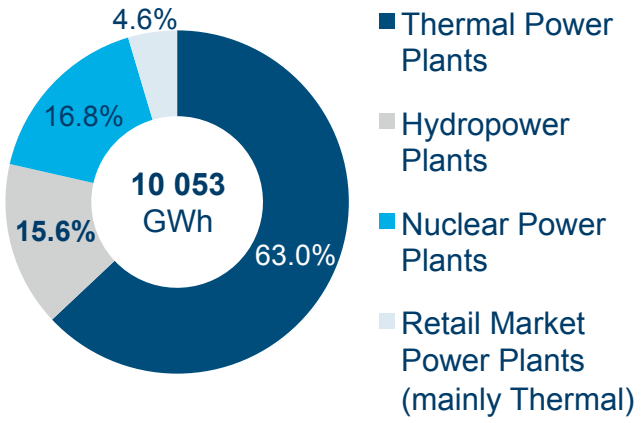
1. Fuel Mix and Role of Renewables

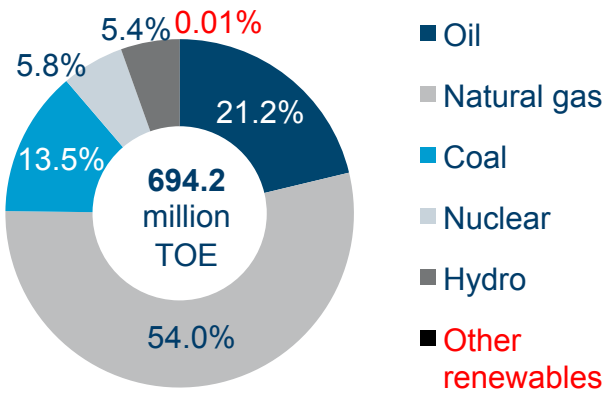
What would be the other than hydropower renewables that will take off in Russia?

- **Development Commitment by the State**
  - It means that certain support and **federal and region programs** will be initiated in the coming years. Technology choice is not clear and articulated (some focus on solar and wind).
  - Fairly high targets set - **renewables share up to 4.5% by 2020**.
- **Early Days of Development and Low Starting Point**
- **Long History and Developed Expertise**.
  - Geothermal in Kamchatka (Pauzhetskaja GeoES), tidal power plant in Kola Peninsula (Kislogubskaja PES), some innovative projects in fuel cells, wind, solar and bioenergy, energy storage.
  - There is still substantial **accumulated experience** that **is heavily underutilised**.
- **Hydrocarbons Abundance Still the Biggest Obstacle**: Conventional wisdom, also at the level of Government decision makers, is that since we have a lot of hydrocarbons we do not need hurry up with costly renewables.

Electric Power Generation in Russia (2012)



Primary Energy Consumption by Fuel (2012)



Source: BP Statistical Review of World Energy 2013

1. Renewables of Russia in the International Context

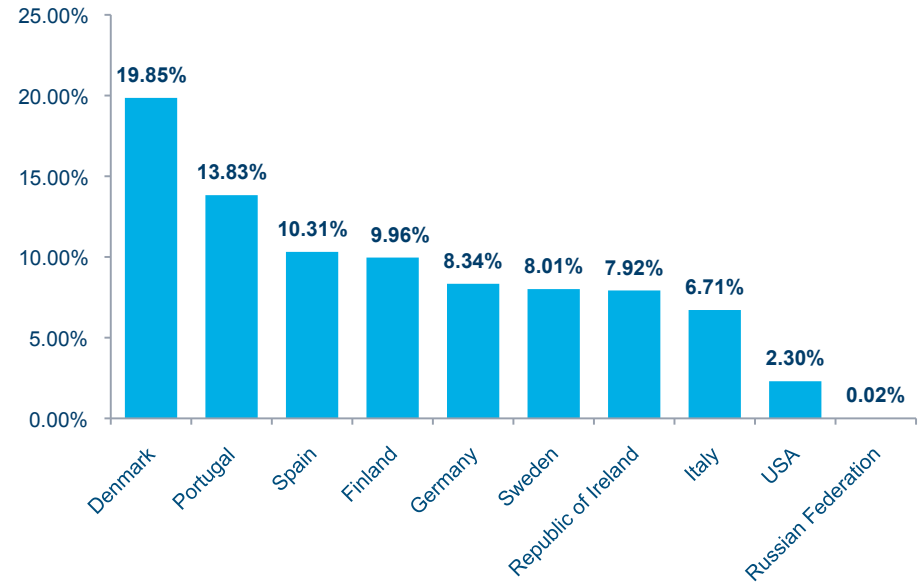
Significantly lagging behind the European Union and even other BRIC countires

- **Good Share In Global Comparison Only in Hydropower** – over the average of about 15% of the total generation.
- **There is a Large and Growing Development Gap With the Developed World**. The gap is not only in use but also in literally every other aspect, i.e. in regulation, financing, manufacturing, service and maintenance, etc.
- **Development Gap with Other BRIC is Also Large and Increasing**.
- **Is There Any Hope For a Leap and Catching Up**?

In fact there might be a chance in mid term due to

  - Decreasing costs in many renewable technologies,
  - Urgent need to provide efficient energy supplies in certain regions where the unified system fails or is costly
  - Development of the dispersed, privately owned generation and distribution

Share of Renewables in Fuel Consumption of Selected Countries in 2012*, %



** Not including hydropower.*
Source: BP (Statistical Review of the World Energy 2013).

2. Opportunities and Barriers

Natural Selection?

2. Opportunities

Both resources/natural prerequisites and demand are available

- Resources/Natural Conditions/Prequisites
  - Due to its vast territory and diverse geography and climate conditions Russia has an outstanding potential for renewables of all sort:
    - Solar in the sun-rich areas
    - Small scale hydropower: plenty of suitable rivers
    - Long coasts – though most of them are sparsely populated - allow to develop wind and marine wave technologies
    - Geothermal opportunities in certain areas,
    - Abundance of forest resources and agriculture products make it possible to develop diverse biofuels and generation

- Demand
  - In remote areas where conventional solutions are not possible or feasible, in cases where the centralised supply is not competitive or fails to deliver
  - There could be observed a growth of interest and a certain potential demand for renewables as a source of decentralised or complimentary energy for industries and business (in forest industry it is already in use)
  - Growing interest at the private consumer level for technologies that lead to reduced energy cost and combine with conventional/centralised sources (heat pumps, solar, bio)

2. Barriers

The whole national energy environment is rather unfriendly

- Administrative:
  - Bureacracy, i.e. really difficult to establish a generation of any kind, etc,
  - Lack of standards
  - Tariff policies that make longer term investment uncertain and risky
  - Artificially low tariffs for certain areas, types of energy, etc
- Geographical
  - Large distances from suitable areas to consumers
  - Big concentrations of the population in areas where renewables potential is limited.
- Economic
  - High cost of capital and poor availability of capital for renewables
  - Costly bureacratic requirements that are not tailored for such technologies

2. Barriers

The whole national energy environment is rather unfriendly

- Infrastructure
  - Grids are underdeveloped and overloaded in the areas of high consumption
  - Development of smart grids is in its infancy,
  - Access to common infrastructure and related regulations are really difficult and not considered for the renewables

- Other
  - Lack of public awareness and interest in the renewables and conservation issues
  - Small market size - poor availability of professionals, suppliers and service providers in the industry even in the populated and otherwise diverse areas
  - Lack of incentives and procedures from any level of the state, federal, regional or local.

3. Development Targets As Set by State

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3. The Russian Energy Strategy 2030 (introduced in 2009)

Electricity Production

	2005		2008		Stage 1		Stage 2		Stage 3	
	bn kWh	% of total	bn kWh	% of total	bn kWh	% of total	bn kWh	% of total	bn kWh	% of total
Electric power domestic consumption	941	-	1021	-	1041-2018	-	1315-1518	-	1740-2164	-
Electric power net exports	12	-	16	-	18-25	-	35	-	45-60	-
Electric power production, including:	**953**	**100%**	**1037**	**100%**	**1059-1245**	**100%**	**1350-1555**	**100%**	**1800-2210**	**100%**
Nuclear power plants	149	15.7%	163	15.7%	194-220	17.6-18.3%	247-282	18.2-18.3%	356-437	19.7-19.8%
Plants on renewables, including hydropower	**175**	**18.3%**	**167.5**	**16.1%**	**181-199**	**16-17.1%**	**224-240**	**15.4-16.6%**	**319-422**	**17.7-19.1%**
Combined heat and power production	277	29.1%	322	31.1%	299-423	28.2-34%	432-592	32-38.1%	620-873	34.4-39.5%
Thermal power plants	352	36.9%	385	37.1%	385-403	32.4-36.4%	441-447	28.3-33.1%	478-505	31.6-28.1%

End of Stage 1: 2013-2015
End of Stage 2: 2020-2022
End of Stage 3: 2030

Source: Energy Strategy of Russia until 2030 (published 2009)

3. Russian Energy Strategy 2030 (introduced in 2009)

Installed Capacity

	2005		2008		Stage 1		Stage 2		Stage 3	
	Million kW	% of total	Million kW	% of total	Million kW	% of total	Million kW	% of total	Million kW	% of total
Total installed capacity:	**216.3**	**100%**	**224.9**	**100%**	**239-267 (253)**	**100%**	**275-315 (295)**	**100%**	**355-445 (400)**	**100%**
Nuclear power plants	23.7	11.0%	23.8	10.6%	28-33	11.1-13.0%	37-41	12.5-13.9%	52-62	13.0-15.5%
Plants on renewables, including hydropower	**46.2**	**21.4%**	**47.2**	**21.0%**	**55-59**	**21.7-23.3%**	**66-73**	**22.4-24.7%**	**91-129**	**22.8-32.3%**
Combined heat and power production	67.1	31.0%	68.4	30.4%	67-83	26.5-32.8%	73-103	24.7-34.9%	100-148	25.0-37.0%
Thermal power plants	79.3	36.6%	85.5	38.0%	89-92	35.2-36.4%	98-99	33.2-33.6%	106-112	26.5-28 %

End of Stage 1: 2013-2015
End of Stage 2: 2020-2022
End of Stage 3: 2030

Source: Energy Strategy of Russia until 2030 (published 2009)

3. Mid-Term Indicators for Renewable Energy Development in Russia

Seem to Be Optimistic Forecast Considering Current Path of Development

Type of energy generation	Unit	2005	2010	2015	2020
Hydropower plants < 25 MW	Bn kWh MW	2.8 680	3.5 850	10.0 2,430	20.0 4,800
Wind power plants	Bn kWh MW	0.0097 12	0.21 120	2.6 1,500	17.5 7,000
Geothermal power plants	Bn kWh MW	0.4 71	0.6 90	2.0 300	5.0 750
Biomass power plants	Bn kWh MW	5.2 1,413	13.5 2,800	22.0 5,000	34.9 7,850
Tidal power plants	Bn kWh MW	0.00 1.5	0.00 1.5	0.024 12	2.3 4,500
Solar power plants	Bn kWh MW	0.00002 0.02	0.00003 0.03	0.002 1.5	0.018 12.1
Others	Bn kWh MW	0 0	0 0	0.08 20	0.5 250

Source: Russian Energy Agency

4. State as Facilitator

Still Learning the Basics

4. Role of State (1/2)

The Focus is on Direct Subsidies

- In **May 2013**, the Russian President Vladimir Putin approved a **subsidy program** to boost clean-energy generation with an estimated budget of **RUR 50 billion** (€ 1.14 billion) **until 2020**
- In **September 2013**, Russia for the first time offered state support for renewable energy by awarding subsidies to 39 clean power ventures via **specialized auction**
- The projects of **solar and wind generation** with a total capacity of 504 MW were selected
- **Solar power is the biggest area of support -** developers secured 399 MW out of the limit equal to 710 MW
- **Wind power was less successful** – below 100 MW of the limit of 1,100 MW
- The successful projects were selected on basis of the lowest costs of capital investment. For solar energy, the final bids were around € 2,500 per kW.
- Russia already has plans for a **second tender** to be held **in June 2014**:
  - aimed at projects between 2015 to 2018.
  - The limit will be set at 1,645 MW for wind, 496 MW for solar and 415 MW for small hydropower plants.

4. Role of State (2/2)

Other supporting measures

- **Easing Access to Grid For Renewables**. The local distribution companies are now obliged to buy “green” electricity and have a promise of compensation of loss that originates from its transmission.

- **Changes in Tariff Regulation and Practices**.
  - Capital and operation costs of green power are supposed to be included in the retail tariffs imposed by the regional energy agencies
  - The new law on regulation introduced recently - 28th May 2013, the Russian government issued decree #449: “About the mechanism of encouraging the usage of RES on the wholesale market for electric power and capacity”. This decree established a new RES-supporting scheme based on tariff compensations for the green electricity producers

4. Tariff Regulation Is Still a Struggle

There is a lot of controversy on capital costs used in tariff calculations

Type of energy generation	Proposal on capital costs for tariff calculation by the Ministry of Energy, € per kW	Capital costs adopted by Energy Wholesale Market Council, € per kW
Wind, up to 1 MW	3,132	1,495
Wind, from 1 to 25 MW	1,495	
Hydropower, up to 1 MW	7,923	6,610*
Hydropower, from 1 to 5 MW	3,818	3,268*
Hydropower, from 5 to 25 MW	3,818	3,818
Solar power, up to 1 MW	3,521	2,647
Solar power, from 1 to 5 MW	3,238	
Solar power, from 5 to 25 MW	2,647	
Biomass	2,856	2,250*
Biogas, up to 1 MW	6,181	3,269
Biogas, from 1 to 5 MW	5,187	
Biogas, from 5 to 25 MW	4,149	

** Not considering cost of connection to the grid*

Source: Vedomosti newspaper, documents of the meeting at Energy Wholesale Market Council (non-commercial partnership Sovet Rynka) dated 22.10.2013.
Note: RUR/EUR rate used in calculation = 44.00

5. Selected Cases

5. Beginning of The Trend?

Selected New Investments

Solar

- Avelar, a division of Renova Group, intends to build solar power plants with capacity not less than 100 MW wiin the Orenburg Region, Republics of Bashkortostan and Altai. The plants will require investment of about RUR 11 billion (about EUR 250 million) and are supposed to be launched by the year 2017. The assumed supplier of solar panels is Hevel, a JV of Rosnano and Renova.
- There are also a number of financial investors considering participation in green power projects, such as GazpromBank and RusEnergoInvest fund. Specifically, RusEnergoInvest fund plans introduction of solar power plant with capacity of 50 MW in the city of Kislovodsk, Stavropol Region, with estimated investment of RUR 4 billion (about EUR 90 million).

Small-Scale Hydropower

- RusHydro plans construction of Sengileevskya small HPP with capacity of 10 MW in the Stavropol Region.
- There are several small-scale hydropower projects planned by EuroSibEnergo, which controls Krasnoyarsk HPP and IrkutskEnergo, and KES Holding, which is a part of Renova Group.

Wind

- Vetroenergetisheskie Systemy (Wind Power Systems) is a new player in wind generation that plans to implement a wind power plant with capacity of 60 MW. The plant is to be placed in the Yeisk district of the Krasnodar Region; assumed investment - RUR 3.9 billion (about EUR 88 million).
- ZAO InterTekhElectro and Sowitec International GmbH launched a project of wind generation in the Kurgan Region (Western Siberia) with the planned capacity of 50 MW (25 wind generators). The production is supposed to be launched in the 2nd half of the year 2014.

5. Renewable as a Way of Coping with Energy Supplies in Remote Areas

Using Renewables Start to be a Solution in Isolated Energy Systems

- The Russian Far East is isolated from the country's major power grid, and independent distributed energy generation model is widespread.
- At present, there are more than 500 power plants working on diesel fuel in the Far East of Russia with total capacity of 670 MW.
- The construction costs of green energy plants in the Russian Far East are quite comparable with the ones of traditional large-scale units. Specifically, the solar power plants are estimated to cost EUR 1.8-2.2 kEUR per kWh – conventional generation could be even more expensive.
- By this time, the state controlled RAO Energy System of the Far East, the owner and operator of the major power assets in the region, has partially replaced diesel generation with renewables generation in more than 10 settlements of Saha-Yakutia and Kamchatka. The company has also implemented a number of pilot projects in the solar and wind generation as well as an experimental biofuel plant.
- RAO Energy System of the Far East has also plans to introduce 60 MW of green power generation by the year 2016 with further expansion of capacity up to 120 MW by the year 2020.

6. Final Remarks

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6. There Is A Long Way to Go

Development: planned or spontaneous?

- Early stage of development
- Convergence of costs of renewables and conventional modes of generation will certainly facilitate introduction of renewables in Russia
- Isolated and dispersed systems will be the first to see growth
- The Government started valuable work on creating the legal framework and rules of the game. However much more will needed to make a difference
- Private initiative and demand will be of crucial importance
- There is a chance of breakthrough and leap forward if certain conditions met (spontenously and, most likely locallly in the region with natural potential)

THANK YOU!