Russian energy sector forecasting.

Energy Research Institute
Russian Academy of Sciences

ERI-ENEL meeting

Moscow, February 18, 2014

ERI RAS – experience in system energy studies

Energy Research Institute of the Russian Academy of Sciences (ERI RAS) was established in 1985 for the fundamental studies in the area of national energy policy development and implementation:

✓ state level - methodological, modeling and analytical support for the energy policy priorities and implementation mechanisms (incl. macroeconomic, technological, pricing, environmental and other aspects), quantitative elaboration of the economy and energy sector scenarios in the context of Energy Strategy

- ***Ministry of Energy, Ministry of Economic Development, Ministry of Natural Resources, Federal Antimonopoly Service***

✓ corporate level – capacity building, modeling and information support of the strategic planning system of leading energy companies, justification of investment and market policy under the energy markets transformation processes

- ***Gazprom, Gazexport, NovaTEK, Mezhregiongas, Wintershall, Roneft, TNK-BP, SUEK, RAO EES Rossii, SO-UPS, Rosenergoatom, Fortum, Gazenergoholding***

ERI RAS – experience in system energy studies

1. Addition and revision of the USSR ENERGY PROGRAM – 1986-1989
2. Integrated USSR SCIENTIFIC AND TECHNICAL PROGRESS PROGRAM – 1985-1989
3. CONCEPT OF RUSSIAN ENERGY POLICY under the new economic conditions – RF Government resolution 10.09.1992 №26.
4. ENERGY STRATEGY of Russia – RF Government resolution 13.10.1995 №1006.
5. ENERGY STRATEGY of Russia to 2020 - RF Government resolution 28.09.2003 №1234-p.
6. ENERGY STRATEGY of Russia to 2030 – RF Government resolution 13.11.2009 № 1715-p.
7. **New revision of Russian ENERGY STRATEGY TO 2035 – under development, 2013-2014**

8. Reform of the Russian ELECTRIC POWER SECTOR. World Bank-RF Ministry of economy – RF President decree 28.04.1997 № 426.
9. Reform of GAS DISTRIBUTION sector in Russian Federation. World Bank – RF Ministry of fuel and energy – 1999-2001

10. GENERAL PLAN for power sector development and distribution to 2020 - RF Government resolution от 22.02.2008 г. 215-p.
11. GENERAL PLAN for power sector development and distribution to 2020 and for 2030 prospect – RF Government protocol 3.06.2010
12. Russian power sector modernization program to 2020 – will be considered by RF Government 27.09.2012

13. GLOBAL AND RUSSIAN ENERGY OUTLOOK to 2035 – yearly forecast since 2012

Actual problems of the energy sector forecasting

At present the understanding and proper accounting of the diversity and dynamics of internal and external relationships of energy industries became more and more important and complicated

- ✓ global energy markets
- ✓ macroeconomic trends and solvent demand
- ✓ new technologies in energy sector and energy consumption
- ✓ energy balances
- ✓ domestic energy markets: competition and regulation
- ✓ financial balances of energy companies and investment resources
- ✓ long-term (after-) effects from implementation of investment decisions in energy sector
- ✓ environmental and social externalities

Key actors at the energy markets must have their own strategic vision of the through the modeling of “energy future”

National Energy Modeling System

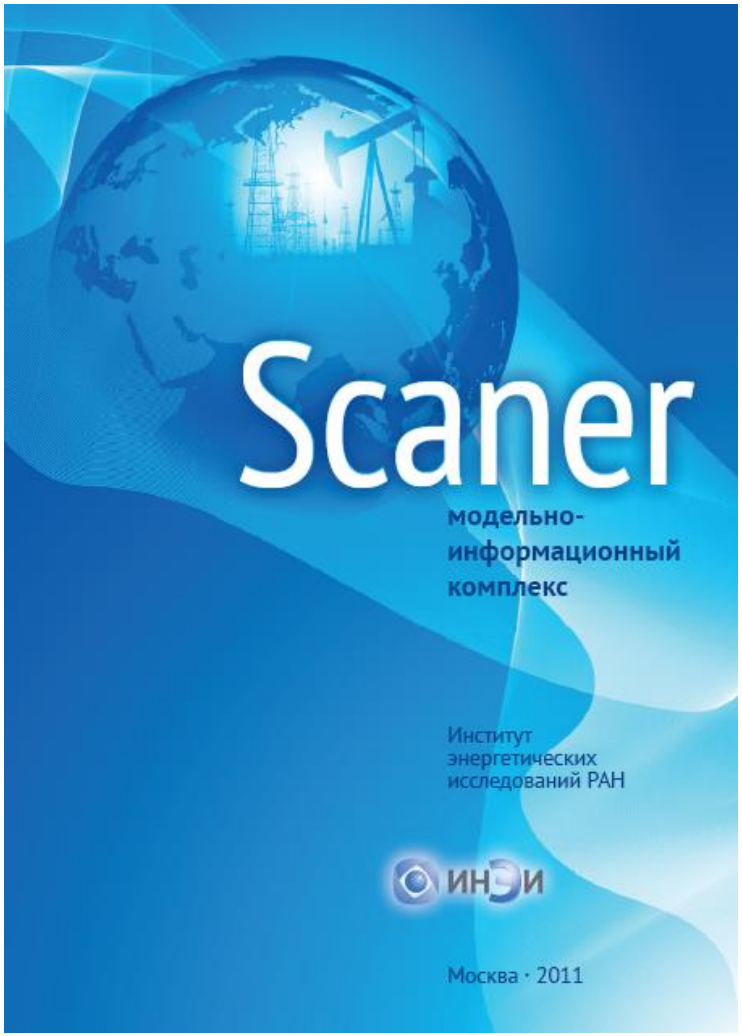
System for Analysis of Global Energy Markets

GEM + PRIMES

Times Integrated Assessment Model

SCANER

SCANER – multi-functional system of models for the investigation of the global and Russian energy sector development



«SCANER» is a tool for the system analysis of the Russian energy sector development for the mid- and long-term prospects (to 2030-50) as an important part of national economy and global energy markets. Integrating the powerful modeling and informational resources, SCANER provides:

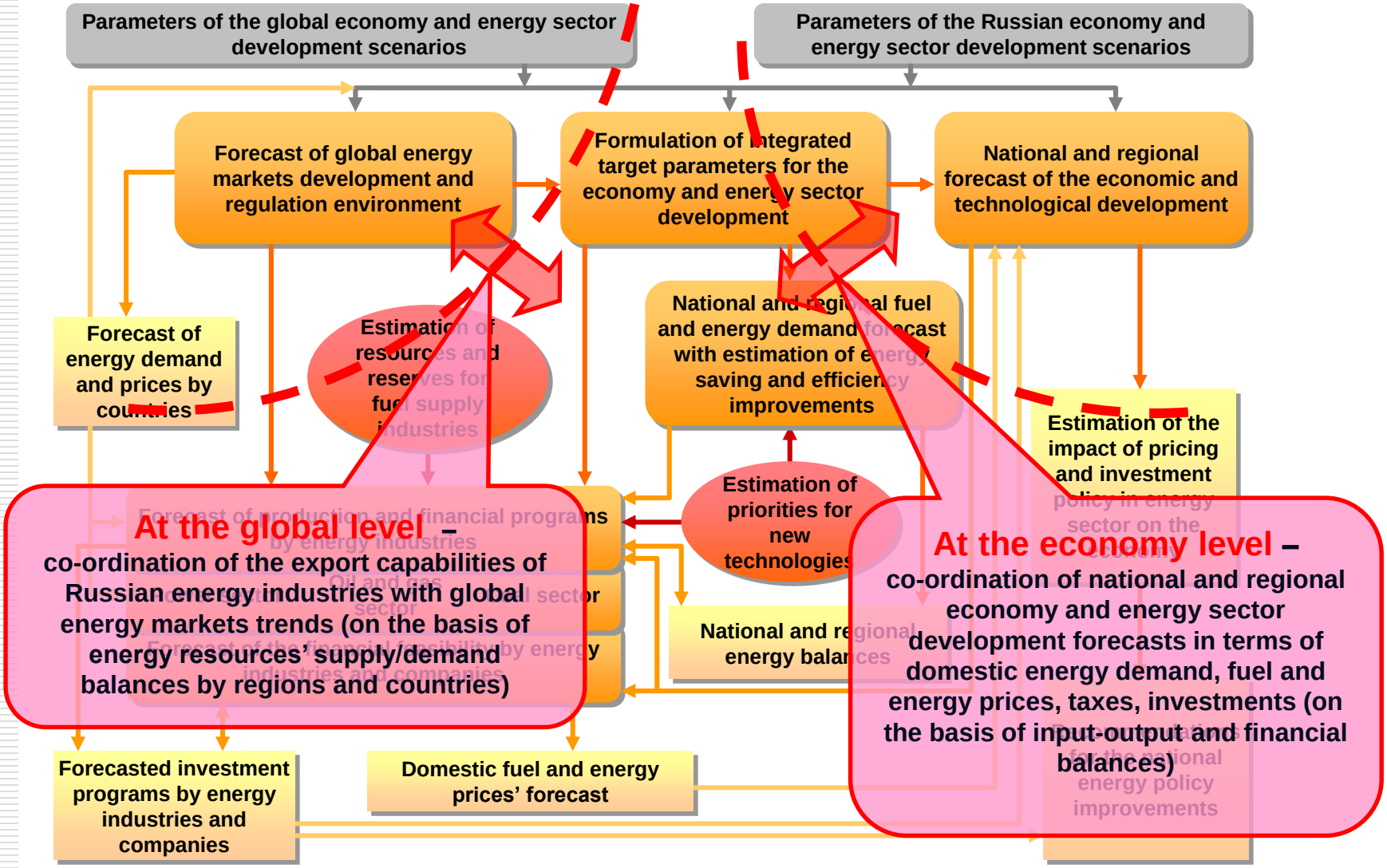
✓ Unique informational support to the analysis and forecasts (regularly updated databases on the national and regional economy, energy sector, energy balances and markets)

✓ Multi-level co-ordination system of energy forecasts focused on the formulation of rational variants of the economy, energy sector and energy companies' development

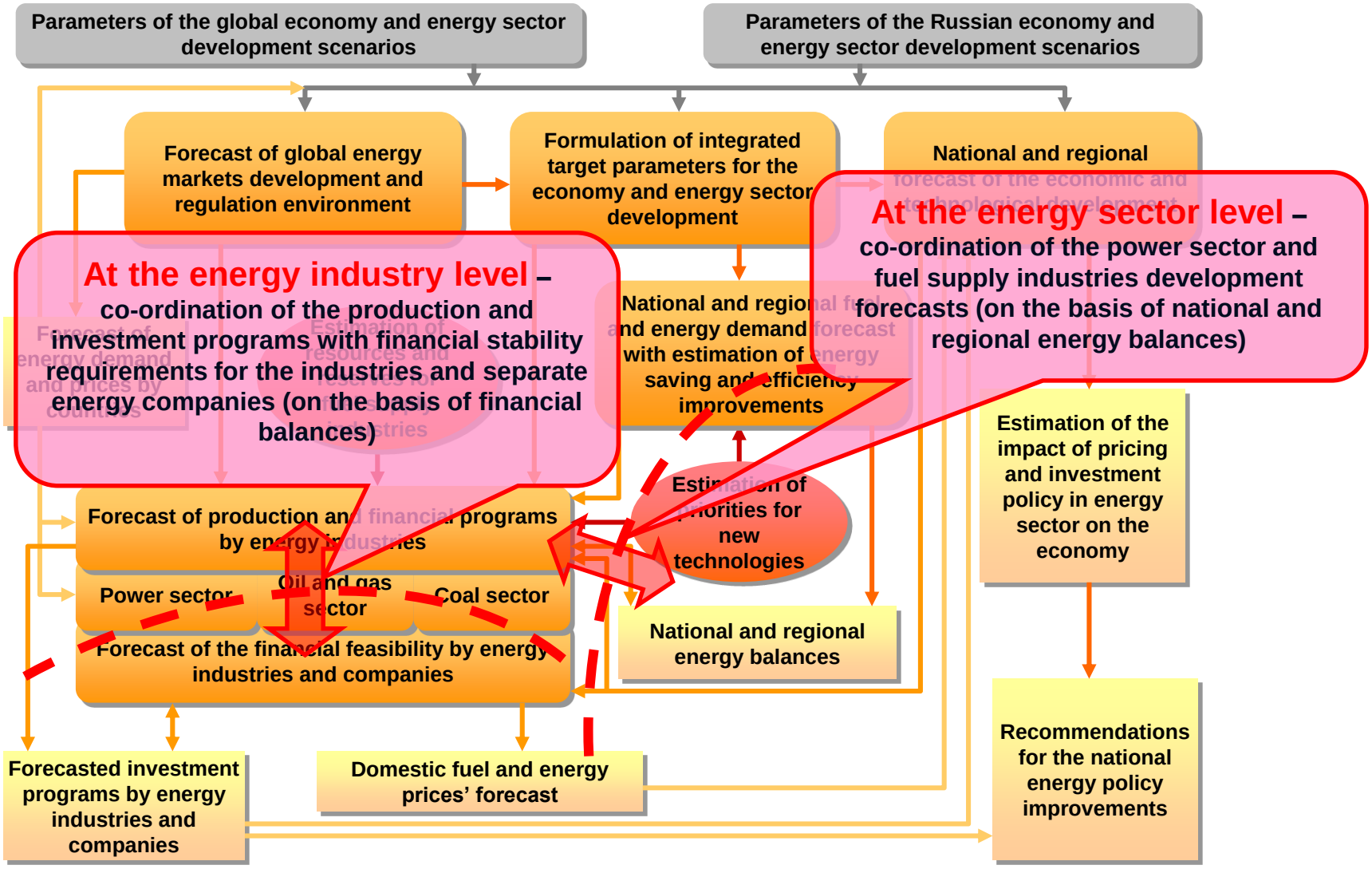
✓ Huge flexibility and fast adaptation of the models and their calculation modes under the separate forecasting requirements

RU&EN versions are available at www.eriras.ru

SCANER – multi-level co-ordination of energy forecasts

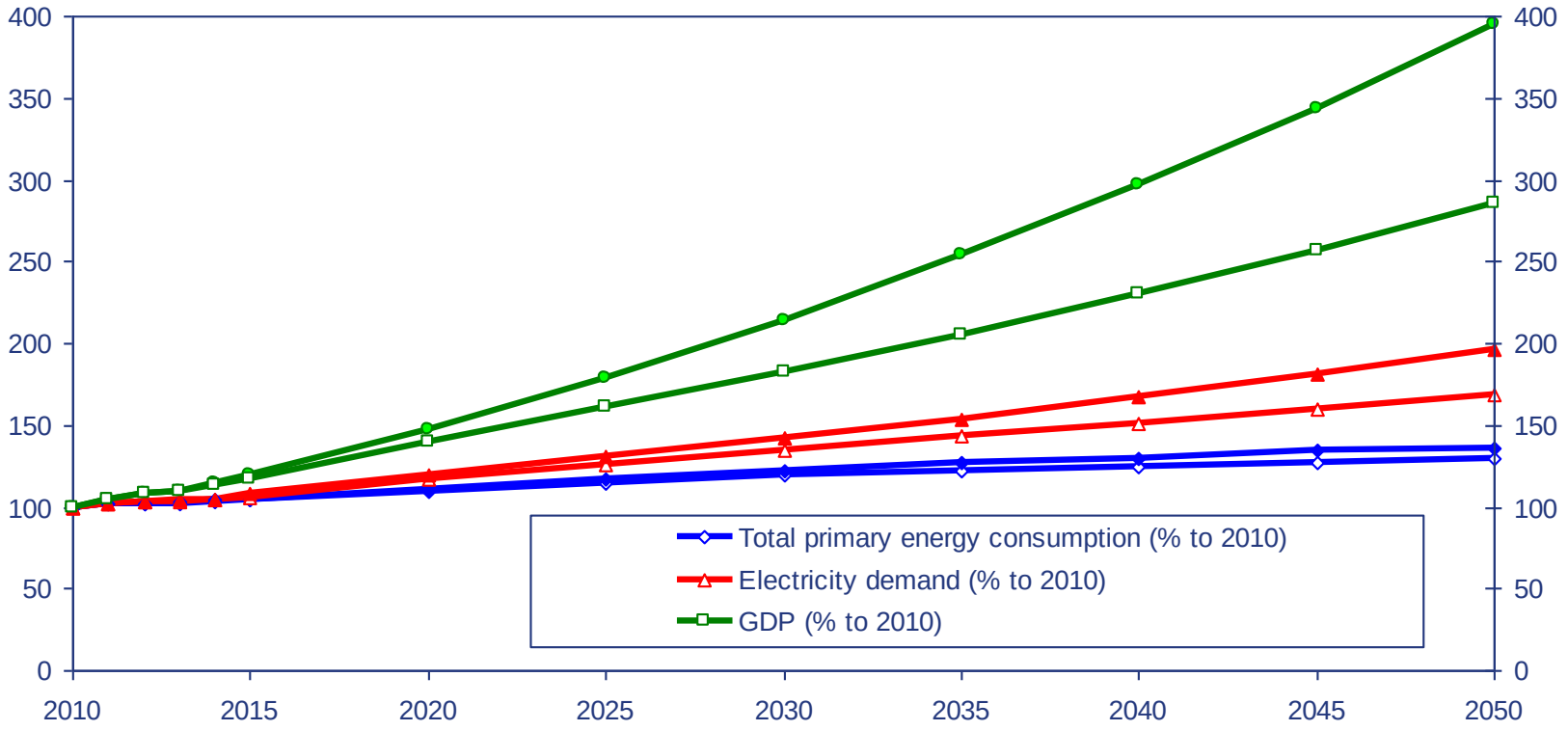


SCANER – multi-level co-ordination of energy forecasts



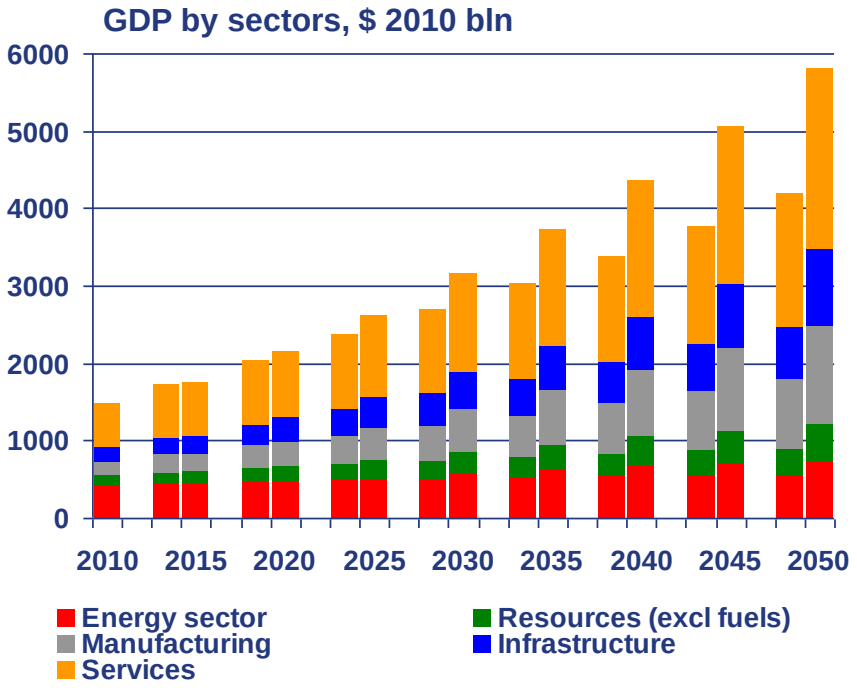
Russian energy sector to 2050.
Economy and energy demand growth

Innovative scenario of the Russian economy assumes 2,5 times GDP growth to 2035 and 4 times to 2050. External and internal threatens may slow this growth at 20-25% (2 times to 2035 and 2,9 to 2050)



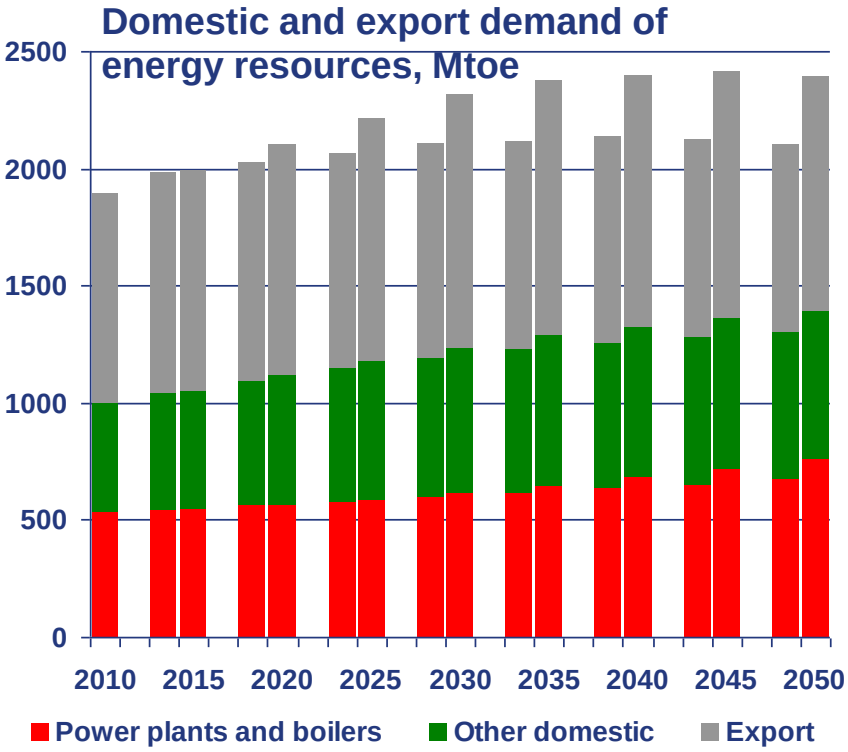
Energy efficiency decrease twice to 2035 and 3 times to 2050 and will suppress domestic energy growth at 22-27% to 2035 and 29-37% to 2050. Electricity consumption will rise faster (at 43-54% to 2035 and in 1,7-2 times to 2050) due to the increased substitution of other energy carriers

Russian energy sector to 2050. The role of energy sector



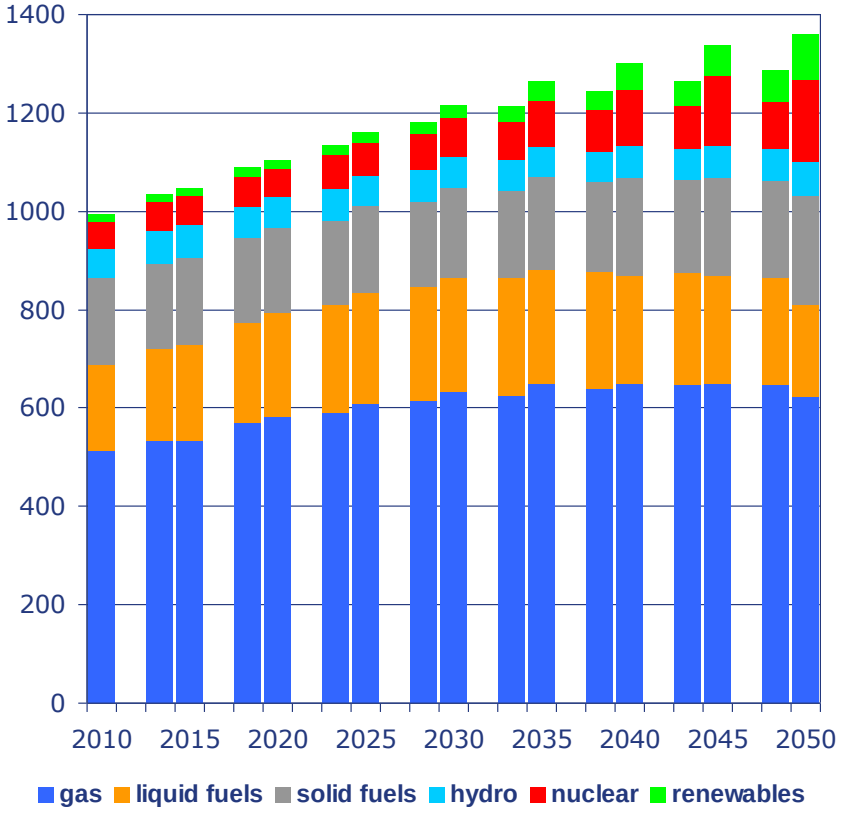
Energy sector will not remain the key driver of the economic growth but it will play the infrastructural role stimulating the development of other sectors providing secure energy supply at prices that ensure the global competitiveness as well as create the domestic market for innovations. Its share in GDP will decrease from 29% in 2010 to 17% in 2035 and 13% in 2050

Stabilization of energy export since 2030 will decrease its share from 50% of total energy production to ~45% to 2035 and to ~40% to 2050. Power plants and boilers will remain the greatest and increasing domestic consumer that will require 27-29% of produced energy resources in 2035 and 32% in 2050

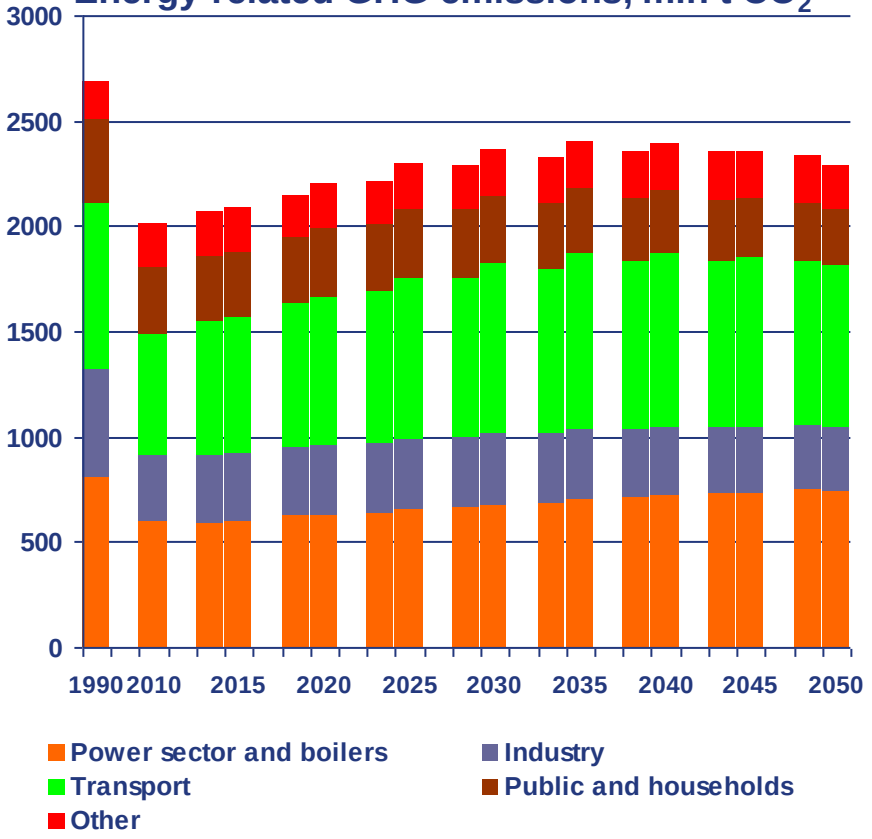


Russian energy sector to 2050.
Resource mix and effect on GHG emissions

Domestic primary energy consumption, Mtoe

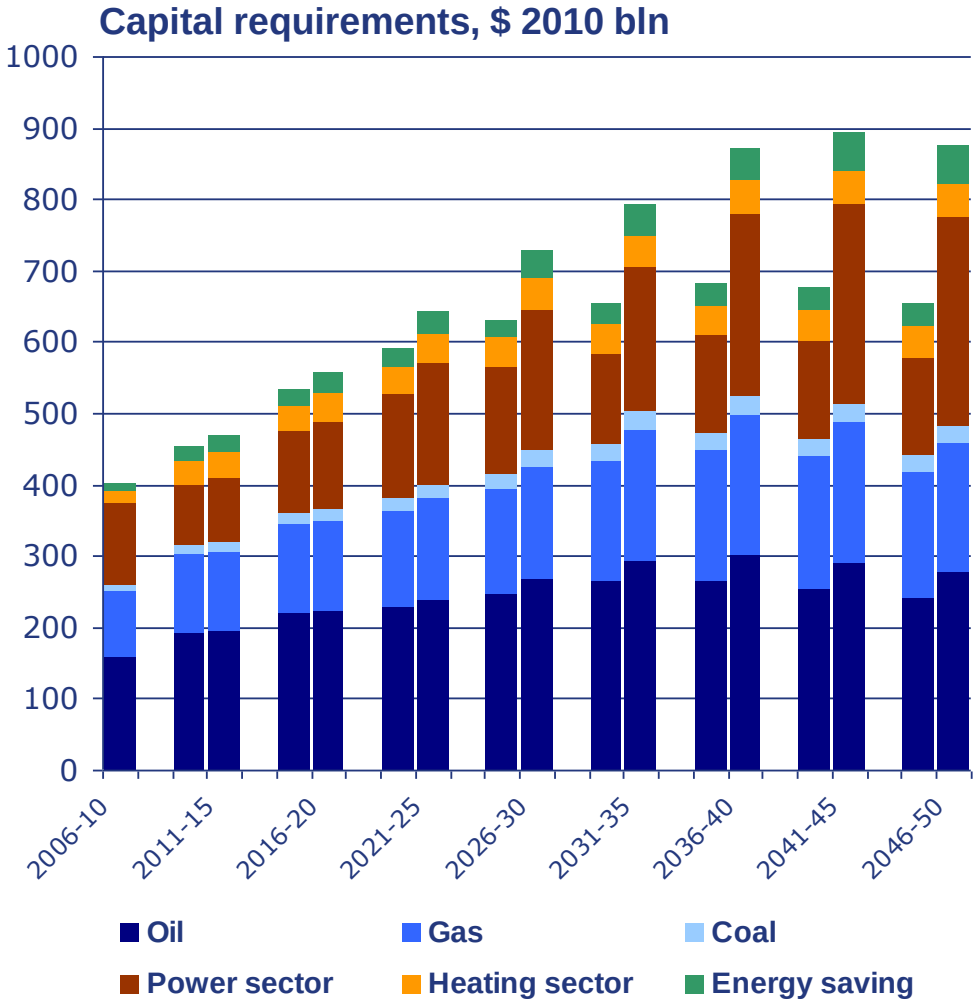


Energy-related GHG emissions, mln t CO_2



Natural gas will remain the key energy resource providing 51-53% of TPEC to 2035 and 45-46% to 2050; liquid fuel will stabilize at 18-19% to 2035 and decrease to 13-14 to 2050. The total share of non-carbon resources will increase from 13% to 15-16% to 2035 and 24% mainly by the nuclear power. GHG emissions will continue to grow up to 2035 (although will remain 12-15% lower 1990) and begin to decrease in the next 15 years.

Russian energy sector to 2050. Investment requirements



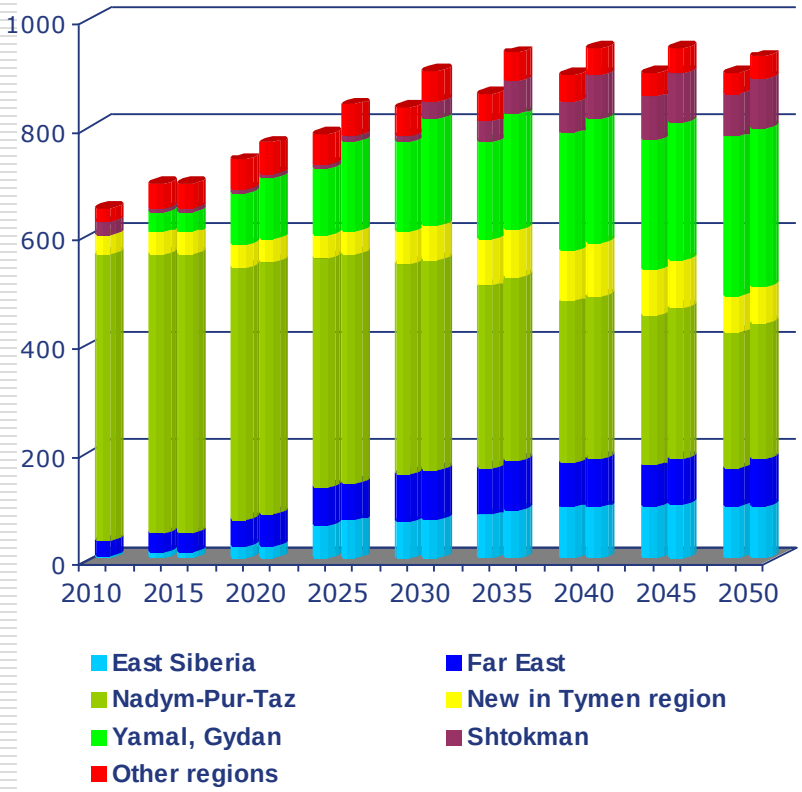
Increase of production capacities together with wide-scale modernization of existing energy production and transportation infrastructure already resulted to the growth of capital needs

Capital requirements in energy sector will increase 1,5-2 times to 2035. More than 60% of all energy-related investments will be concentrated in the gas and oil industries

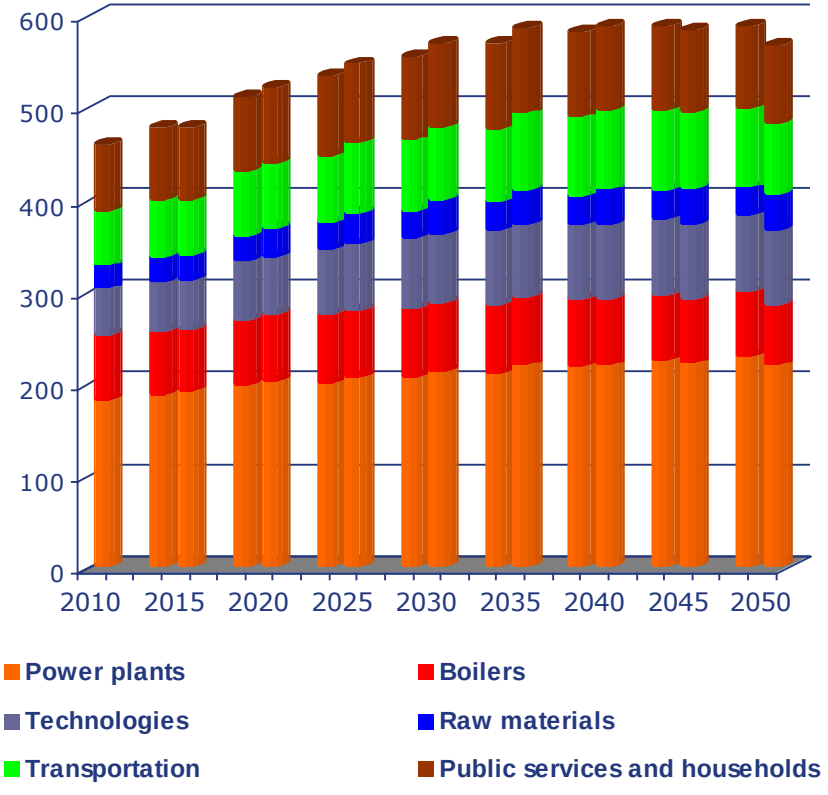
Energy infrastructure will maintain decreasing but still high investment pressure in the Russian economy - 6% of GDP in the short-term, 4% near 2035 and 3% near 2050.

Russian energy sector to 2050. Gas sector development

Gas production, bln cubic meters



Domestic gas consumption, bln cubic meters

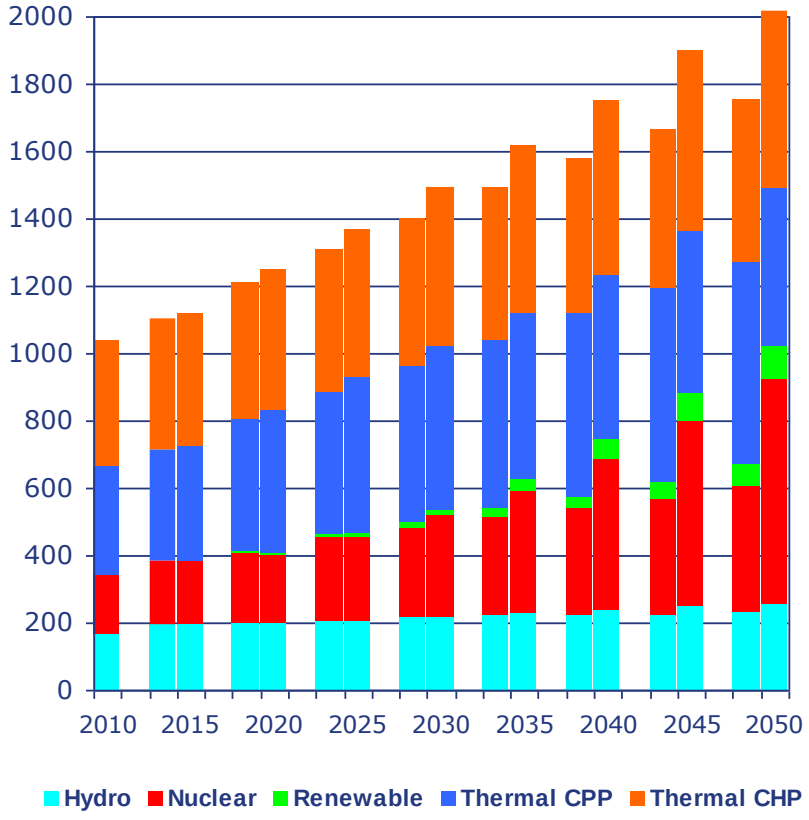


Gas production will stable after 2035 reaching the limit of traditional resources. Impact of existing Tyumen areas will be twice lower with the increase of production at the Far East, Yamal, East Siberia.

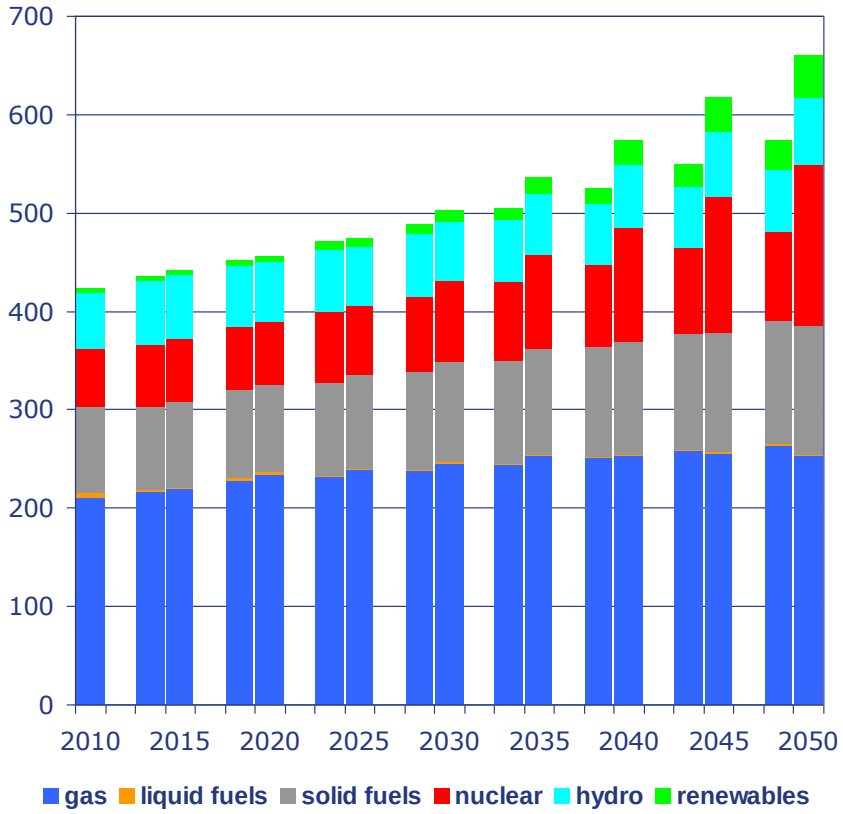
Gas export will stabilize after 2035 at 320-360 bcm. Export routes will be more diversifies and LNG supplies will reach up to 22-30%. Demand of the domestic power sector will increase at ~20% also will stabilized at 250-260 bcm since 2035

Russian energy sector to 2050. Power sector development

Electricity production, TWh



Primary energy consumption by power plants, Mtoe



Power sector will remain the main area of inter-fuel (resources) competition increasing the share of non-carbon generation from 33% to 36-39% to 2035 and 38-50% to 2050. Nuclear plants will generate 1,7-2,2 times higher in 2035 and 2,2-4 times in 2050. RES will play a marginal role (2% in 2035 and 3,6-5% in 2050). Nuclear and RES generation together with the efficiency improvements in gas generation will decrease existing 50% gas share in power sector resource mix (47-48% to 2035 and 46-38% to 2050)

Russian power sector.
How to create the strong bridges to the future

State level of strategic planning

- Long-term economy forecast
- ENERGY STRATEGY
- GENERAL PLAN for power sector development and distribution

Implementation mechanisms

Administrative

- general legislation
- market rules and antimonopoly control
- technical regulation and control
- environmental regulation and control

Economic

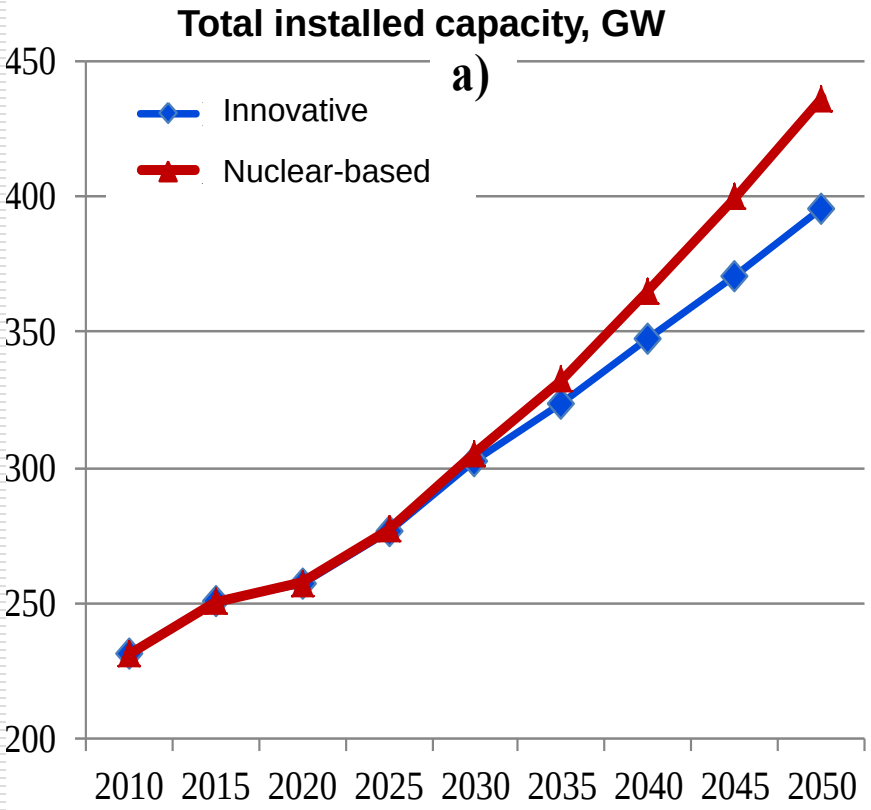
- competitive pricing mechanisms
- tariff regulation area and methods
- direct and indirect financial support

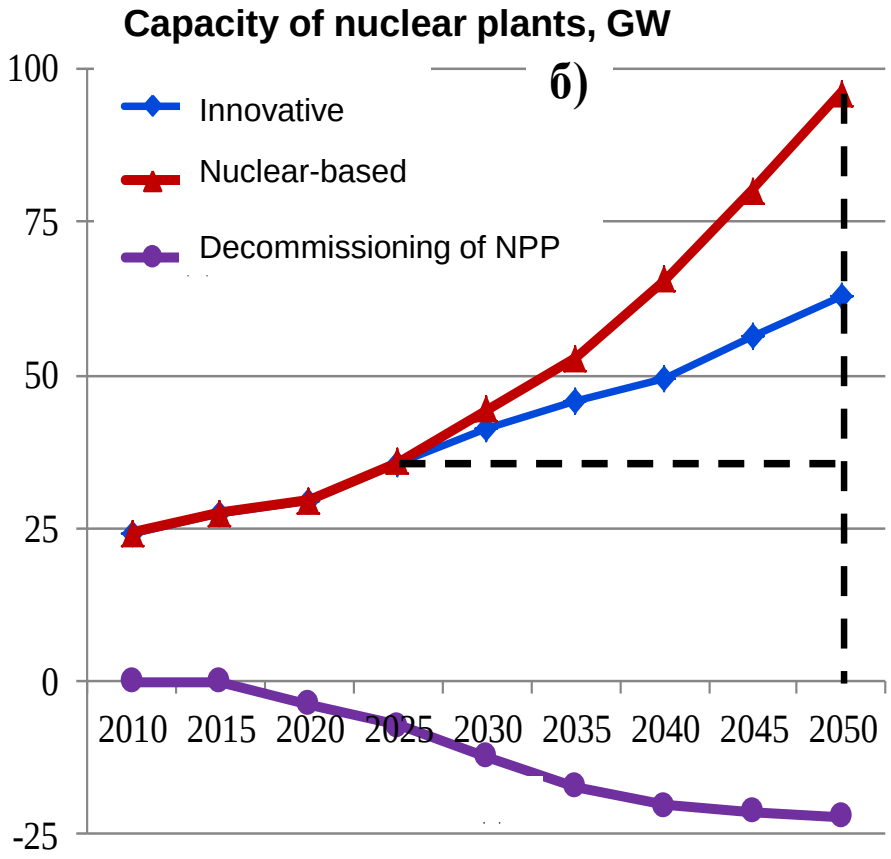
Corporate level of planning of existing and new actors (*GenCos, GridCos Consumers, IPPs)*

- Corporate strategy
- Feasibility studies
- Financial plans

The key problem – is to find the most effective mix of administrative and economic implementation mechanisms balancing the economy-driven priorities of the power sector development formulated at the state level with the business-driven priorities in the corporate strategies. At this, quantification of the effects, estimation of the consequences becomes inevitably required

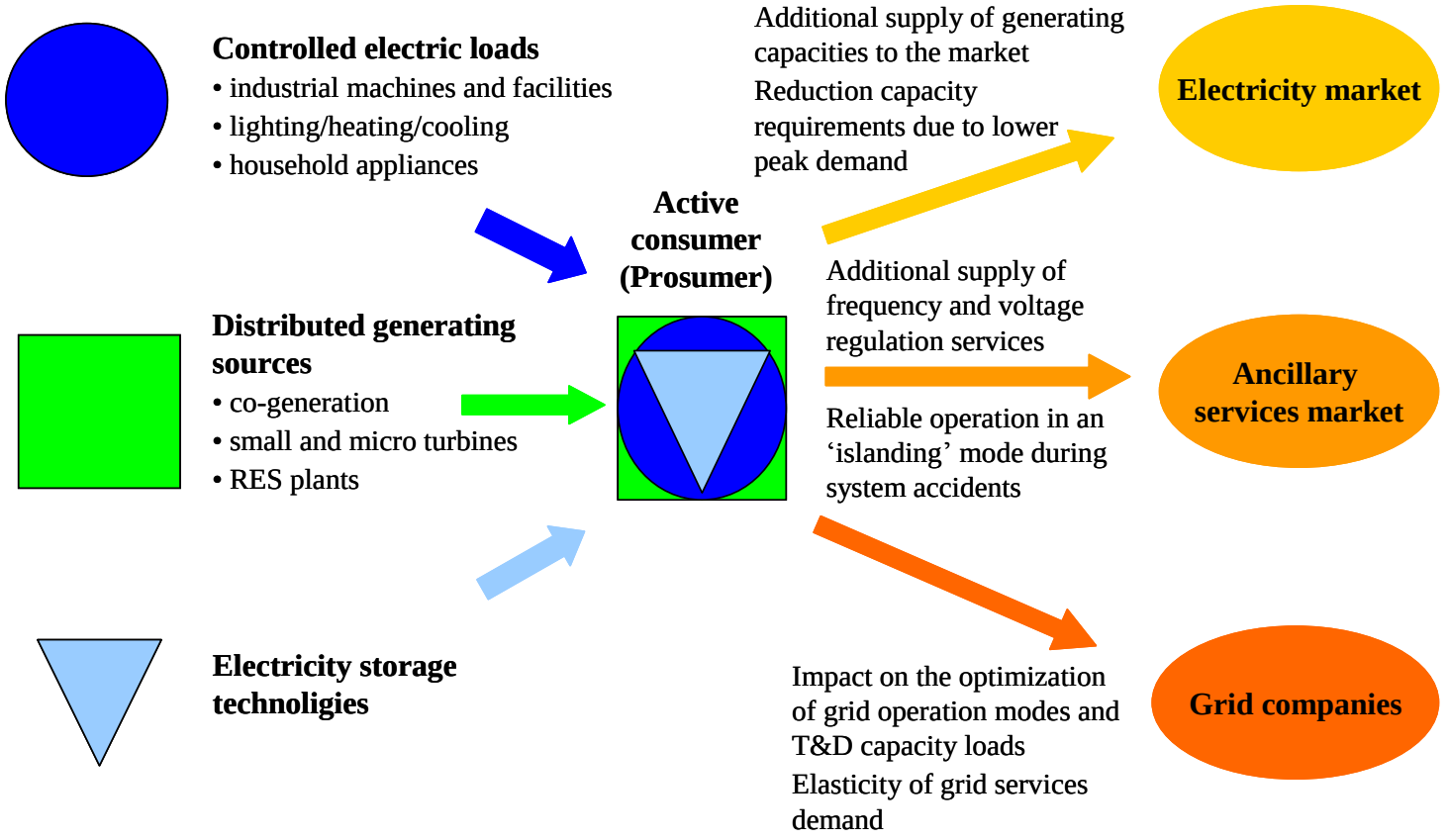
Russian power sector.
Prospects and problems. Nuclear power





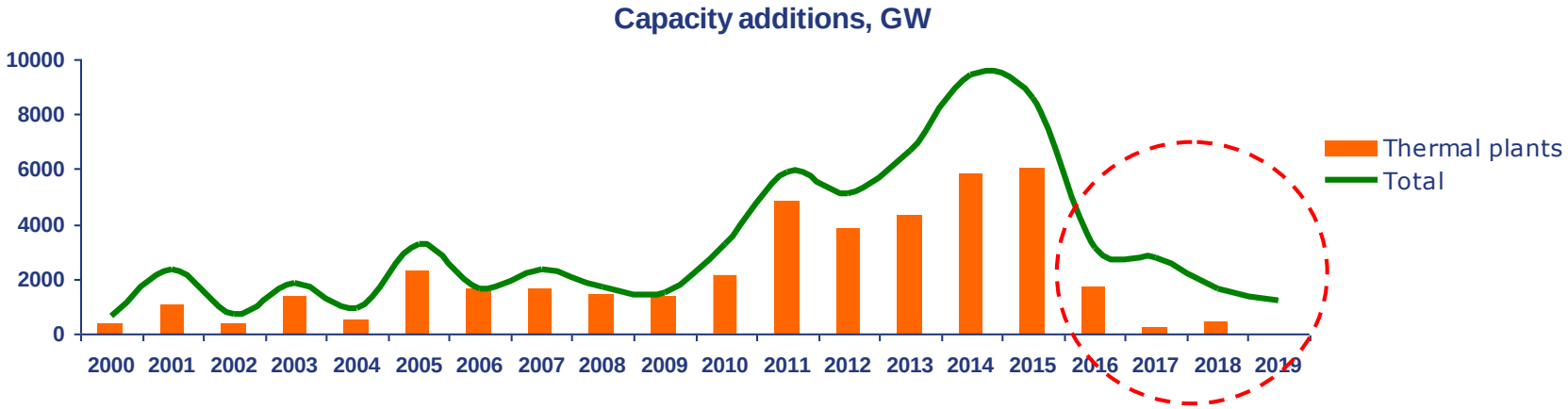
Intensified development of nuclear sector will double the capacity of nuclear plants from 2025 to 2050. It will increase the investments by 50%, creating the increasing domestic market for innovations and providing 3-4 times higher cumulative effects in the economy. But nuclear plants are still expensive and will competitive with gas and coal generation under the lower cost of capital or with carbon costs (at least $15/t)

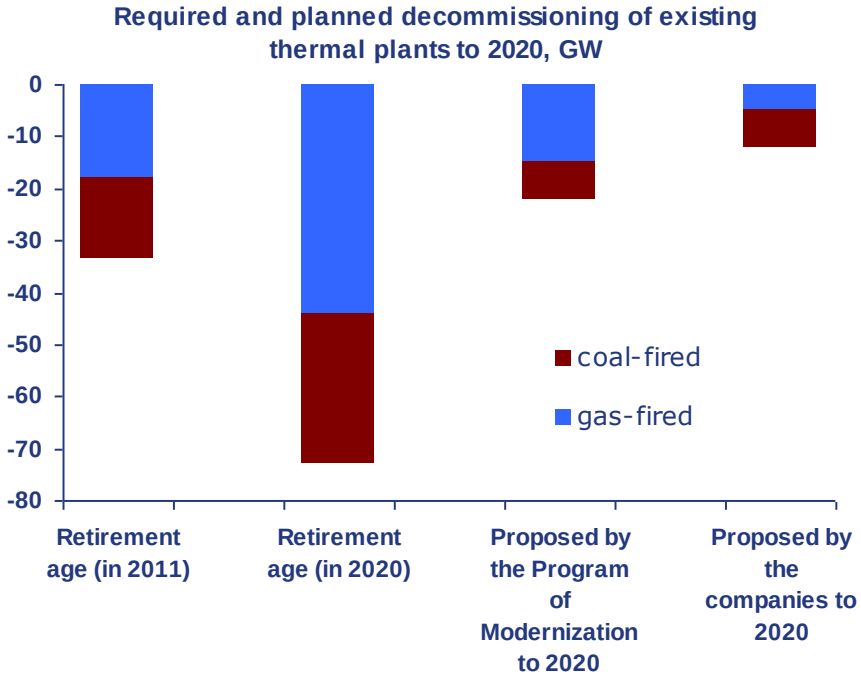
Russian power sector.
Prospects and problems. Smart “bottom-up” retail competition



Active consumers/prosumers/distributed generators will form new competitive conditions for the traditional generation and grid suppliers. Smart grid approach provides opportunities to create the real competitive environment at the retail level and efficient alternative to the traditional supply of final consumers.
Pilot projects are required to test technical and market solutions as well as to make proper changes in legislation, forming technical and economic regulation basis for new market area.

Russian power sector.
Prospects and problems. Lack of signals for investments



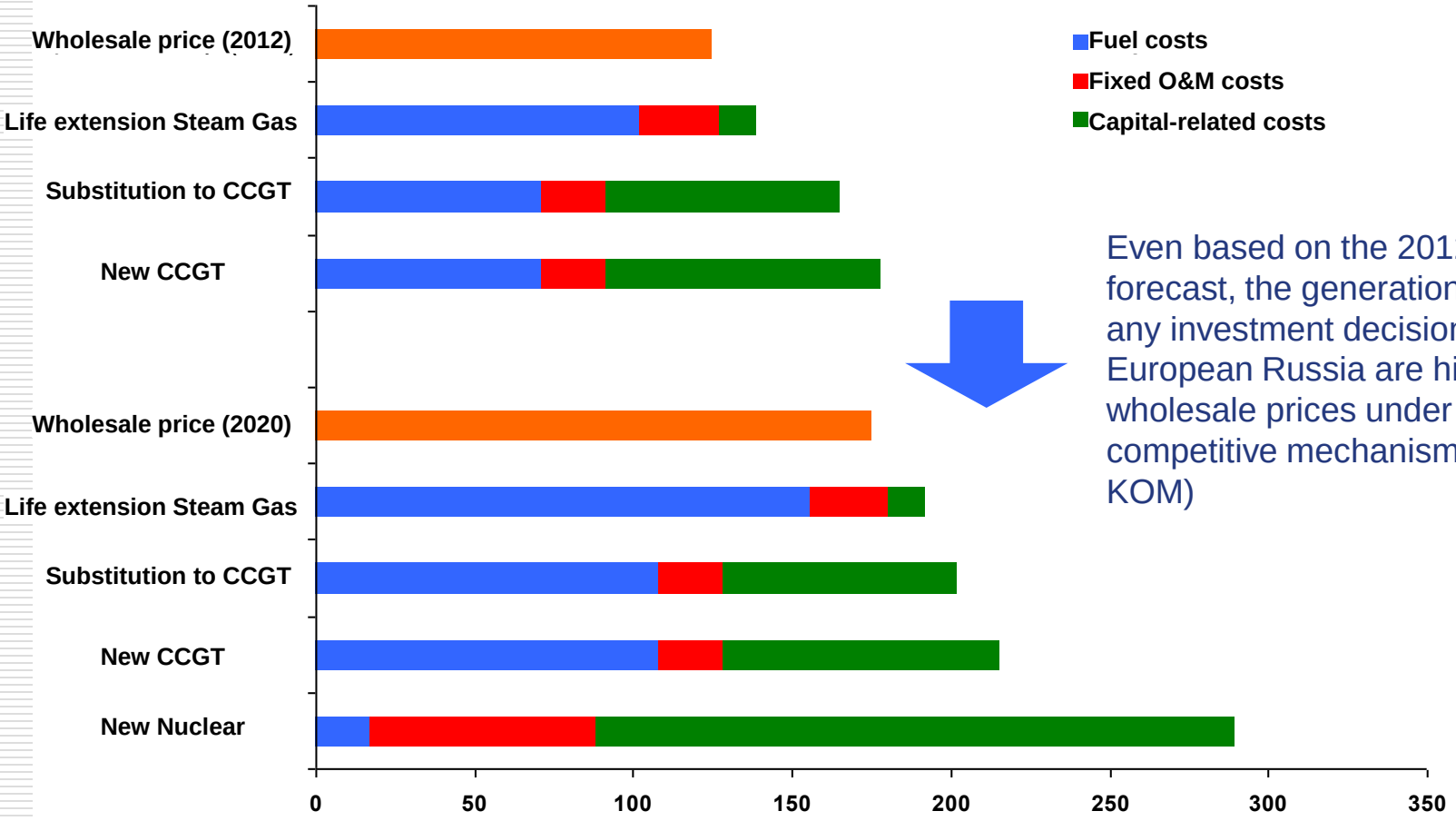


The market reform was not focused on the investments and long-term options. As a result, regulated approach to the investment decisions (DPM) led to the overinvestment and excessive price pressure to the consumer.

Post-DPM future is a grey area. The market-driven mechanisms are required to maintain the investment activity and implement the Energy Strategy declarations concerning the power sector modernization.

Russian power sector.
Prospects and problems. Lack of signals for investments

Generation costs of projects for gas-fired and nuclear plants in comparison with the wholesale market price (RSV+KOM) in 2012 and 2020 (kop 12/kWh

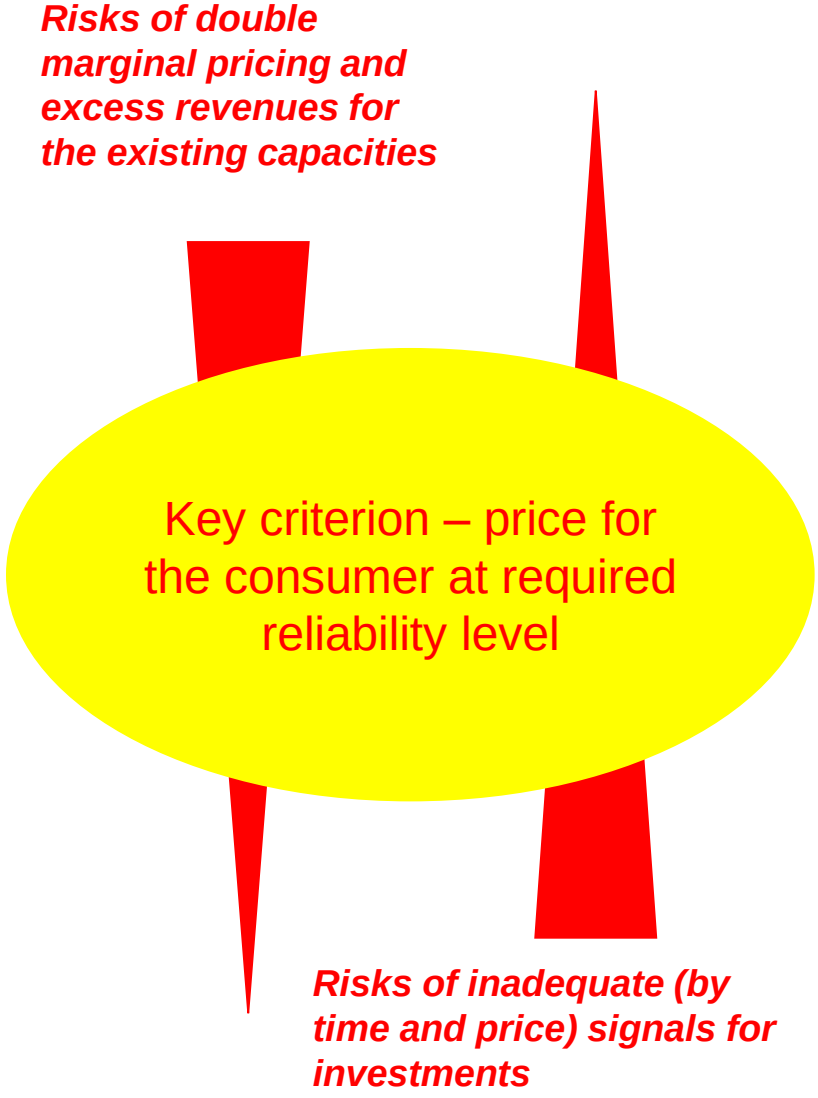


Even based on the 2012 gas price forecast, the generation costs of any investment decisions in the European Russia are higher than wholesale prices under existing competitive mechanisms (RSV and KOM)

Russian power sector.
Prospects and problems. The prices/investments balance

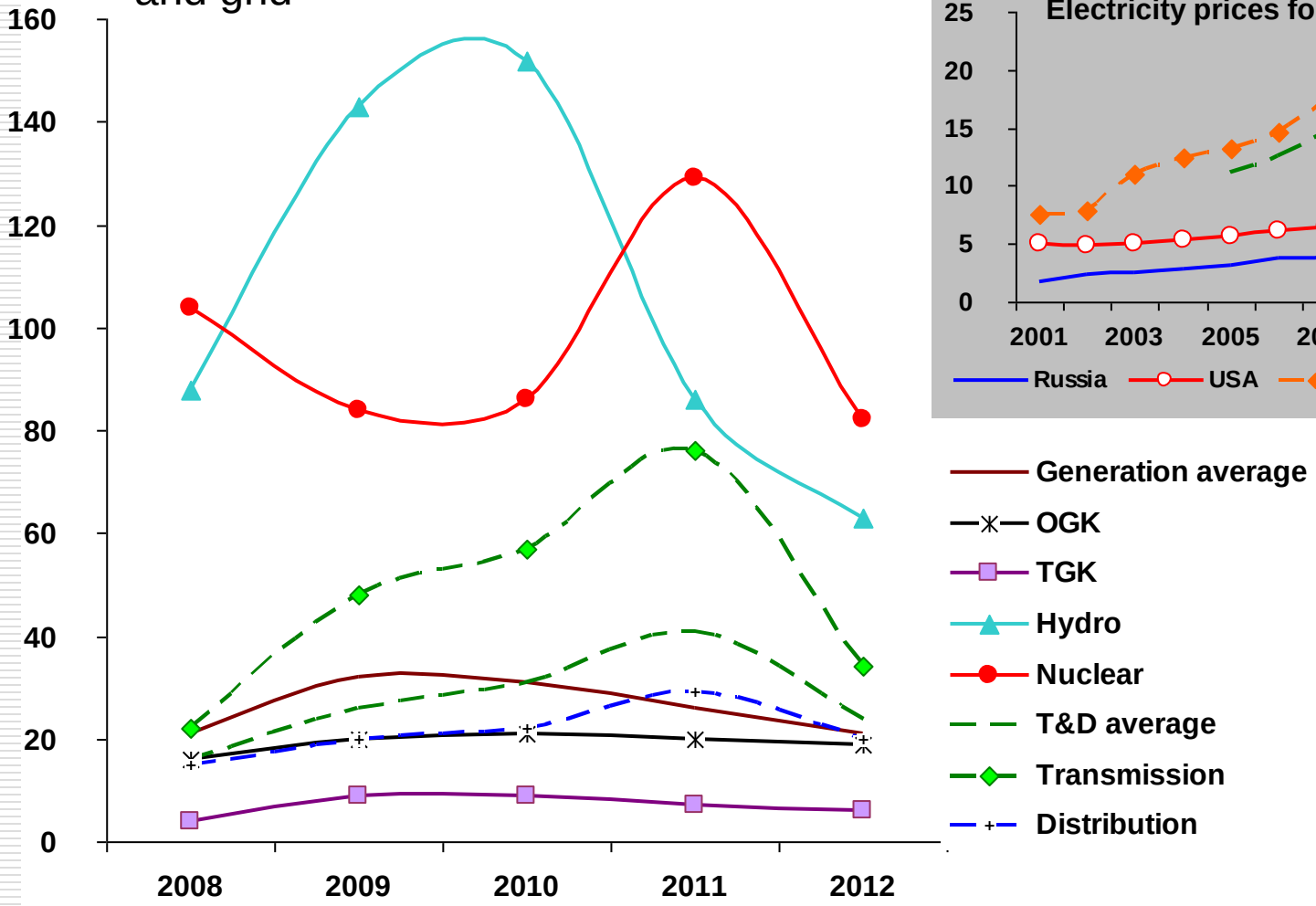
Key uncertainty at the wholesale level is the future of capacity payments:

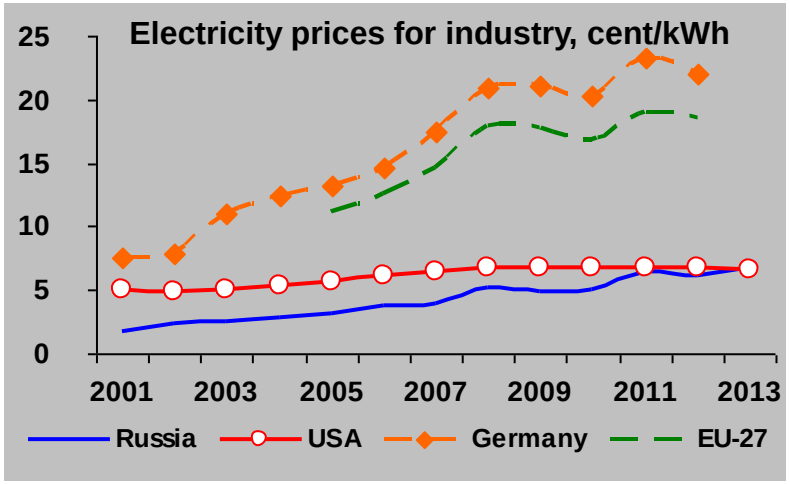
- Scenario 1 – centralized common competitive bidding and optimization procedure for existing and new capacities with unified marginal pricing
- Scenario 2 (final state under the current Market Rules) – separate competitive bidding and optimization procedure for existing and new capacities (+ consumers with active load or DG and grid projects for congestions etc.). Marginal pricing for existing capacities only, new capacities obtain their bid price or cap (RAB-based)
- Scenario 3 – decentralized (what-term?) market based on the bilateral contracts with centralized balancing (peak) capacity market



Russian power sector.
Prospects and problems. The prices/investments balance

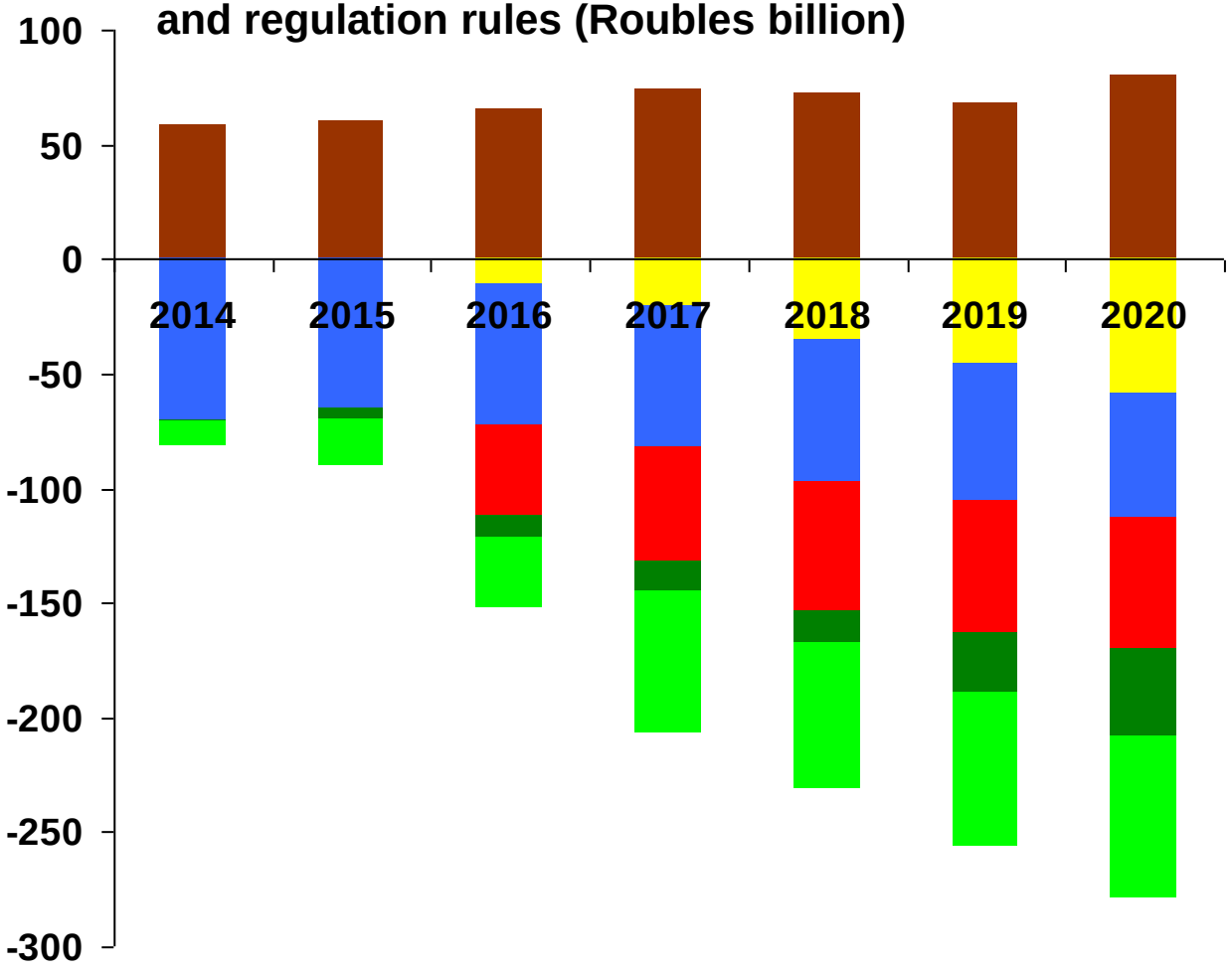
Profitability pattern by types of generation and grid





Russian power sector.
Prospects and problems. The prices/investments balance

Analysis of additional costs and potential savings for consumers with complex changes of the market and regulation rules (Roubles billion)



- Cap for profitability of Distribution services based on revenue requirement
- Cap for profitability of Transmission services based on revenue requirement
- Cap for profitability of Nuclear based on revenue requirement
- Cap for profitability of Hydro based on revenue requirement
- Impact of modernization on the spot (RSV) electricity prices
- + Additional revenue requirements for modernization of thermal generation

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Thanks for attention