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The future of renewable energy and a renewable energy system in Russia

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Presentation outline

- Russia's energy mix and an outlook
- The history of renewables deployment. Drivers and barriers
- Electric power industry and renewable energy scenario analysis
- The impact of COVID-19 pandemic
- Recommendations and future actions



Russia's energy mix is dominated by natural gas







Russia's power generation is dominated by thermal power plants





Russia's CO₂ intensity is higher than in most developed countries

CO₂ emissions from fossil fuel combustion per \$1,000 of GDP (in 2010 prices) (purchasing power parity), by country (kg)





Russia's wind potential is highest in Krasnoyarsk region, Republic of Sakha, Yamalo-Nenets, Chukotka, Nenets, Krasnodar, Altai, Saratov, Rostov, Volgograd and Orenburg regions

Annual specific technical potential of wind energy (N=100 m; MWh/year)





Russia's solar potential is highest in in the South-West (Northern Caucasus, Black and Caspian Sea regions), Southern Siberia, and the Far East

Total annual solar radiation in Russia (optimally oriented surface, kWh/sq. m per



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Power generated at qualified renewable power plants at wholesale and retail markets, with certificates, thousand kW/h





There is a policy mix in place to support wider application of RES

- 2008: the Russian Government decree setting the rules for power generation unit to qualify as RES-based
- 2013: Government decree to supporting the use of renewables at the wholesale power and capacity market: RES support scheme (PPA) (2014-2024, 6 GW target)
- 2013: the Russian Government Decree that aims at increasing the energy efficiency of the electric power industry through renewables until 2020
- 2014: the Russian Government decree setting the rules for registry of renewable certificates
- 2015: the Russian Government decree introduced tools to support biogas, energy biomass, landfill gas, and other renewables on retail electricity markets, including the definition of regulated long-term prices (tariffs)
- 2016: a roadmap to promote the development of 7 smart grid and Internet of Energy markets (Energy.Net) in the scope of the National Technology Initiative
- 2019: Federal Law amending the "Law on Electric Power Industry" with regard to microgeneration (allowing to sell excessive power below 15 kW to the grid)
- 2021: extended RES support program (PPA) (2025-2035, 6 GW target)



The impact of the pandemic on the energy industry has been moderate

- Lower energy generation and consumption, lower energy prices
- Decrease in the energy companies' revenues; power companies had to cover cash shortages by credits, increasing their debt burden
- Industry dependence on imported equipment, currency fluctuations aggravated associated technological and security risks
- Non-payments and deferrals due to more bankruptcies, higher poverty, and government economy support measures
- Temporary prohibition to disconnect consumers for nonpayments
- Faster digital transformation in the energy industry



Russia's 2040 energy outlooks differ substantially

ERI RAS & Analytical Center scenarios (2018-2040):

- The total primary energy consumption will increase by 12–13 %
- Natural gas will remain to be the dominant fuel: it's share will raise from 54 to 57% of the total primary energy consumption.
- Liquid fossil fuel will decrease from 21 to 17-15%
- Solid fuel will decrease from 17% to 13-9%
- Low-carbon energy sources (RES, hydro, nuclear) will grow from 10% to 19%

BP scenarios (2050):

- By 2050 primary energy consumption will decrease by 1-11%, the share of renewables will grow to 4-48%, net CO₂ emissions will decrease by 24-92%
- Natural gas will remain the dominant energy source constituting 57-23%
- The demand for oil and gas will not change in *BaU*, decrease by 39% in *Rapid* scenario and by 64% in *Net Zero* scenario
- The demand for coal will decrease in all scenarios up to zero
- Nuclear power will grow by 17-94% (up to 13% in energy balance)

Sources: ERI RAS, Analytical Center, 2019; BP, 2020



Russia's renewable energy outlook 2030 is more ambitious that government targets

Renewables share in the energy balance, %							
	Scenario 1: New energy paradigm (3D)	Scenario 2: Relying on hydrocarbon exports	Scenario 3: The worst forecast comes true	Scenario 4: Centralized diversification			
Globally	25	20	17	25			
In Russia	10	5	3	8			

Russian strategy documents (name and date of adoption)		Renewable targets			
November 2009	Energy Strategy until 2030	Up to 25 GW			
July 2015	The basic provisions of the energy policy by	4.5% until 2024 (wind up to 25GW,			
	the Russian Government	solar up to 50 GW)			
June 2017	General Development Plan of the Russian	11.6 GW			
	Power Sector until 2035				
February 2018	Energy Strategy until 2035 (draft)	Increase the volume of renewable power 20 times to 46 bn kW/h			
June 2020	Energy Strategy util 2035	Lower the costs of 1 kW/h in off- grid areas by 6% (2024), by 17% (2035) compared with 2018			
12 Source: Proskurvakova, Ermolenko, 2019					



The pandemic and latest changes impact the renewable energy outlook 2030

Indicators / Scenarios	Conservative scenario	Smart Energy scenario	Recurrent COVID-19 scenario	One More Wild Card scenario	
Economic growth (% per year – on average until 2030)	2.5-3.0	3.0-3.5	1.0-1.5	0-0.5	
Inflation (%, on average - per year until 2030)	4	4	6	7	
Domestic demand for electricity (TWh by 2030)	1.207	1.241	1.146	1.032	
Installed capacity of power stations, centralized power systems (GW by 2030)	254	274	234	224	
The share of electric energy produced by the consumers (companies) (%)	7	12	11	14	
Installed capacity of renewable power plants (GW by 2030)	6.3	14.5	5.5	5.5	
Poverty level (%)	6.45	5.5	10	13	
13 Source: Proskurvakova et al., 2021					



Electricity consumption could drop only under the worst scenario





The installed capacity will not increase substantially due to capacity surplus

Installed capacity of power stations, centralized power systems, GW





Renewables will continuer to grow from a very low base

Installed capacity of renewable power plants in Russia, GW



Recurrent COVID-19 scenario and The One More Wild Card

----Smart Energy Scenario



Russia's prosumers will become a challenge for centralized power supply

The share of electric energy produced by the consumers (companies), %





Challenges and barriers are structural, technological and context specific

- Surplus of installed capacity in the country
- Management strives to have 100% back-up facilities for RES-based power plants, while Russia's national grid faces a problem of unloading power plants at night-time and summer time, as well as low capacity factor of thermal power plants (less than 49% of calendar time)
- Insufficient density of electric grids significantly limits the scope for a free flow of electricity
- Monopolistic renewable energy market (2 large players in solar and 2 large players in wind energy)
- Little domestic R&D and intellectual property (royalties drain abroad)
- Lack of plants for equipment manufacturing
- Fast localization requirement may distort the market and reinforce other barriers



The way forward

- Qualitative (structural) changes in the industry: full decommissioning of old power plants, radical reduction of coal-fired generation, and launching an ambitious modernization program
- Market competition in the economy, energy industry, and renewable energy sector should be reinforced
- Localization plans my be revisited
- Ambitious R&D programs should be put in place
- Russian extractive industry companies will have to diversify and restructure
- Grid companies should improve relay protection, automation, and accident prevention systems, given the growing share of distributed power plants



Thank you for your attention!

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