

2017/EWG/EGEEC50/011

#### Resource-Saving Power Supply - The Sustainable Development Basis of Remote Russian Regions with Low Population Density

Purpose: Information Submitted by: Russia



50<sup>th</sup> Expert Group on Energy Efficiency and Conservation Meeting Moscow, Russia 6-7 October 2017



Asia-Pacific Economic Cooperation



NATIONAL RESEARCH UNIVERSITY



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#### RESOURCE-SAVING POWER SUPPLY - THE SUSTAINABLE DEVELOPMENT BASIS OF REMOTE RUSSIAN REGIONS WITH LOW POPULATION DENSITY

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50<sup>th</sup> Meeting of APEC Expert Group on Energy Efficiency and Conservation (EGEE&C)

6 October 2015, Moscow



- Zones of decentralized energy supply the area of about 70% of the country's territory, where lives from 10 to 20 mil. people.
- The tariff rates for electricity are extremely high and in places exceed \$ 1/kWh.





### Power Potentials in Russia Wind Solar

It is estimated that Russia has large wind potential, its gross technical wind energy potential – 21850 billion kWh/year (H=100m).

Region	Power , mln. kWh	Thermal, mil. GCal	Power , tsd. κWh/ha	Thermal , tsd. GCal/ha
Russia	87 972 023.23	219 402.23	51.9892	0.22355
Republic of Adygea	26 148.76	112.44	33.5585	0.1443
Republic of Bashkortostan	528 390.46	2 272.08	36.9641	0.15895
Kemerovo region	1 717.68	9572.5	41.7301	0.17944
Yamalo- Nenets	37 928.89	76925.0	114.666	0.49306







### Animal Wastes, Plant cultivation Wastes, Peet, Hydro Power Potentials in Russia









## Energy, fuel and oil potentials of renewable energy sources in Russia

Technical potential						
RES types	Energy and fuel potential			Oil potential		
	Power	Heat	Fuel	Resource saving	Environmental	
	mil. MWh/year	Млн. Гкал/год	mil. toe/year	mil. t/year	CO-e, mil. t/year	CO <sub>2</sub> -e, mil.t/year
Solar energy	87747.7	202293.0	30060.7	21942.1	27425.7	65826.4
Wind energy	17100.9	39645.0	5891.2	4300.2	5374.8	12900.5
Bioenergy	2896.9	5783.6	859.4	627.3	784.1	1882.0
Geothermal energy	246592.9	571677.3	84951.3	62008.2	77504.7	186024.6
Low temperature heat	34753.2	80568.6	11972.5	8739.0	10923.0	26217.1
Small hydropower	584.5	1355.1	198.7	145.1	181.3	435.2

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# Coal and gas potentials of renewable energy sources

Technical potential							
Res types	Coal			Gas			
	Resource saving	Environmental		Resource saving	Environmental		
	mil. t/year	CO-e, mil. t/year	CO <sub>2</sub> -e, mil. t/year	bln.m³/год	CO-e, mil. t/year	CO <sub>2</sub> -e, mil. t/year	
Solar energy	39141.6	861099.3	117424.8	25969.0	5401.8	51938.0	
Wind enrgy	7670.9	168756.6	23012.7	5105.1	1061.9	10210.1	
Bioenergy	1119.1	24619.1	3357.2	744.8	154.9	1489.5	
Geothermal energy	110613.6	2433455.1	331840.8	73614.6	15312.5	147229.2	
Low temperature heat	15589.2	342955.7	46767.5	10374.8	2158.0	20749.5	
Small hydropower	258.8	5693.0	776.3	172.2	35.8	344.4	



### **RES projects in remote regions**





Case study of resource-saving and environmental impact of energy-efficient houses construction

Indicator	Indicator's characteristics		
Location of the settlement	Turukhansk district of the Krasnoyarsk Territory, the Far North		
Population	2500 persons		
Number of heated buildings	150		
Average air temperature in January	- 26-32°C.		



### Results of resource-saving and environmental assessment of energyefficient houses

NՉ	Indicator	Standard house	Energy- efficient house	Saving
1	Power consumption per unit area, kWh/m <sup>2</sup> ·year	400	70	330
2	Consumption of thermal energy, Gcal/year	4000	700	3300
3	Consumption of coal, t/year	8482.8	1484.5	6998.3
4	Nitrogen dioxide emissions, t/year	31.98	5.60	26.38
5	Emissions of nitric oxide, t/year	5.20	0.91	4.29
6	Emissions of sulfur dioxide, t/year	76.35	13.37	62.97
7	Emissions of carbon monoxide, t/year	129.97	22.76	107.20
8	Emissions of inorganic dust containing SiO <sub>2</sub> 20-70%, t/year	1249.08	218.75	1030.33
9	Soot emissions, t/year	164.00	28.72	135.28



# Structure of the model for optimizing the design of energy efficient houses





### Structure of the model for optimizing the design of energy supply system





- 1. Existing renewable energy potentials in Russia may be explored for achieving the multi-sectoral gains.
- 2. The social implications of renewables include better quality of life in remote Russian regions with low population density.
- 3. Proposed models can serve as a universal tool for solving complex investment problems of designing resource saving generating complexes as well as energy efficient houses.



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### Thank you!

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