

SECURE project

Environmental targets and possible changes in the Russian energy sector

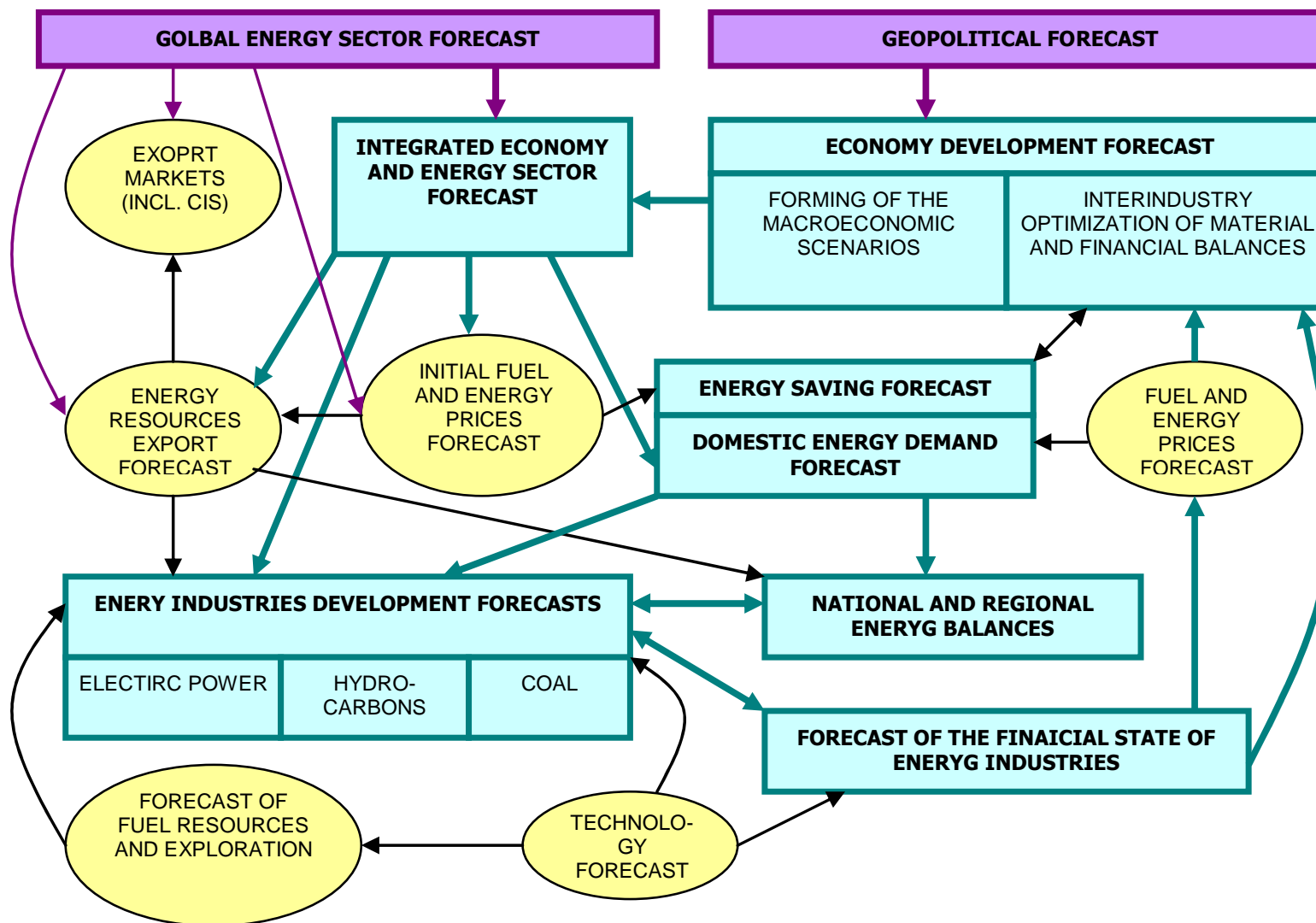
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Moscow, July 2010

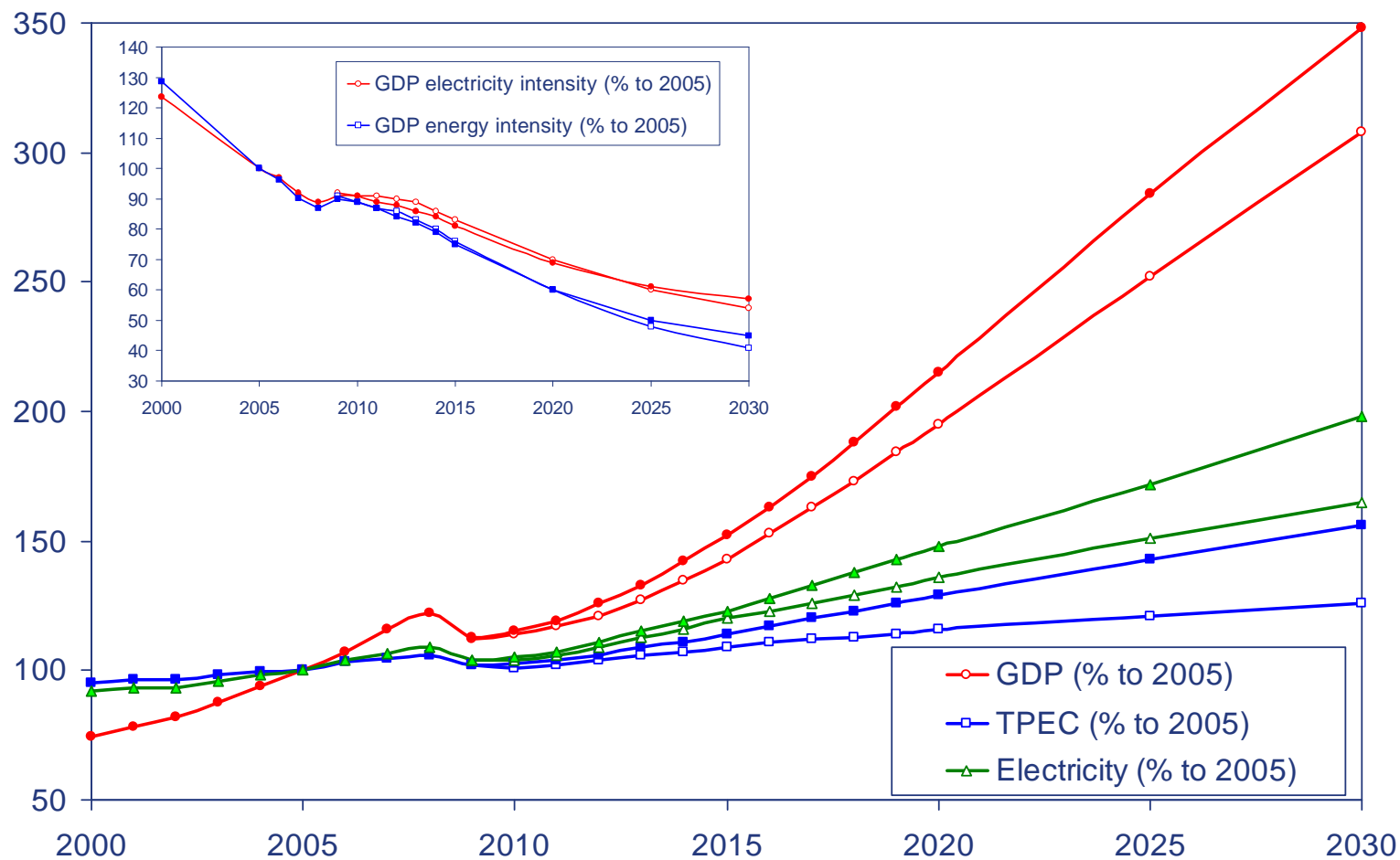


Forecasting of rational scenarios of the Russian energy sector development

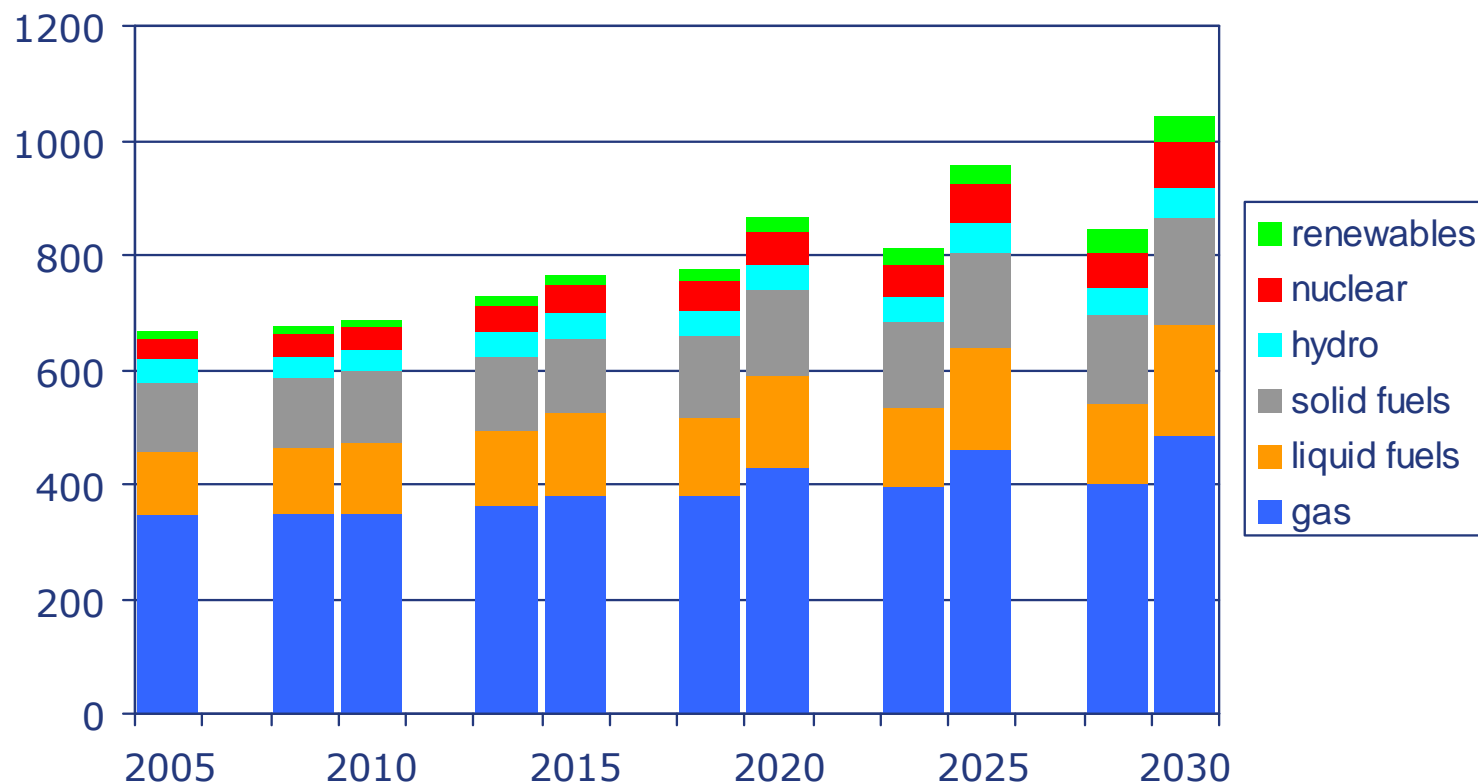


Economy and energy intensity

Depending on the scenario, GDP will grow 3-3.5 times by 2030. Due to the considerable decrease of energy intensity, TPEC growth will not exceed 26-56% and electricity demand will grow 1.7-2 times by 2030

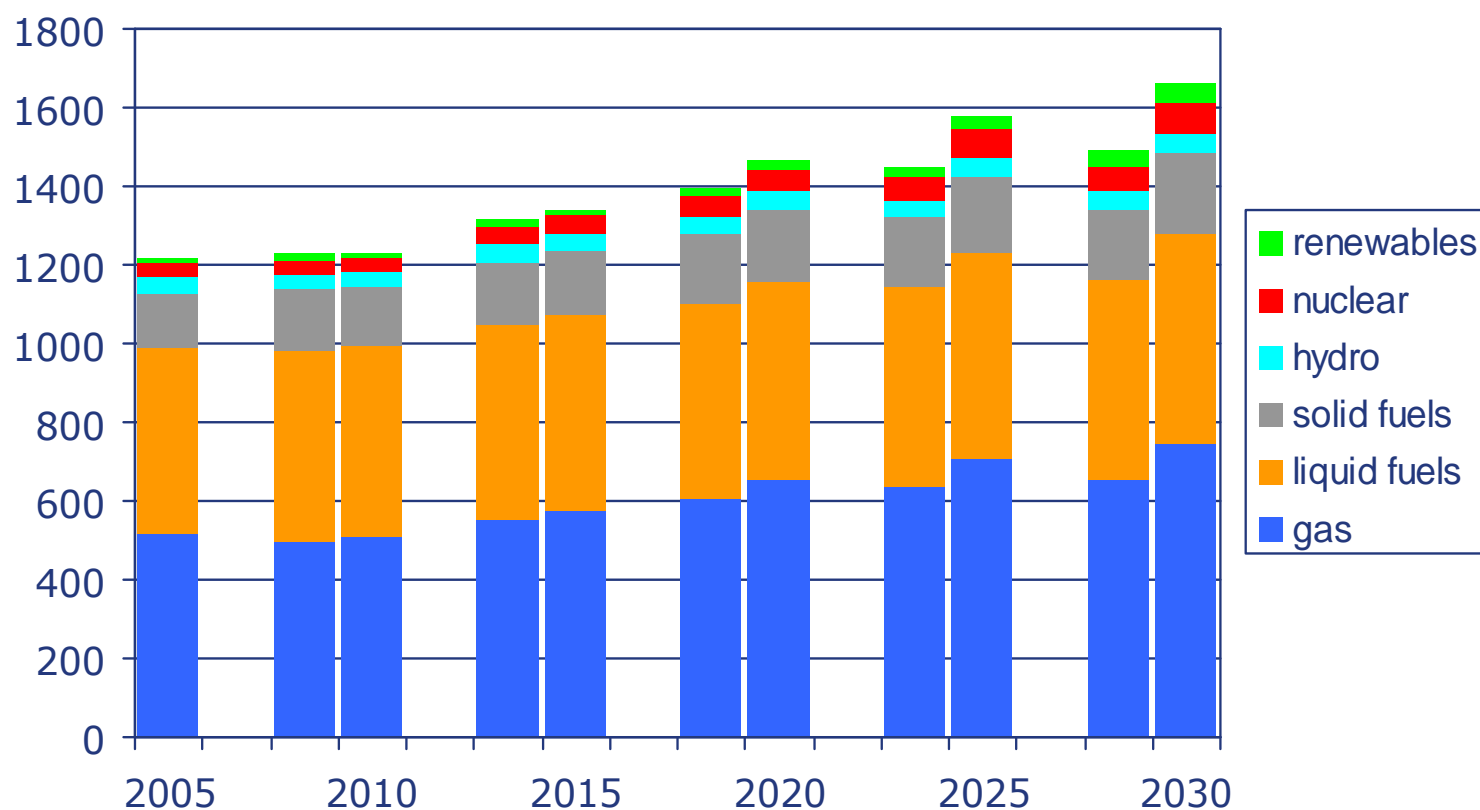


Primary energy consumption, Mtoe



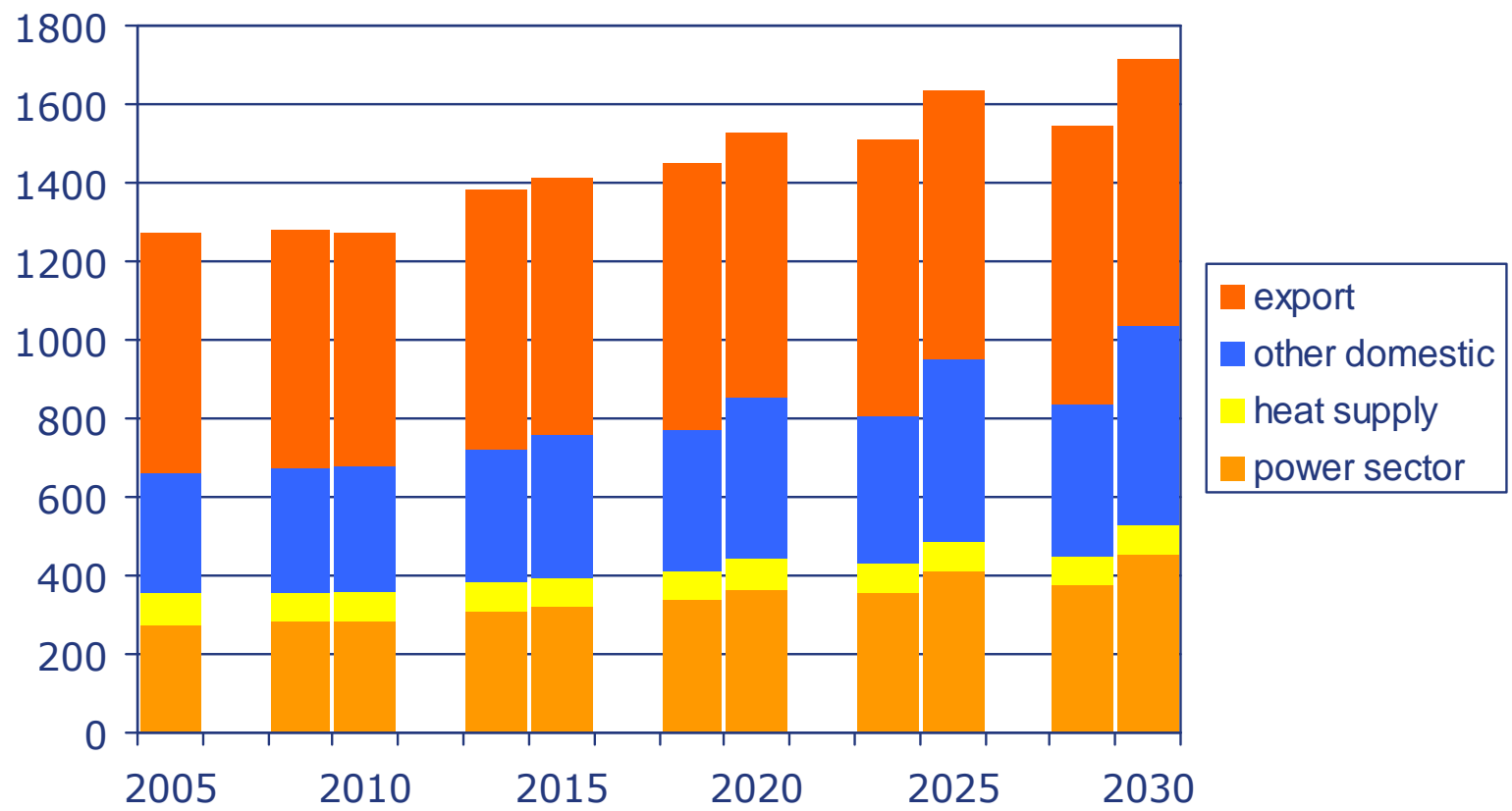
By 2030 domestic energy consumption will grow by 26-56% compared to 2005. The share of natural gas within overall energy consumption will fall from 52% to 47-48% in 2030. The share of solid fuel will remain at 18%. The share of non-carbon resources will grow from 13 to 16.5-17%.

Energy production, Mtoe



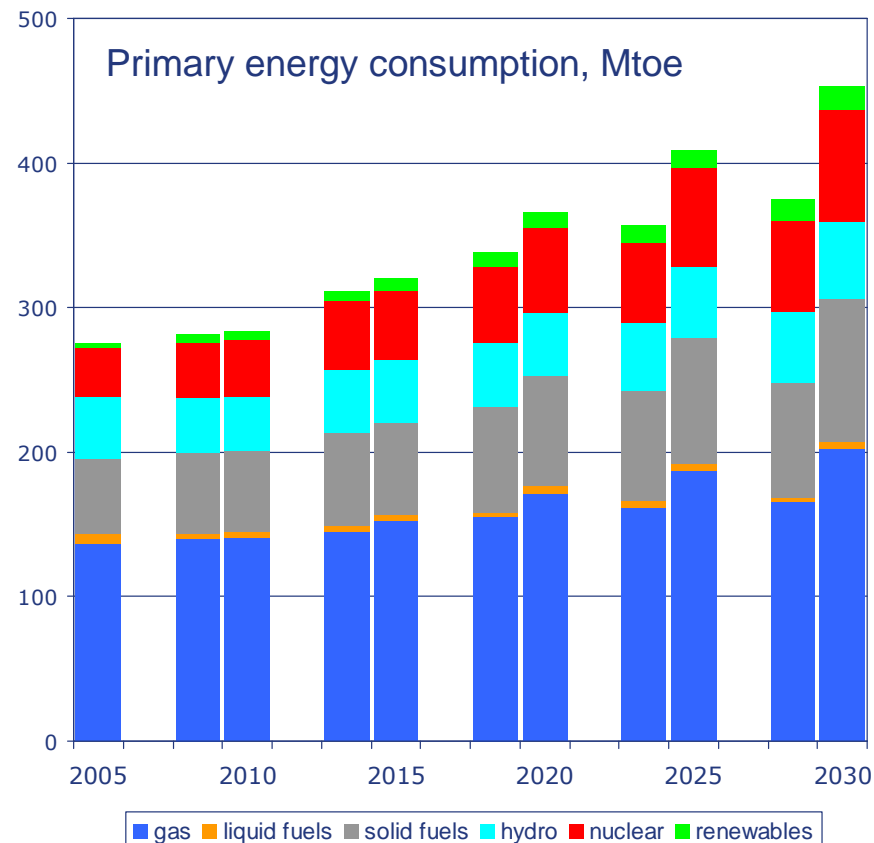
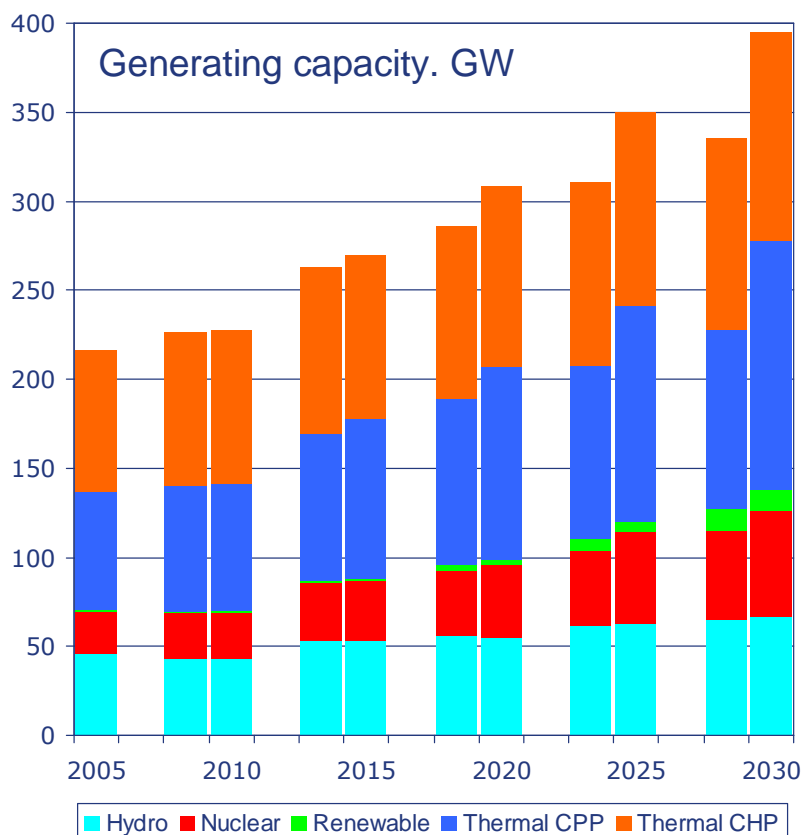
By 2030 energy production will grow by 22-36% compared to 2005. Oil will decrease from 38% to 32-34%. In both scenarios oil will be substituted mainly by non-carbon resources (growing from 7 to 10-11%) and to the certain extent – by gas (growing from 43% to 44-45%). The share of coal will remain constant (near 12%).

Total primary energy supply and domestic and export energy needs, Mtoe



The range of TPES is defined by the domestic energy consumption and does not affect on energy export opportunities. Domestic energy demand will grow faster than energy export (from 52% to 54-60% of TPES). Faster electricity demand growth will stimulate more intensive growth of energy needs of the power sector (its the share will increase from 22% to 24-26% of TPES)

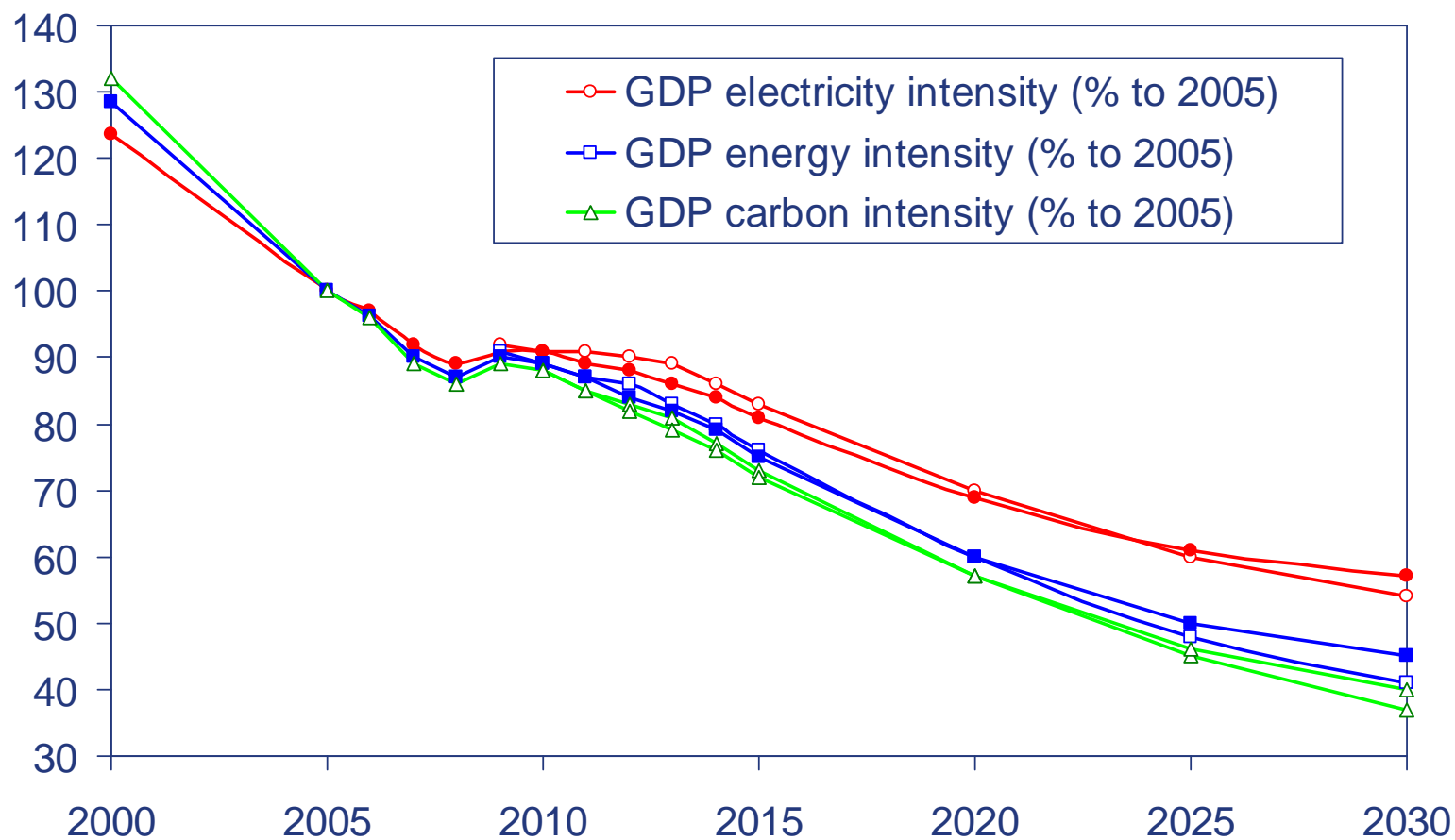
Power sector development



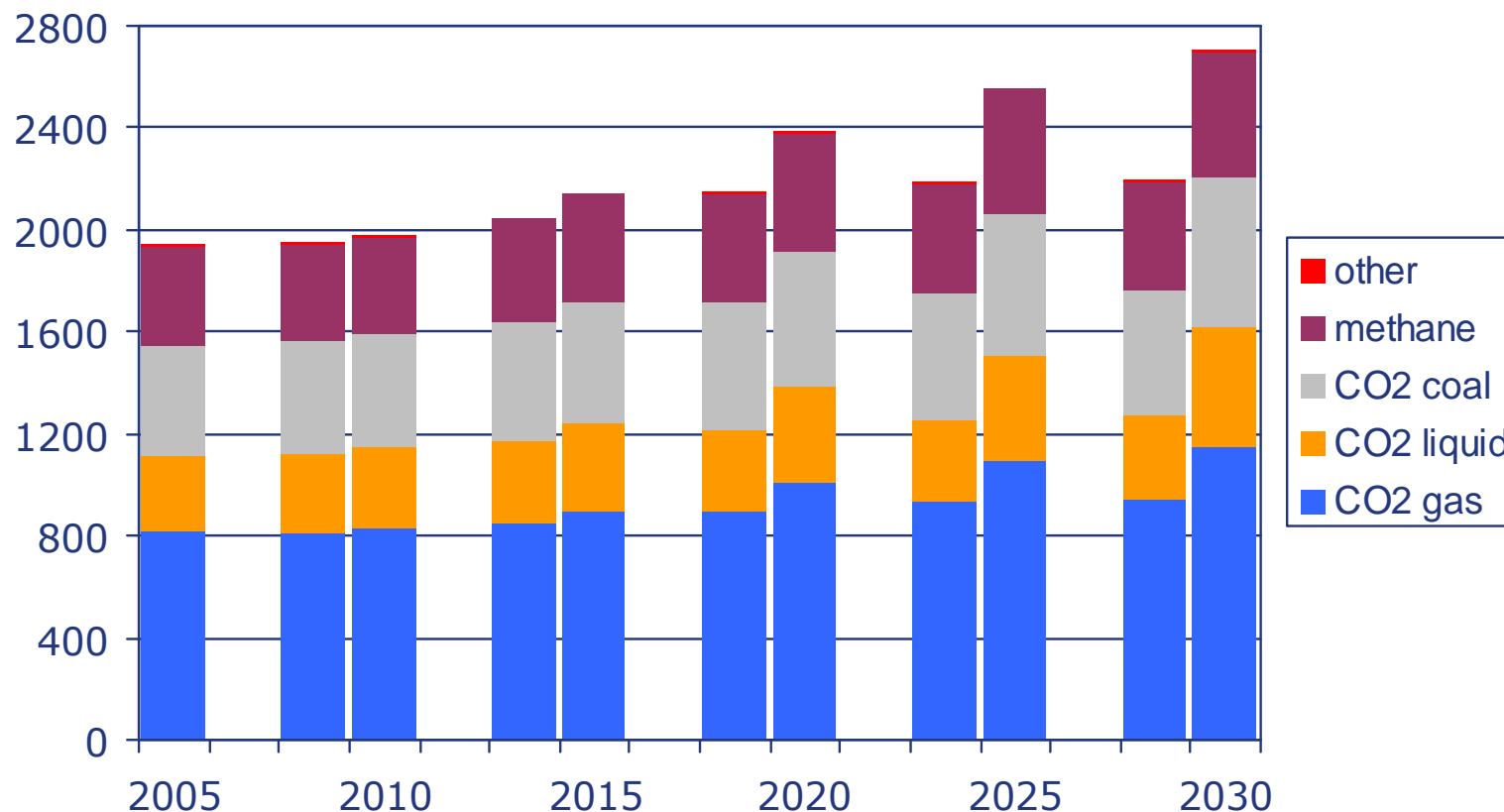
To ensure growing electricity demand, generating capacities will increase 1.5-1.8 times by 2030. The total share of non-carbon (hydro, nuclear and renewable) power plants will grow from 32.4% to 35-38%. It will lead to the reduction of gas share in the sector primary energy consumption from 49.8% to 44-45%.

GDP carbon intensity

As a result of efficiency improvements and changing energy supply and demand mix carbon intensity of the Russian economy will decrease faster than its energy and especially electricity intensity



Greenhouse gas emissions from energy sector, mln t CO₂

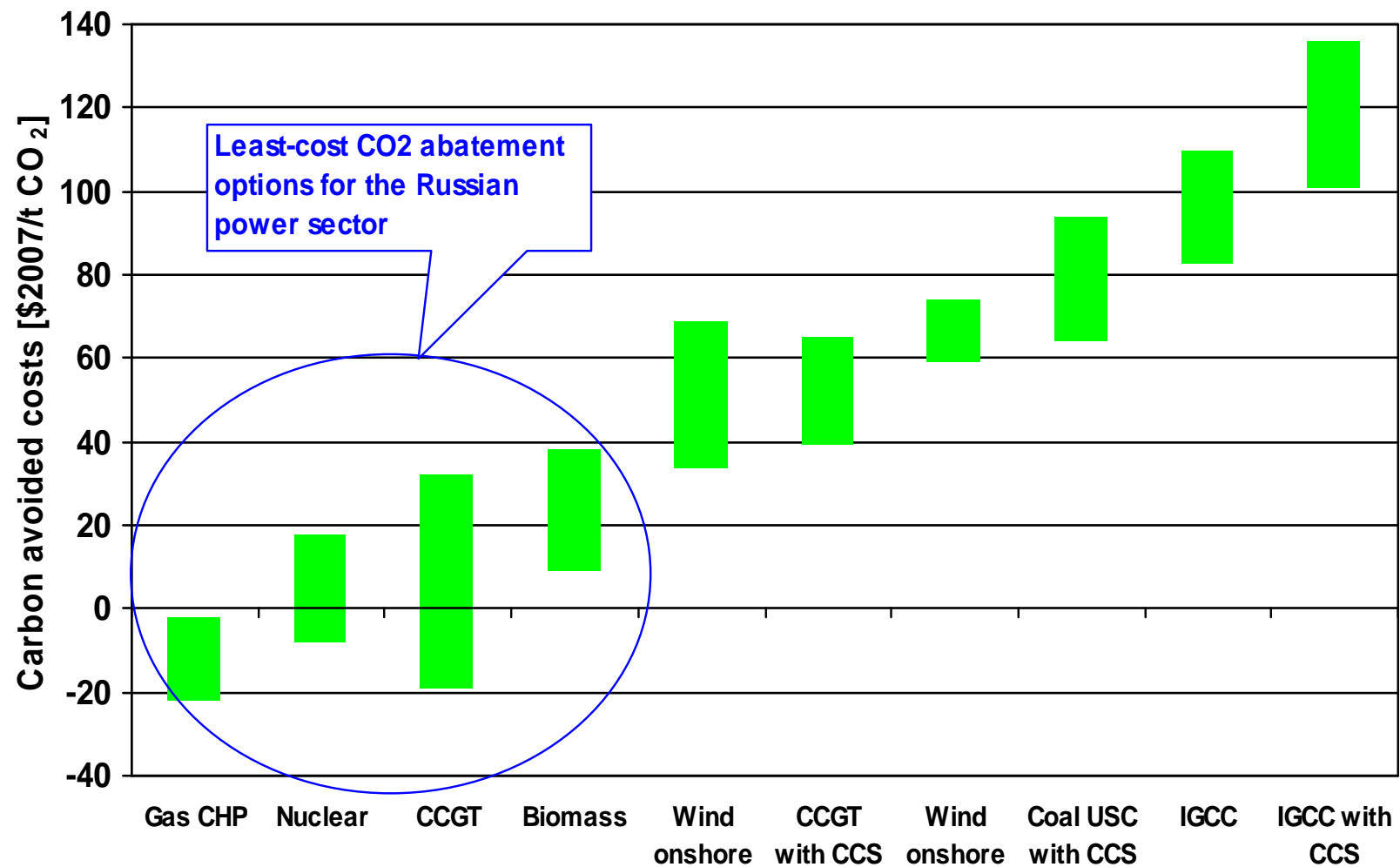


In 2020 GHG emissions from the energy sector will be still 12-20% lower 1990 level. In 2030 emissions will reach 1990 level in 2030 in the innovation scenario and will remain near 20% lower in the environmental scenario.

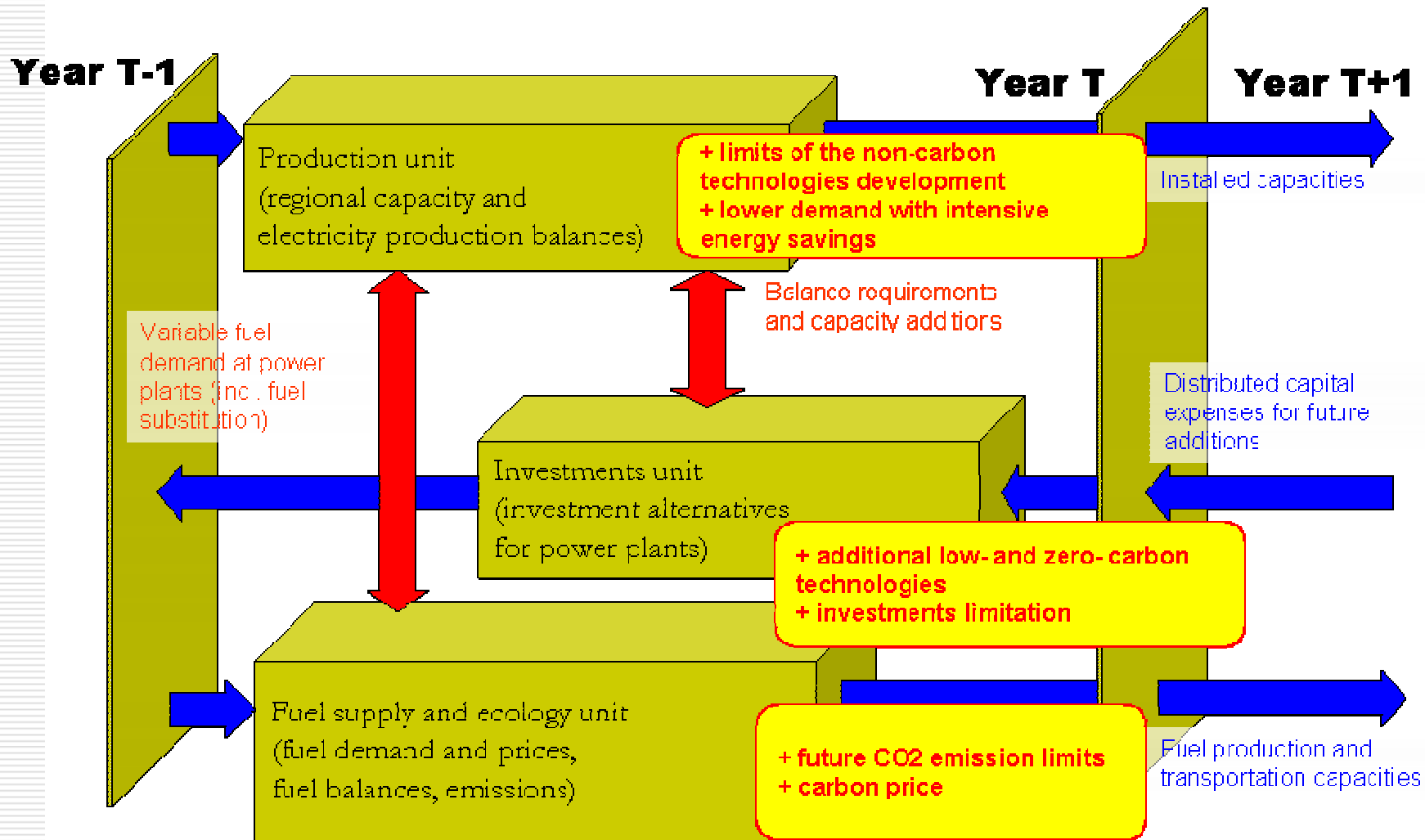
Sensitivity analysis for the power sector

- ❖ Basecase is close to the innovative scenario
- ❖ GHG abatement options
- ❖ Carbon avoided costs
- ❖ Impact of carbon prices (in the range of 25-100 \$ per t CO₂ in 2030) on:
 - Generation structure
 - Fuel mix
 - Investments
 - Revenue requirements and prices

CO₂ avoided costs of power technologies

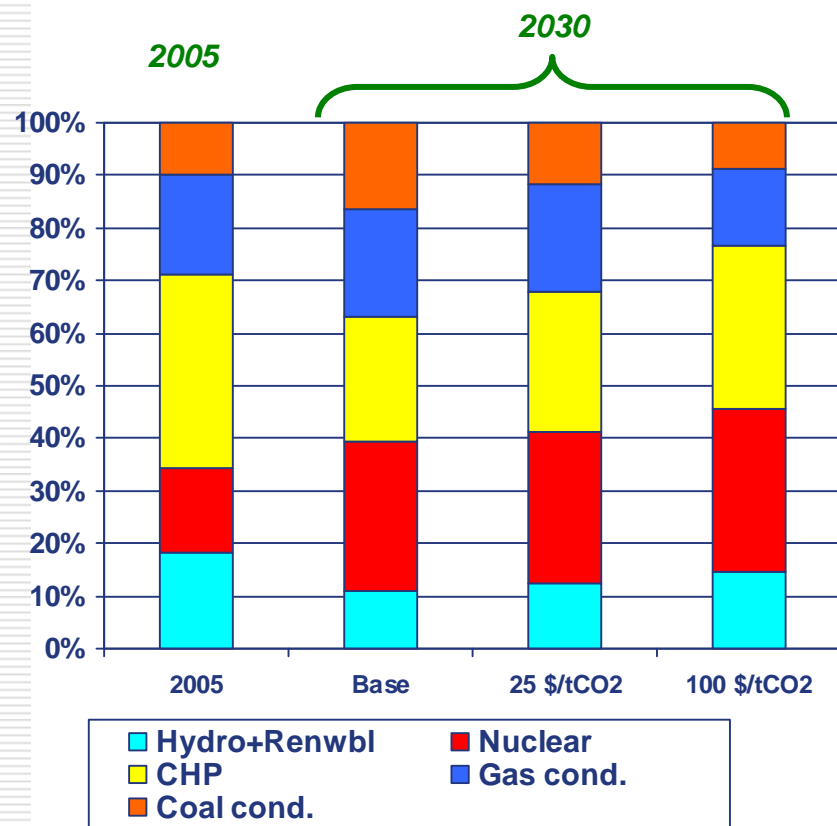


System optimization of the power sector adaptation to the environmental targets is obtained from EPOS-CARBON optimization model developed by ERI RAS

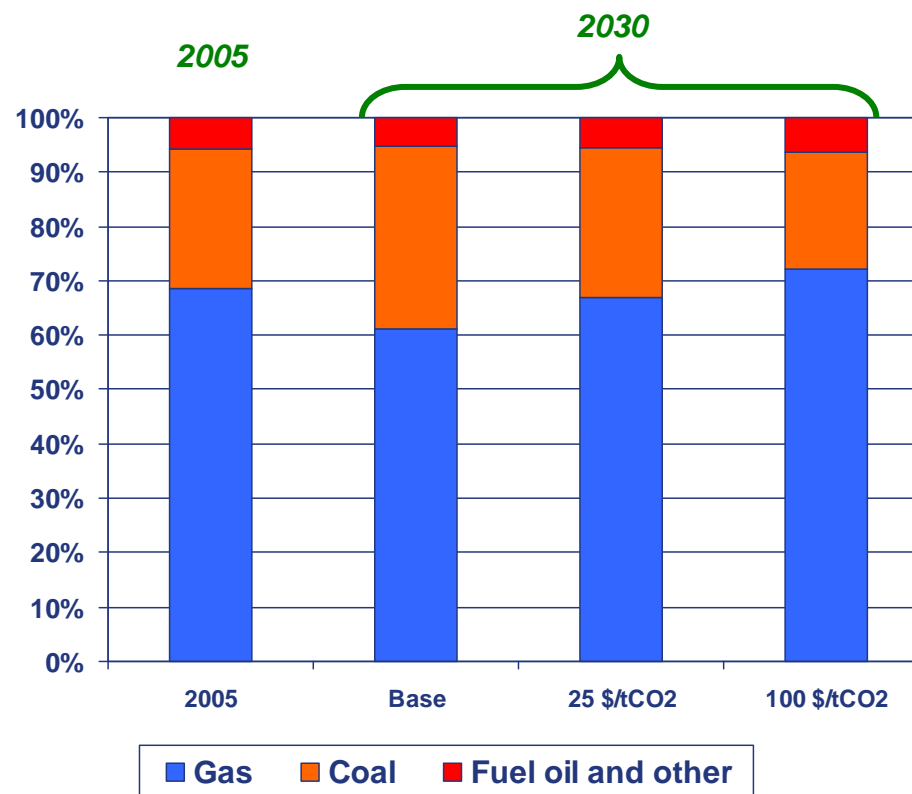


Carbon price will stimulate nuclear and gas-fired generation (mainly at CHP) and preserve the high gas share

Changes in 2030 capacity mix under the base case and carbon price cases

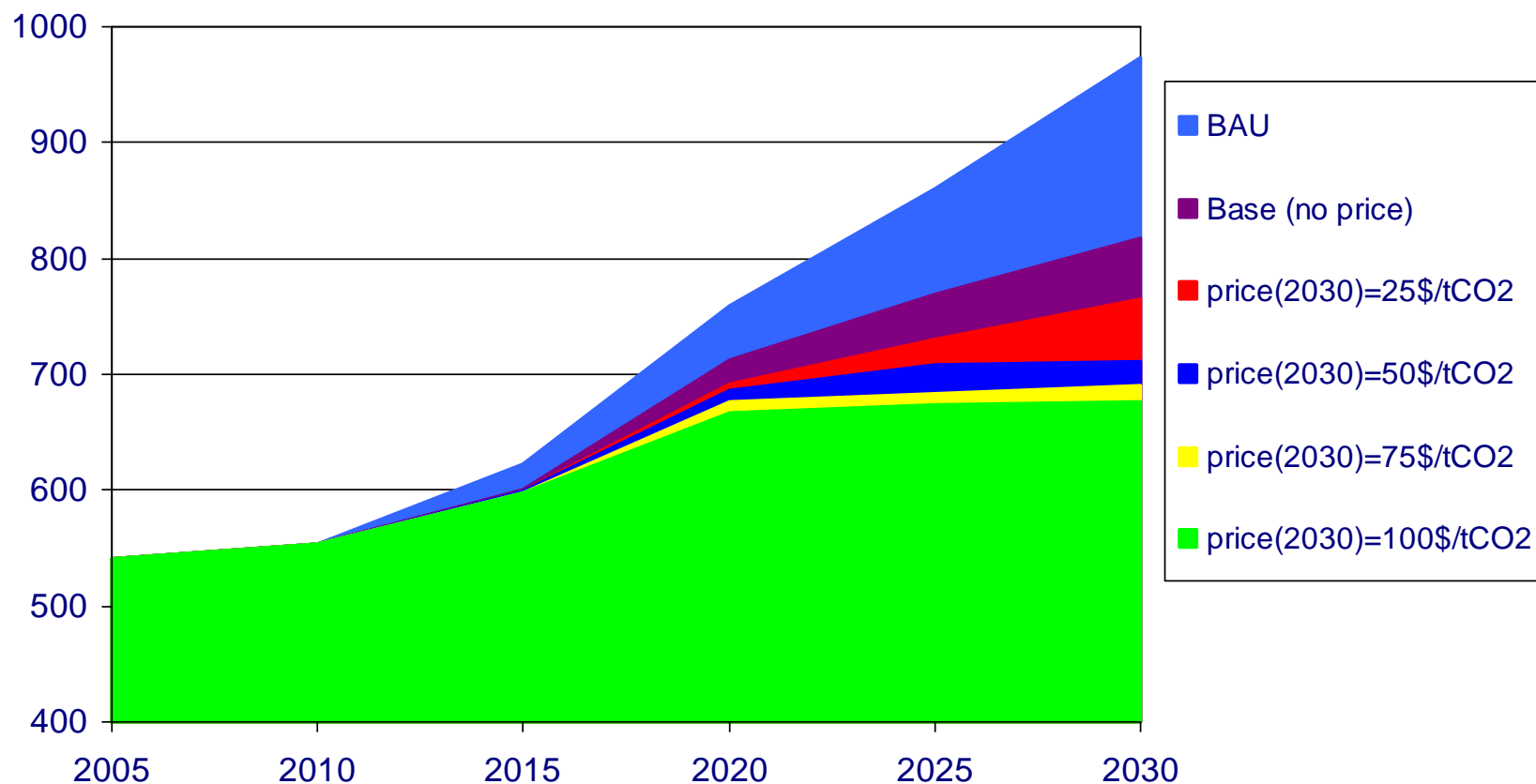


Changes in 2030 power sector fuel consumption mix under the base case and carbon price cases



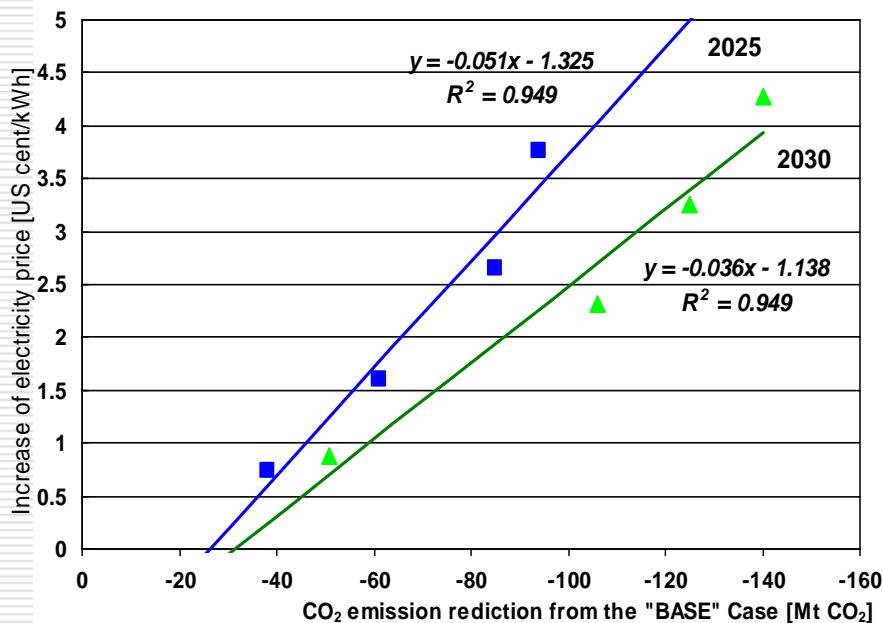
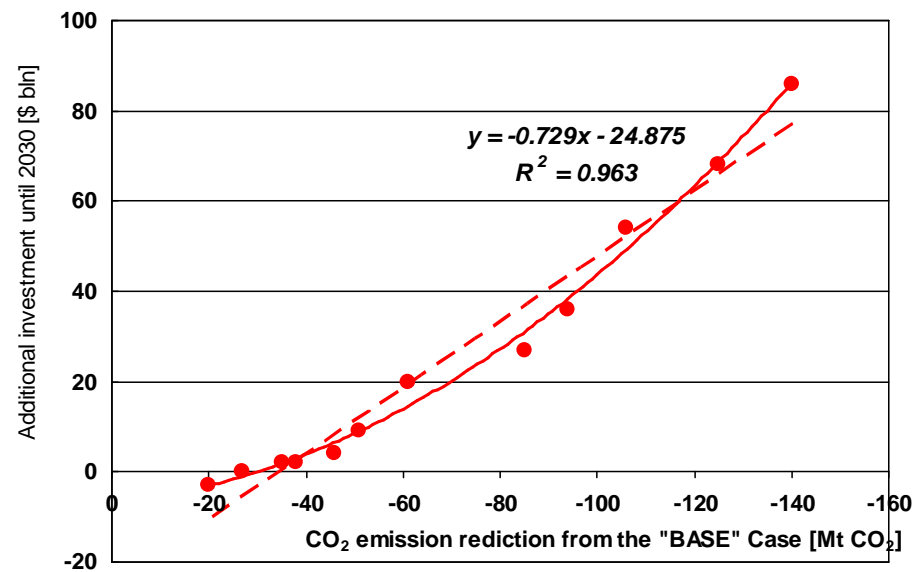
CO₂ emissions in the Russian electric power sector, Mt CO₂

Base case will ensure 20% decrease of CO₂ emissions in 2030 from the BAU case.
Implication of carbon prices will be able to additionally reduce CO₂ emissions in 2030 up to 20% (or 140 Mt CO₂) in respect to the base case.



New environmental targets will require additional investment and higher prices

Each 10 Mt CO₂ abatement in the power sector will require **billion 7 USD 07** of additional investments for low- and non-carbon technologies



Each 10 Mt CO₂ abatement in the power sector will **increase the electricity prices by 0.4-0.5 cent 07/kWh**

Sensitivity analysis for the national economy

- ❖ Basecase corresponds to the innovative scenario
- ❖ Total GHG emission decrease from basecase trend (1%, 5%, 10%, 15%, 20%, 25%)
- ❖ Additional cases:
 - GHG from fossil fuel usage at 80% of 1990 level
 - Implication of carbon prices
- ❖ Impact of emissions limitation and carbon prices on the GDP growth

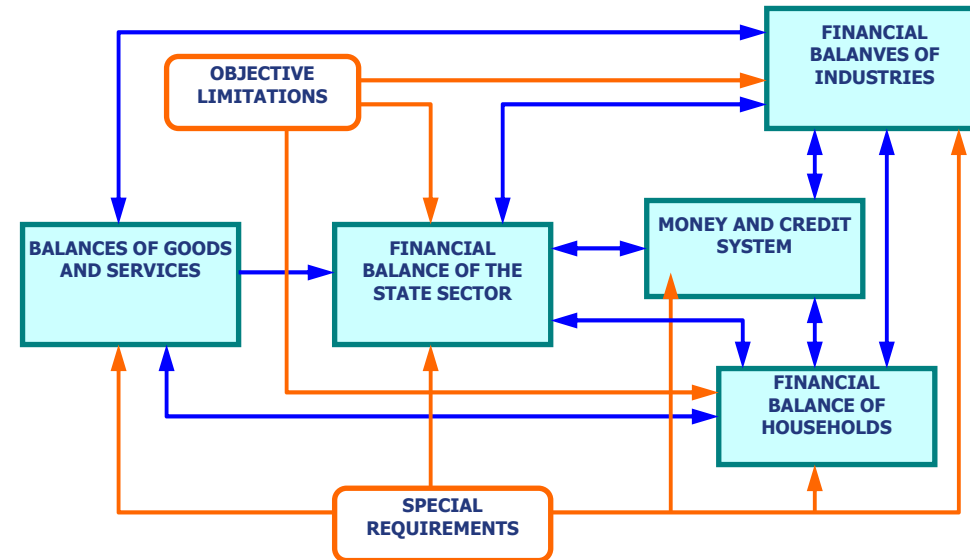
Economy and energy sector interrelations forecasting system (MENEK)

Economic agents:

- ❖ Productive industries
23 types of economic activity
- ❖ *incl. 6 related to energy sector*
- ❖ State institutions
- ❖ Aggregated households

Products:

29 goods and services, incl. 9 related to the fuel and energy: oil, gas, coal, motor fuel, fuel oil, electricity, centralized heat, coke and other oil products

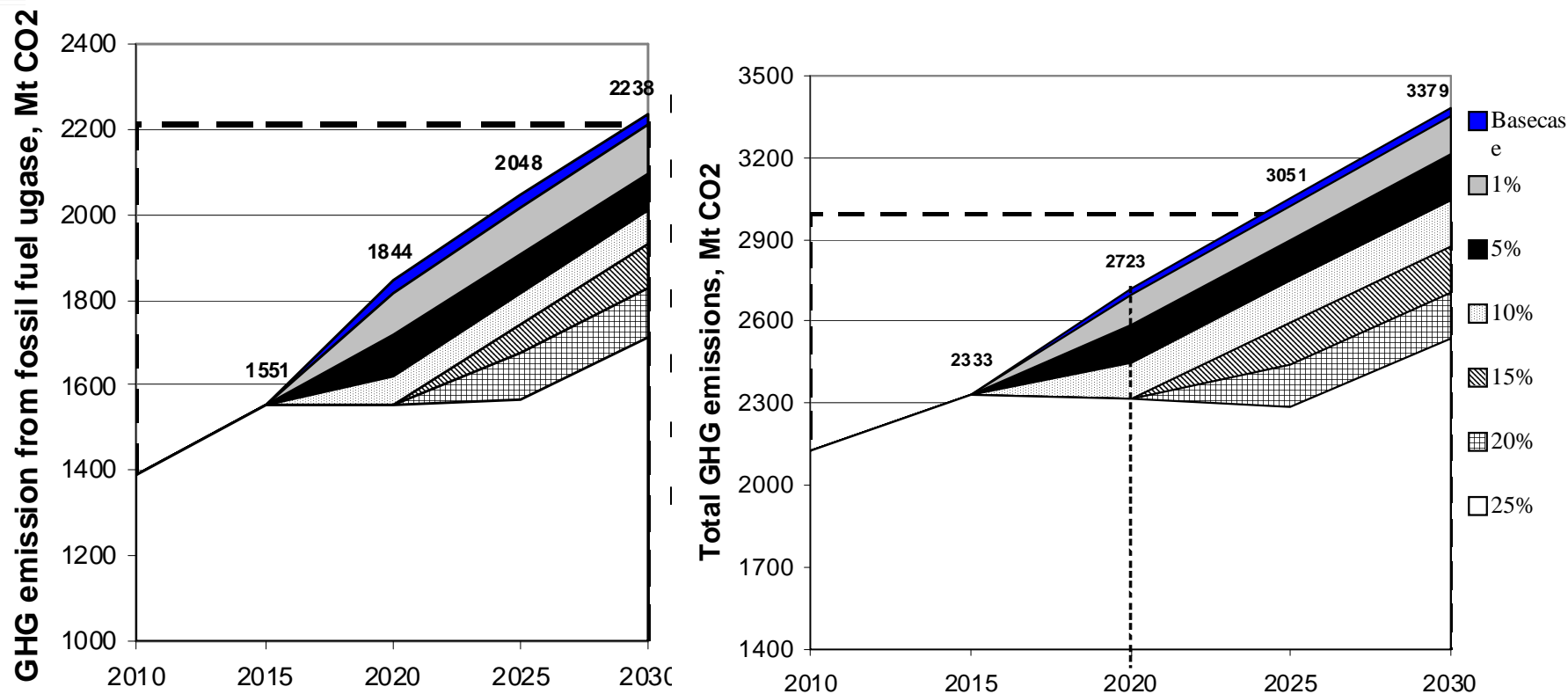


Informational structure of the model (agents and products) corresponds the official statistics provided by the Rosstat

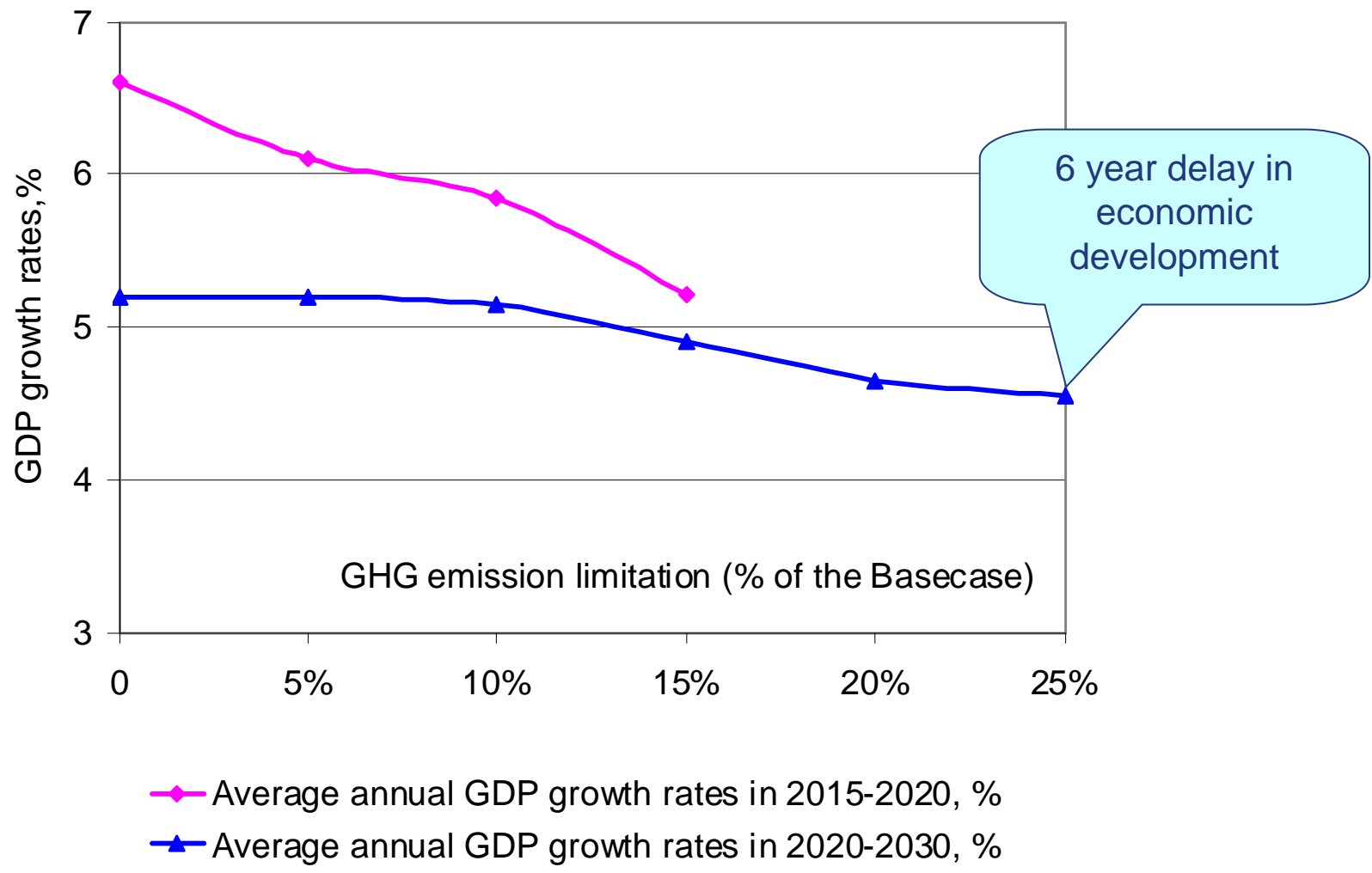
Due to the incompleteness, uncertainty, uncomparability of the reported data from different sources, special optimization "matching models" are developed and used to form the input information to the economy model

Sensitivity analysis of the GDP rates

To remain below the 1990 level by 2030 GHG emissions from fossil fuel usage may be decreased at 1-2% only from the basecase trend. To remain at 1990 level total GHG emissions must be limited at 10% and more.



Sensitivity analysis of the GDP rates



Impact of direct limitations and carbon prices

	2015	2020	2025	2030
GHG emission from fossil fuel usage, Mt CO₂				
❖ Basecase	1551	1844	2048	2238
❖ GHG limitation case and carbon pricing case	1500	1683	1744	1822
Carbon price, \$ per t CO₂				
❖ Basecase, GHG limitation case	0	0	0	0
❖ Carbon pricing case	39	76	95	99
GDP, Trillion Roubles 07				
❖ Basecase	40.8	56.2	73.8	93.3
❖ GHG limitation case	40.7	55.2	71.5	87.8
❖ Carbon pricing case	40.7	55.6	73.0	90.5
Electricity intensity, % to 2007				
❖ Basecase	90.4	79.1	70.4	64.0
❖ GHG limitation case	90.6	75.9	65.1	58.0
❖ Carbon pricing case	90.6	75.3	64.1	56.3

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Thanks for attention