Innovation in energy: what are the prospects?

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THE ENERGY RESEARCH INSTITUTE
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АНАЛИТИЧЕСКИЙ ЦЕНТР
ПРИ ПРАВИТЕЛЬСТВЕ
РОССИЙСКОЙ ФЕДЕРАЦИИ

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GLOBAL AND RUSSIAN ENERGY OUTLOOK 2016

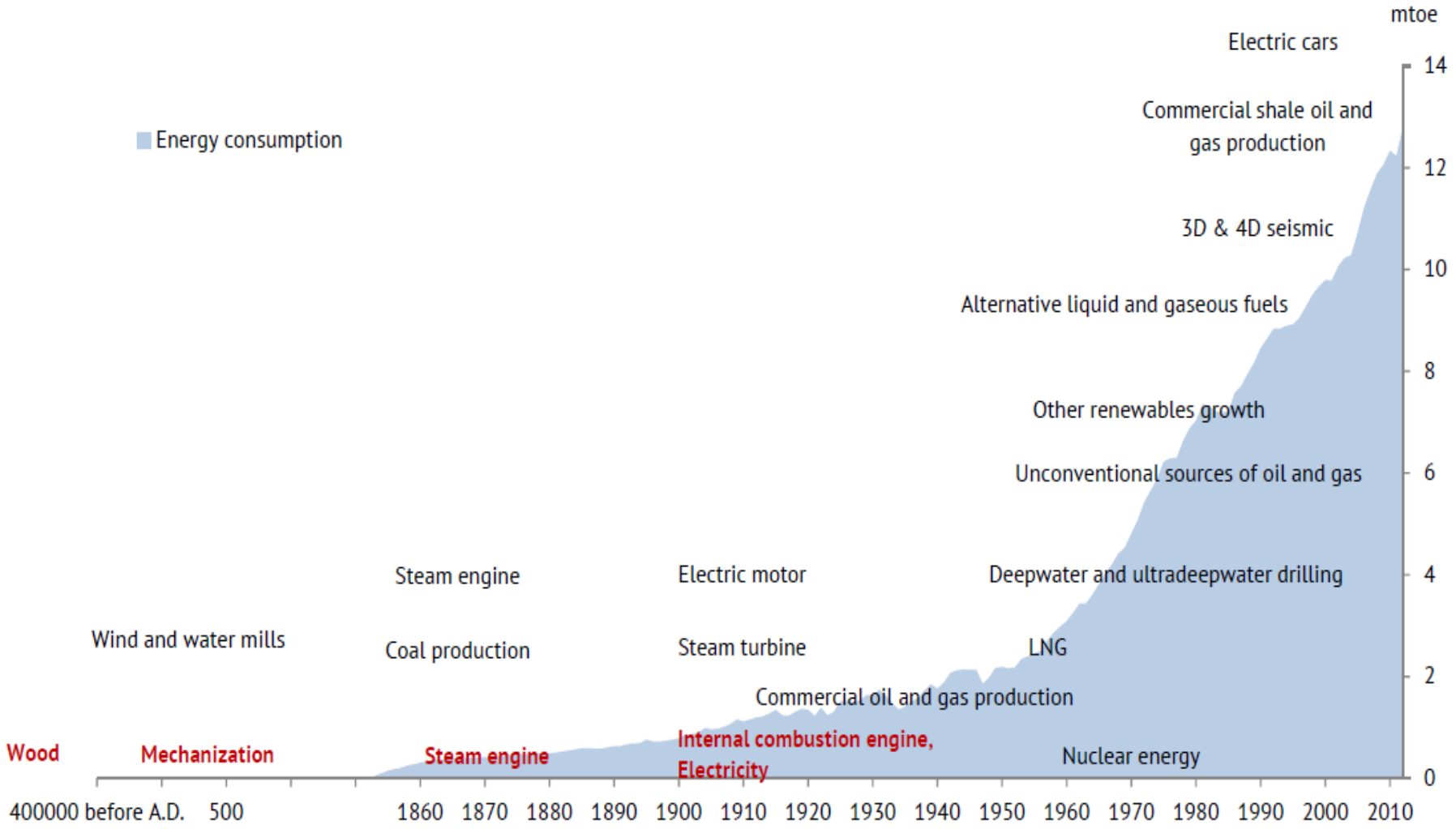
MOSCOW 2016

- **Favorable**(high economy, low risks, technology and capital transfer)
- **Probable** (BAU)
- **Critical** (economic slowdown, many local conflicts, increasing economic and technological gap between the countries)

Scenario Matrix

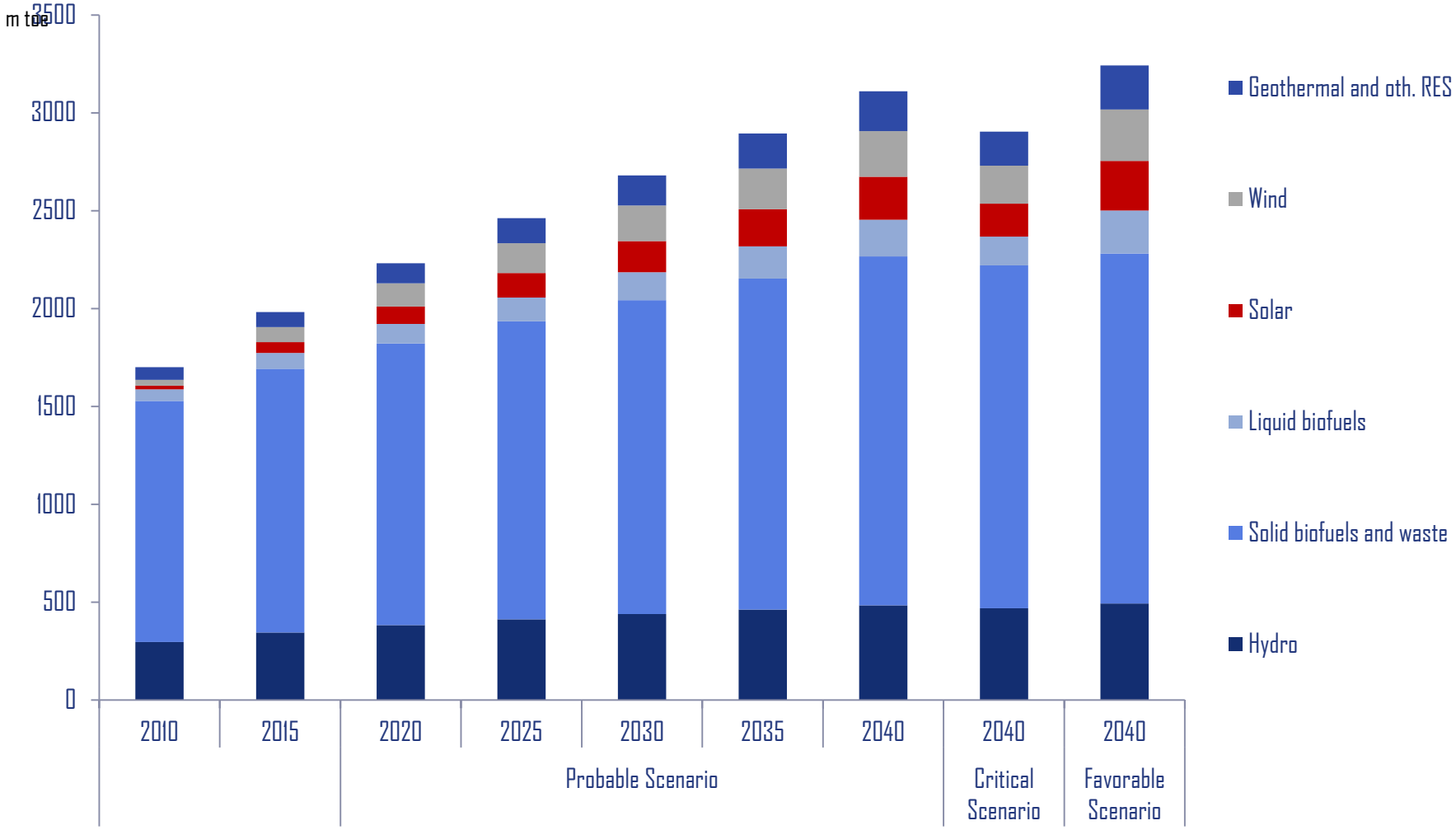
	Favorable	Probable	Critical
Global population	9, 2 bln. by 2040		
Global GDP AAGR	3,4%	2,8%	2,1%
Geopolitical risks	No conflicts	Few local conflicts	Many local conflicts
State energy policies	New plans and methods.	Partial implementation of the existing plans.	Current plans are not implemented.
Global CO2 quotas trade	Global trade is emerging	No global market, but regional trade is developing successfully.	No development
New technologies	No technological revolutions. Several technological breakthroughs, but only for the technologies that are being tested currently.		
Technological transfer	Unlimited	Limited	No transfer, new technologies develop only in OECD and in China

History of technological revolutions and breakthroughs*



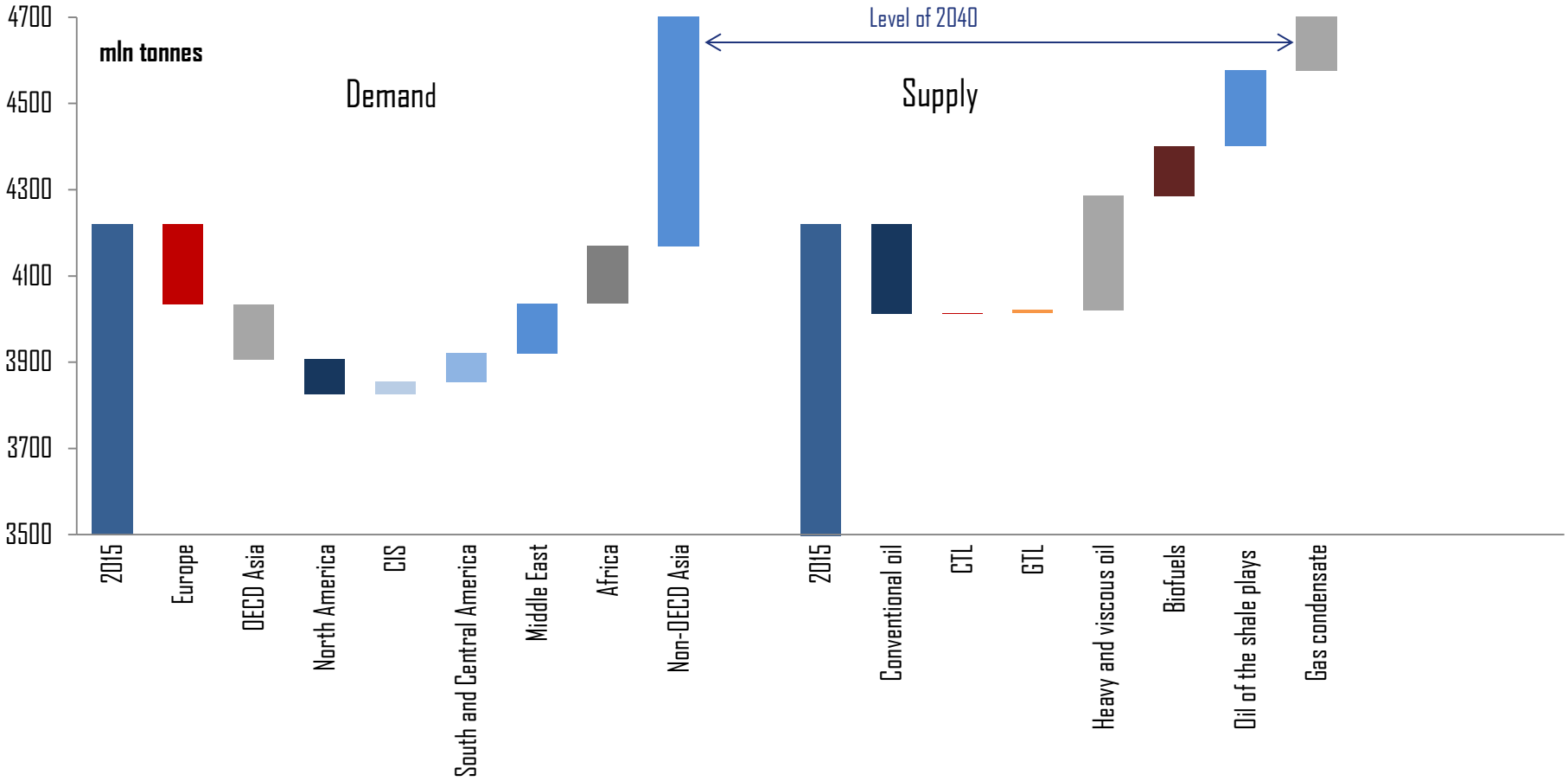
** Technological revolutions are shown in red, breakthroughs – in black.*

Noncarbonated consumption for three scenarios
from 18% in 2015 of total consumption up to 24-25% in 2040



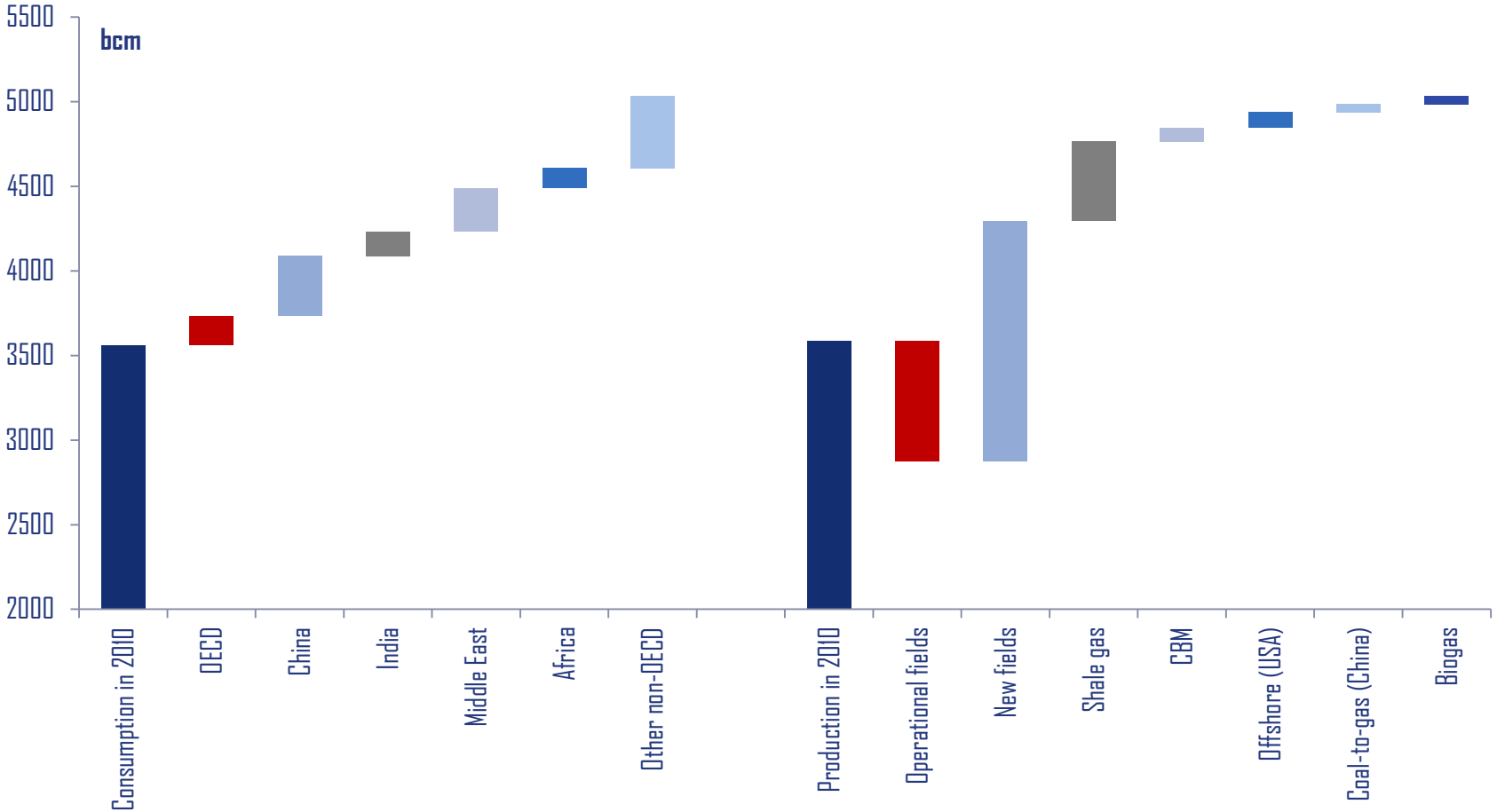
Source: Global and Russian Energy Outlook-2016, ERI RAS-AC

Liquid fuel supply-demand balance by the region and by the type of supply source, Probable Scenario - 15% of unconventional production



Source: Global and Russian Energy Outlook-2016, ERI RAS-AC

Gas supply-demand balance by the region and by the type of supply source, Probable Scenario - 14% of unconventional production



Source: Global and Russian Energy Outlook-2016, ERI RAS-AC

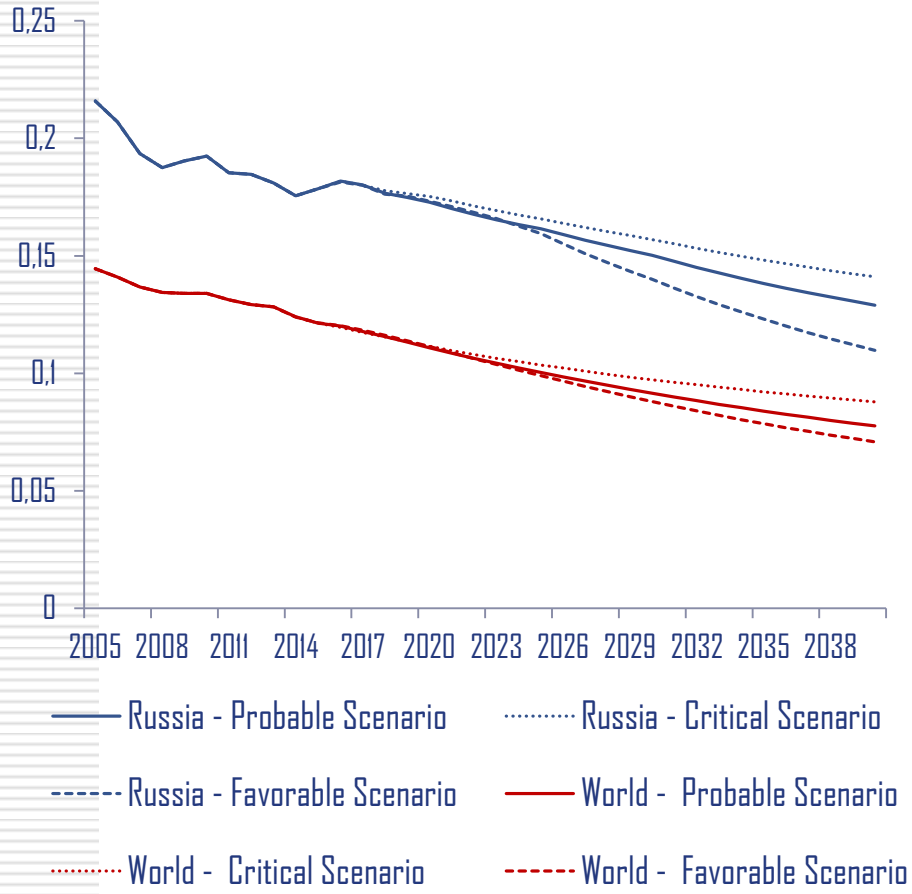
Russian energy sector has several important features

- **Russian economy has 2,5 higher energy intensity than the world average, it`s energy investments share in GDP is 3-3,5 higher (5% of GDP compared to 1,5% world average) and it is less sensitive to the climate change**
  - High availability of relatively cheap energy - 15% of world reserves and just 2.8% of the global population
  - The coldest and extended (11 time zones) country with a low population and energy infrastructure density (4 and 7 times less respectively than the US)
  - Relatively cheap energy at the price of capital which is 2-3 times higher
- **Russian technological priorities in the energy sector:**
  - Energy efficiency and energy saving
  - Less capital intensive technologies
  - Distributed energy
  - Efficient ways of energy resources transportation and transmission
- **Russian energy outlook for 2015-2040:**
  - Energy consumption growth by 10-20%
  - Energy production growth by 0-15%
  - Energy export growth by -10% - +10%

Energy conservation

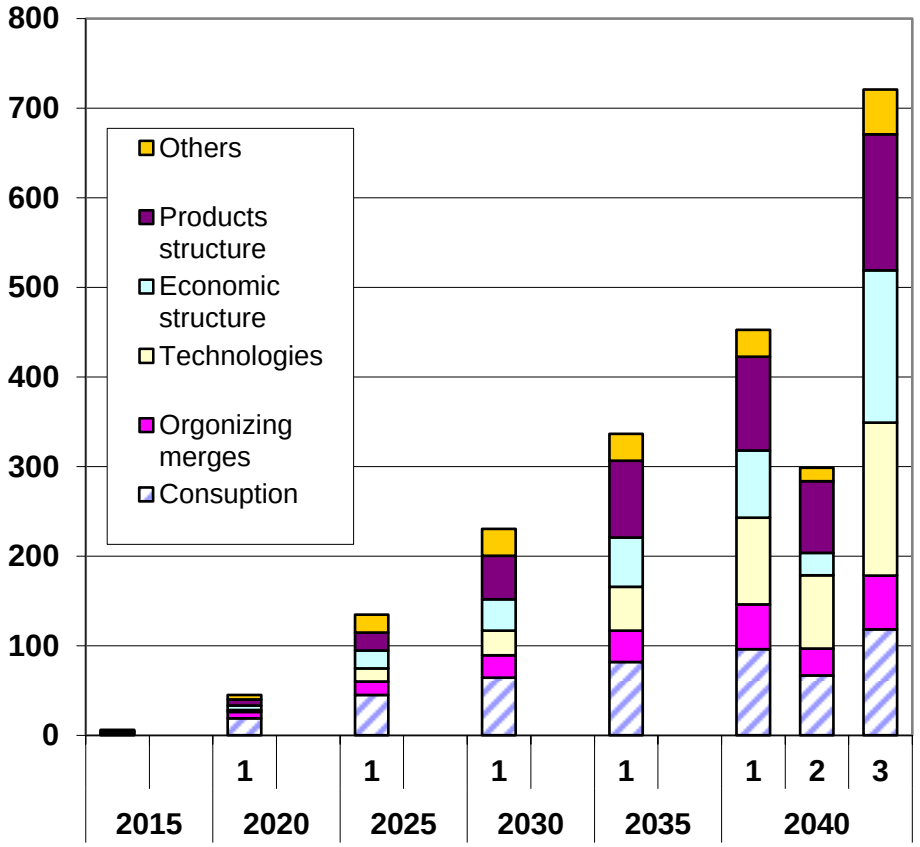
GDP energy intensity,

kg oe/USD2014 г.



Energy conservation, m toe

Scenarios: 1-probable, 2-critical, 3-optimistic



Energy substitution in transportation

	2015	2030	2040
		3	12
Electricity for transportation, TWh	1,0	13	52
		0,4	2
Share of mobile park, %		2	8
		1	2
Substitution for motor fuels, m toe		2	7

	2015	2030	2040
		4	8
Gas for transportation, Bcm	1,0	5	11
		4	14
Share of mobile park, %	0,9	6	22
		4	13
Substitution for motor fuels, m toe	0,8	5	16

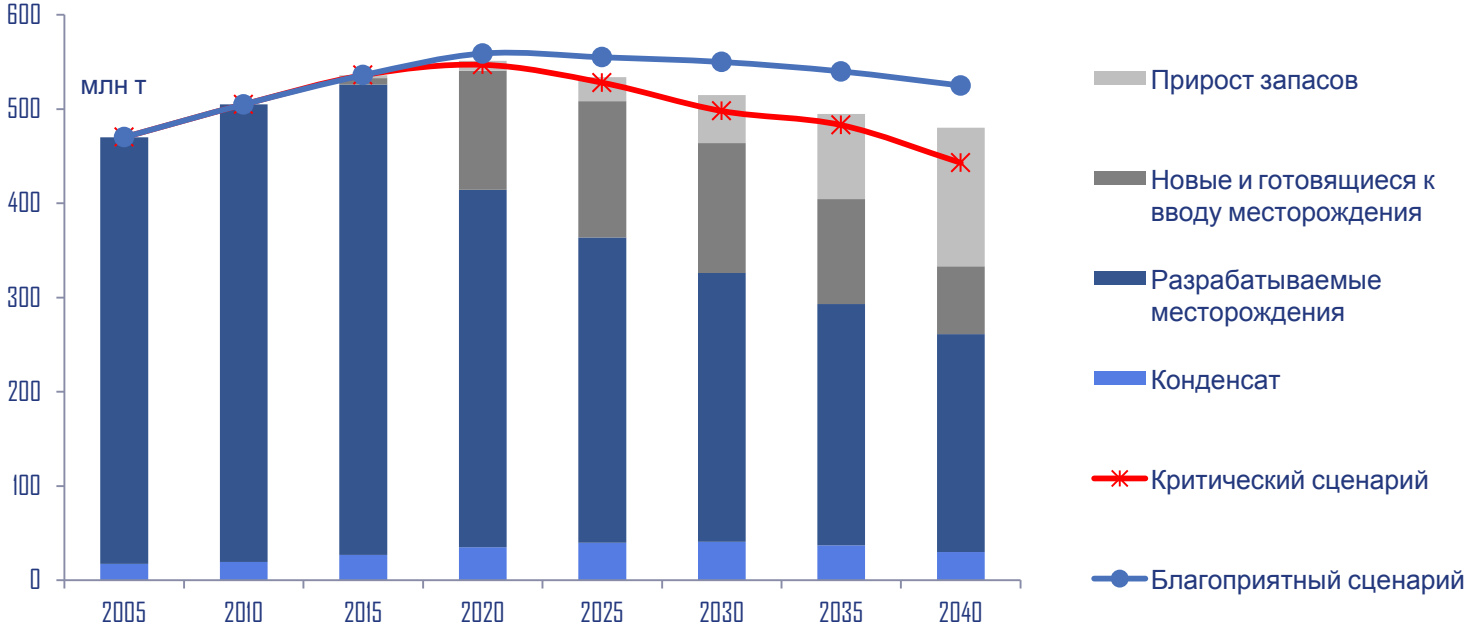
Substitution in Electricity production

	2015	2030	2040
		4	12
Electricity storages, TW	1,0	12	40
Share of electricity capacity		11	37
grouse, %		32	67
		18	27
Renewables, m toe	11	32	67
Share of primary energy		7	14
consumption grouse, %		20	51
		99	105
Hydro & nuclear, m toe	81	105	115
Total increasing of fossil fuels		**14**	**26**
consumption grouse, %		**22**	**50**

Petroleum industry

The main industry objectives:

- efficiency increasing of producing fields development – up to 70-85 m t in 2030;
- development of heavy and highly viscous oil fields - up to 27-105 m t in 2040;
- development of arctic & others off shore fields - up to 20-45 m t in 2030 & 30-60 in 2040;
- increasing of oil refinery depth from 76% in 2015 to 92-94% in 2040 with production of high quality petroleum products.



Main innovations for petroleum industry

Priority directions of technological development:

1) efficiency increasing of producing fields development including

- highly efficient well drilling and stimulated completion of producing formations;
- horizontal drilling along the formation profile;
- increasing of oil production factor by means of complex physical and chemical impacts on the fluid and enclosing rocks;
- “Smart well” and “Smart field”;
- early troubleshooting of equipment and remaining life time forecasting.

2) Development of heavy and highly viscous oil fields:

- technology of heavy and highly viscous oil grades production;
- technology of heavy and highly viscous oil grades transportation.

3) Development of shelves of Arctic seas including

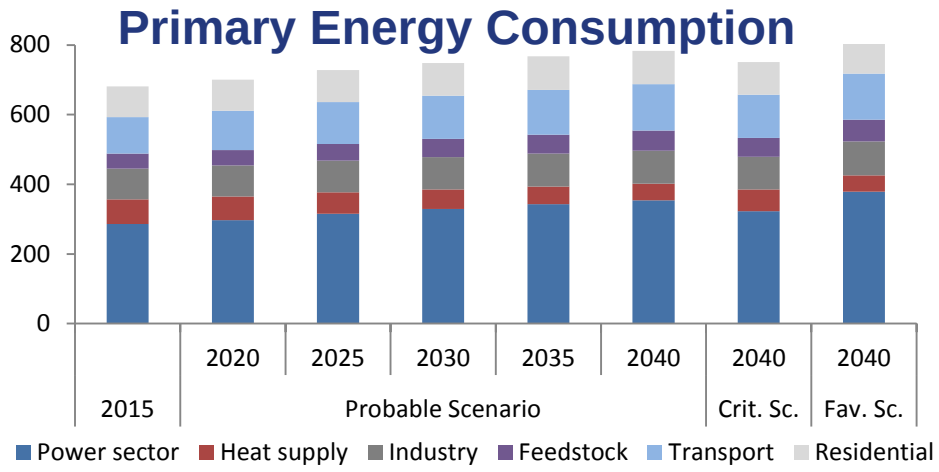
- deep water drilling and oil extraction from the ice resistant platforms;
- underwater (subglacious) remotely controled production complexes; *
- power supply systems of underwater facilities, including ones based on nuclear reactors of small capacity and thermoelectrical (thermo emission) converters;*
- effective technologies of oil spill response in icy conditions at low air temperatures.

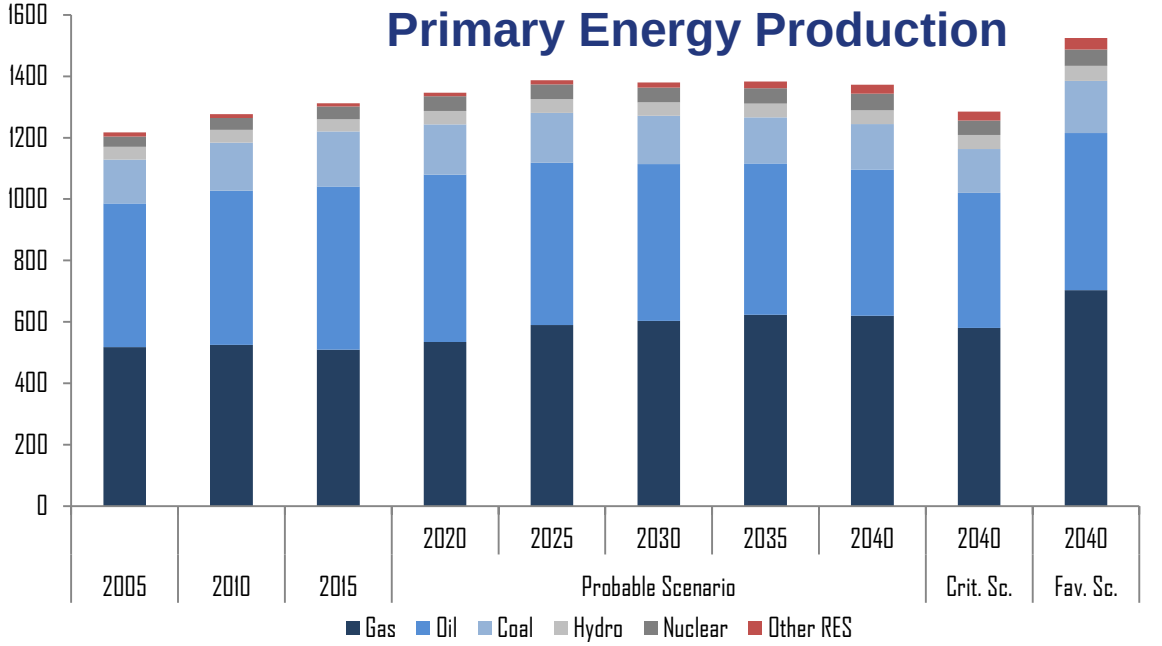
4) **Deep oil refining**

- oil deep destruction technology with production of high-quality oil products;
- processing of heavy and highly viscous oil types;
- locally produced catalysts of oil refinery processes.

* The application technologies in the long term outlook (at high oil prices and high demand of russian oil in world markets). Their development requires high costs.

Russian energy perspectives, m toe





THANK YOU FOR ATTENTION

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