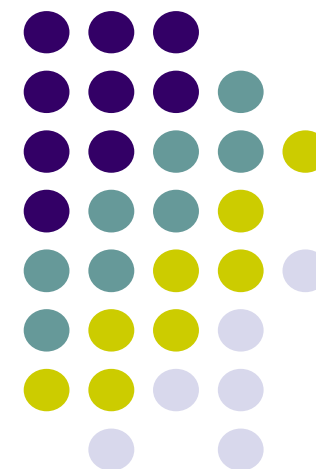


PROSPECTS AND STRUCTURAL OPPORTUNITIES FOR GREENHOUSE GAS EMISSIONS IN THE RUSSIAN POWER SECTOR UP TO 2030

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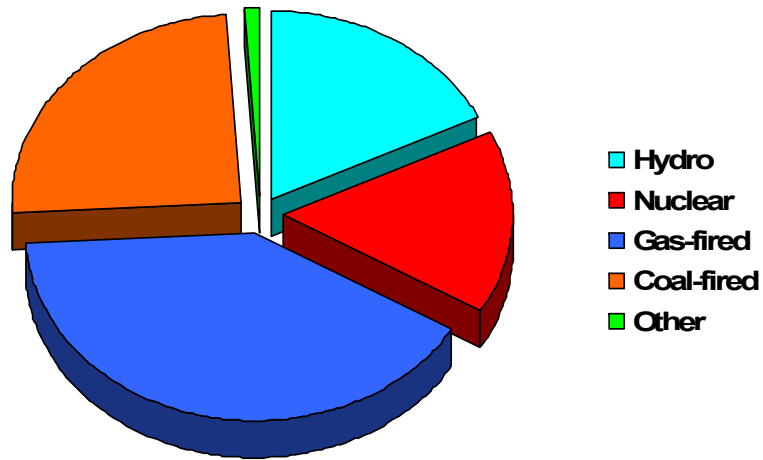
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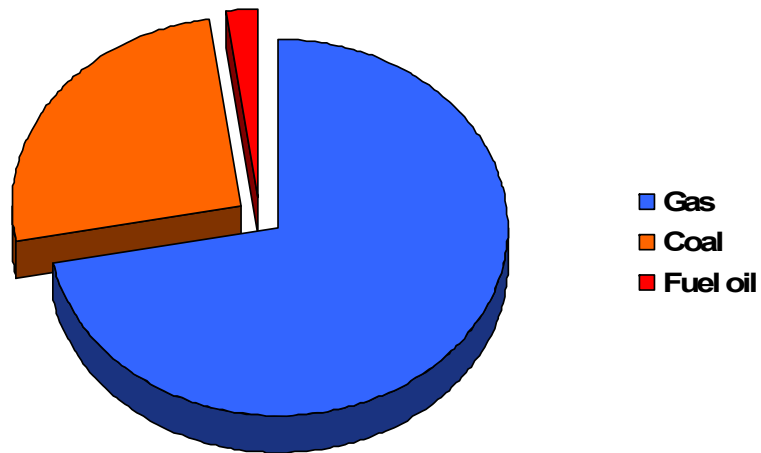
Power sector impact in the national GHG emission. Sector is a largest domestic gas and coal consumer, producing near 30% of the total GHG emissions, and more than 35% of CO₂ emissions.



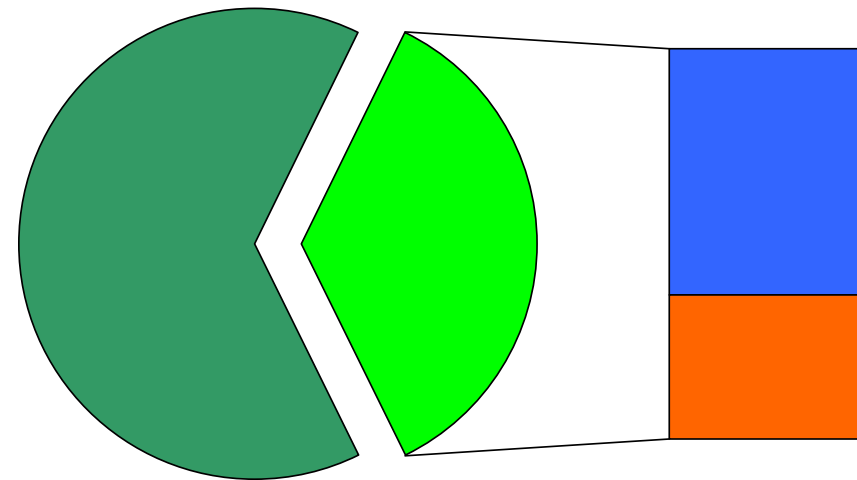
Electricity production structure in 2007



Fuel consumption in the power sector in 2007

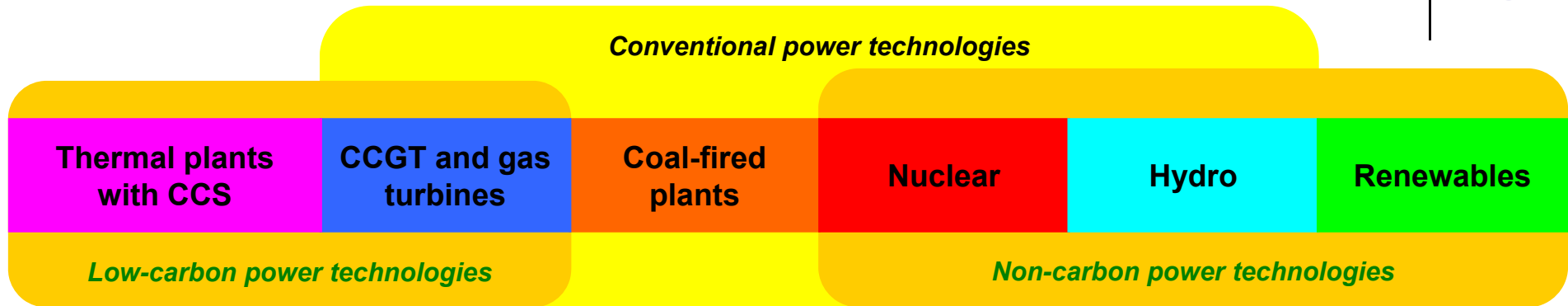


CO₂ emissions in the power sector in 2007

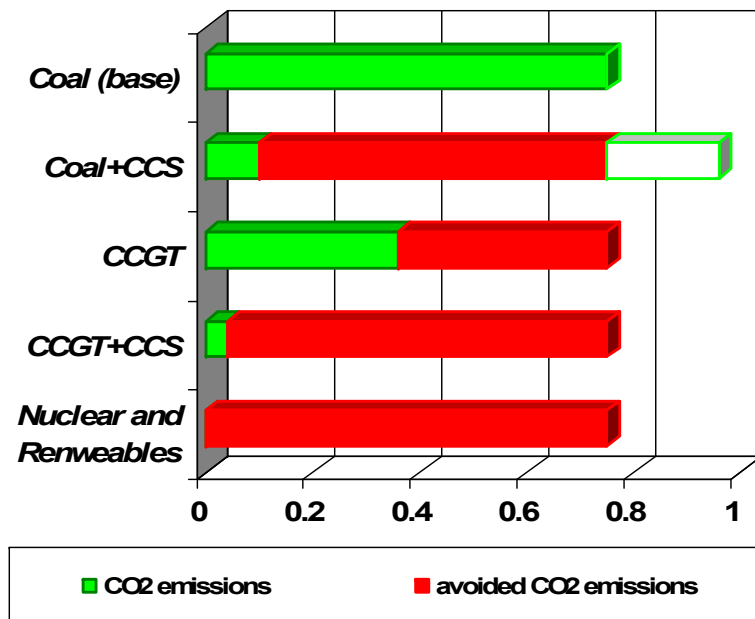


- Other economy
- Power sector (from gas)
- Power sector (from coal)

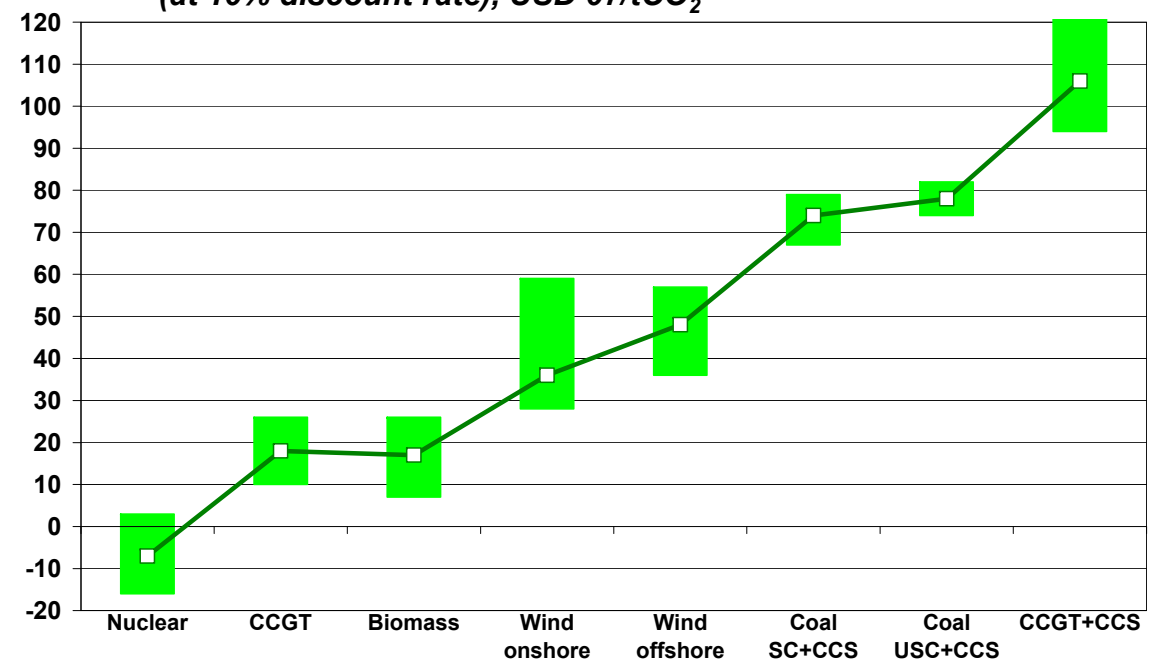
CO₂ avoided costs of power technologies has a wide spread depending on the uncertainties of the cost and performance data/ fuel prices as well as discount rates.



Specific CO₂ emissions by power technologies, tCO₂/MWh



Avoided costs of CO₂ emissions by power technologies (at 10% discount rate), USD 07/tCO₂



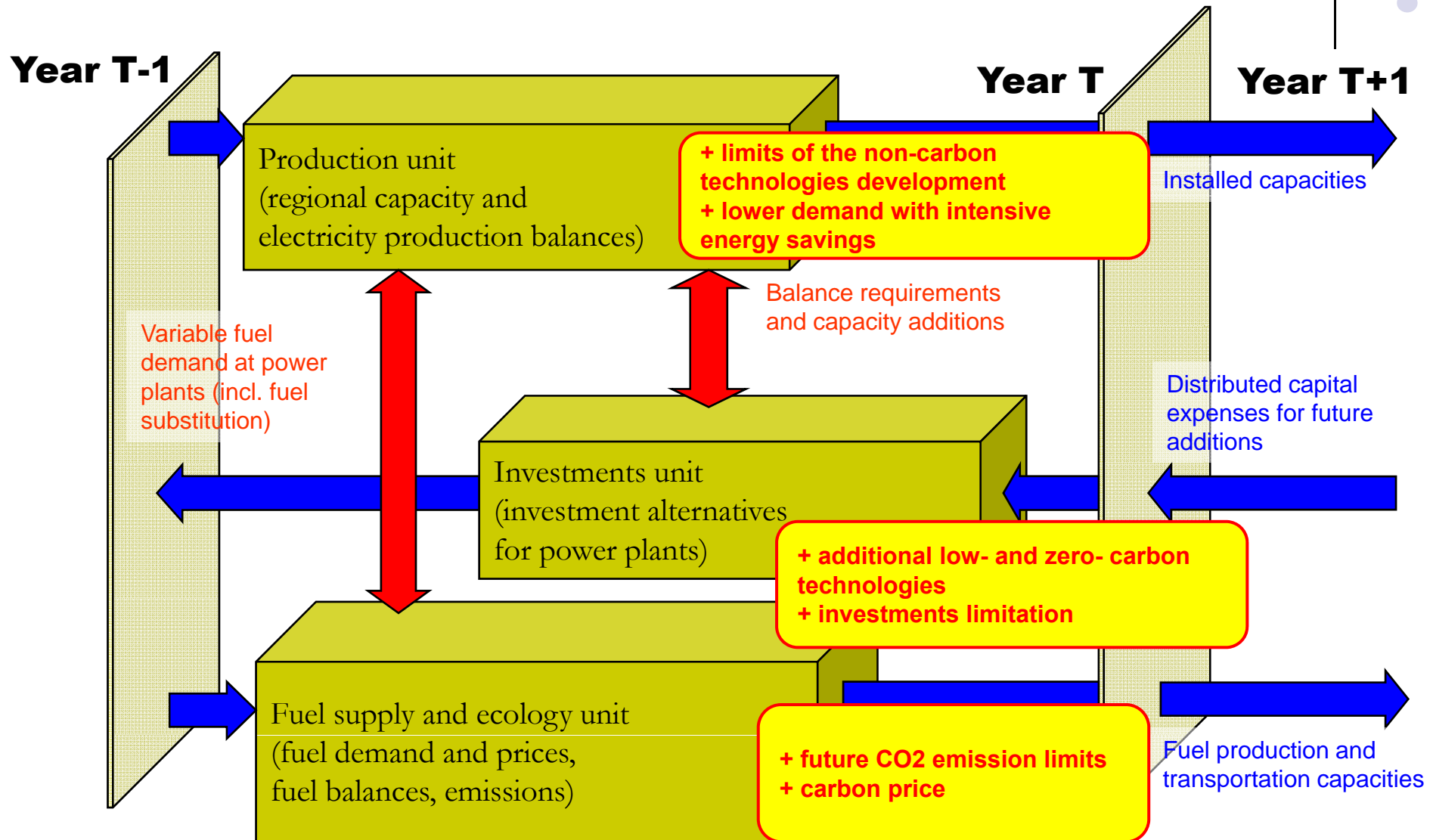
Implementation of price carbon approach may be an effective measure to manage the emissions in the power sector. A wide range of carbon price scenarios was considered due to the high differences in the CO₂ avoided costs.



Price of carbon, USD 07/t CO₂.

Cases	2010	2015	2020	2025	2030
Base	0	0	0	0	0
1	0	5	10	15	25
2	0	10	15	25	50
3	0	15	25	50	75
4	0	25	50	75	100

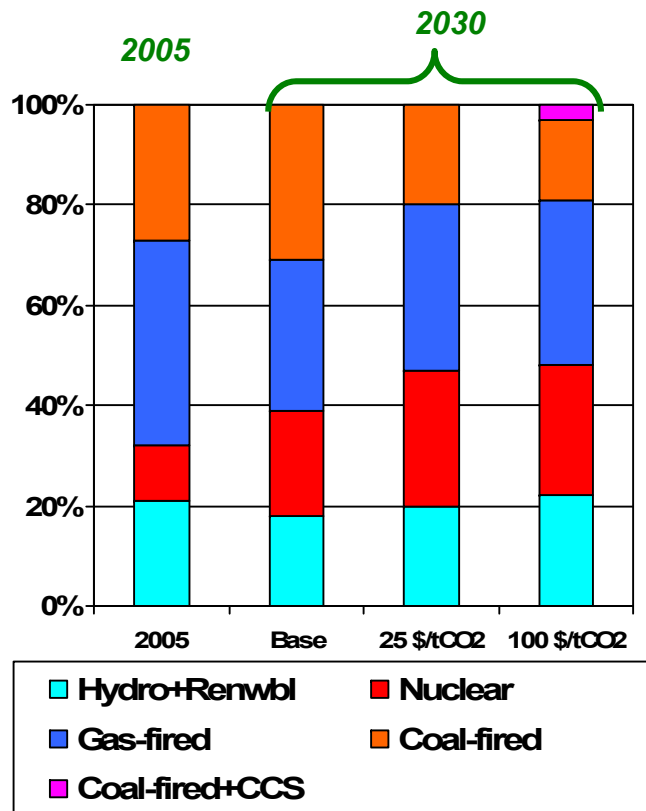
Assessment of the power sector adaptation for post-Kyoto agreements is developed using the modified version of the optimization model (EPOS-CARBON) with the wide opportunities for the choice between technological and structural measures of CO₂ emission limitation



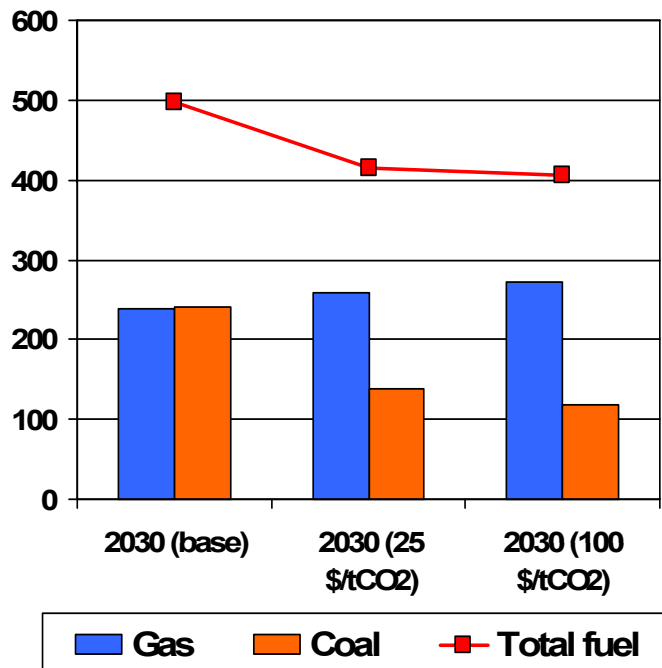
Carbon price will increase the share of nuclear and gas-fired generation. As a result, total fuel consumption will decrease and natural gas will remain the dominating fuel for the power sector – in the contrast to the base case.



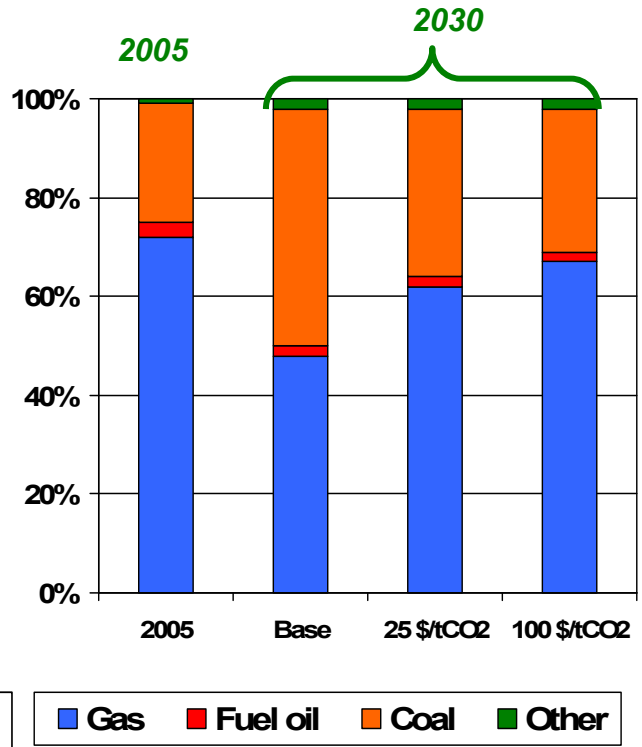
Changes in 2030 capacity mix under the base case and carbon price cases

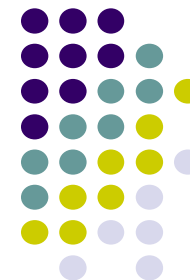


Changes in 2030 power sector fuel consumption under the base case and carbon price cases, Mtce

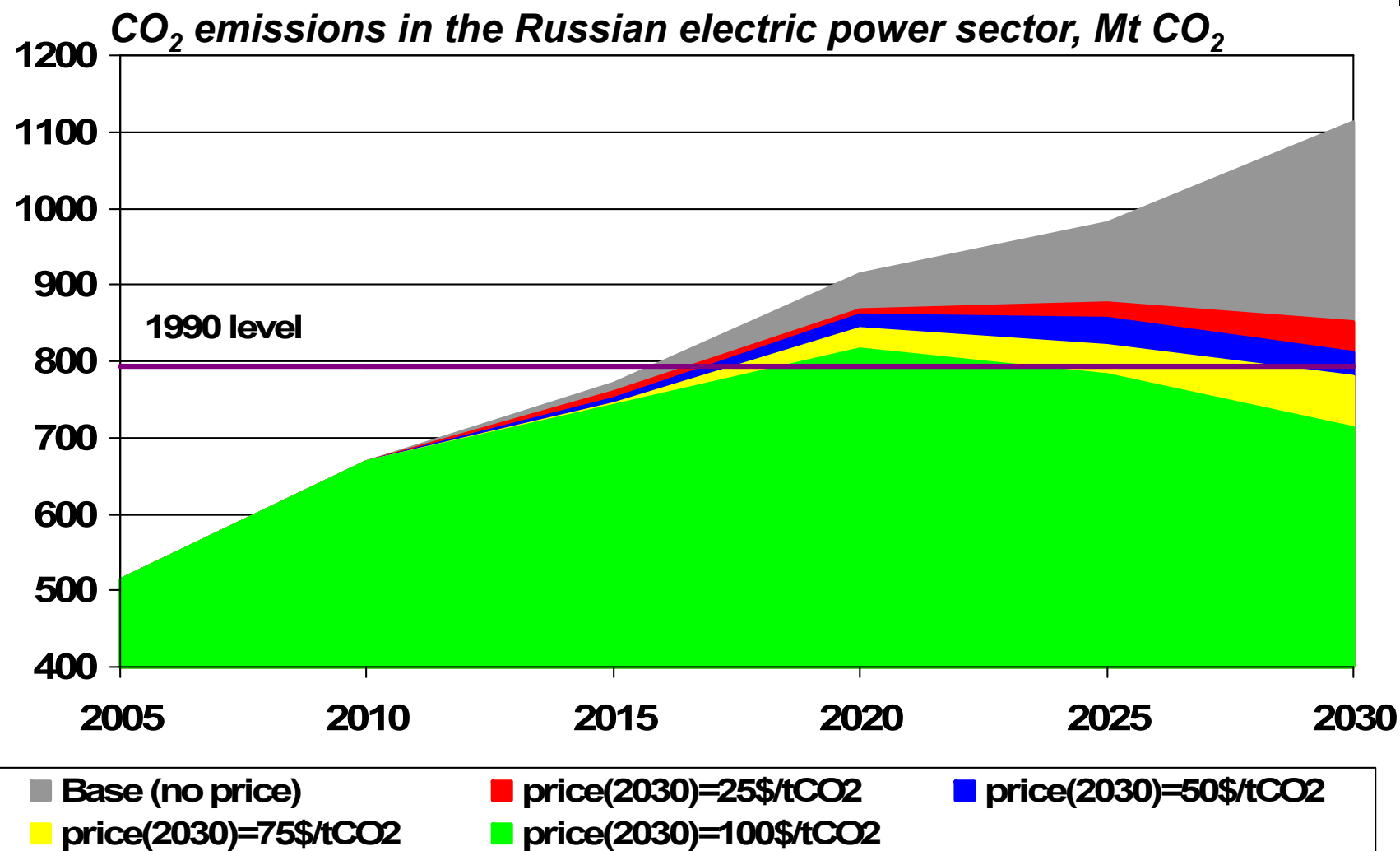


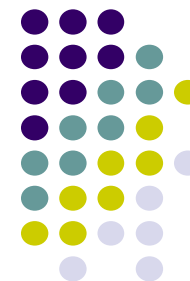
Changes in 2030 power sector fuel consumption mix under the base case and carbon price cases





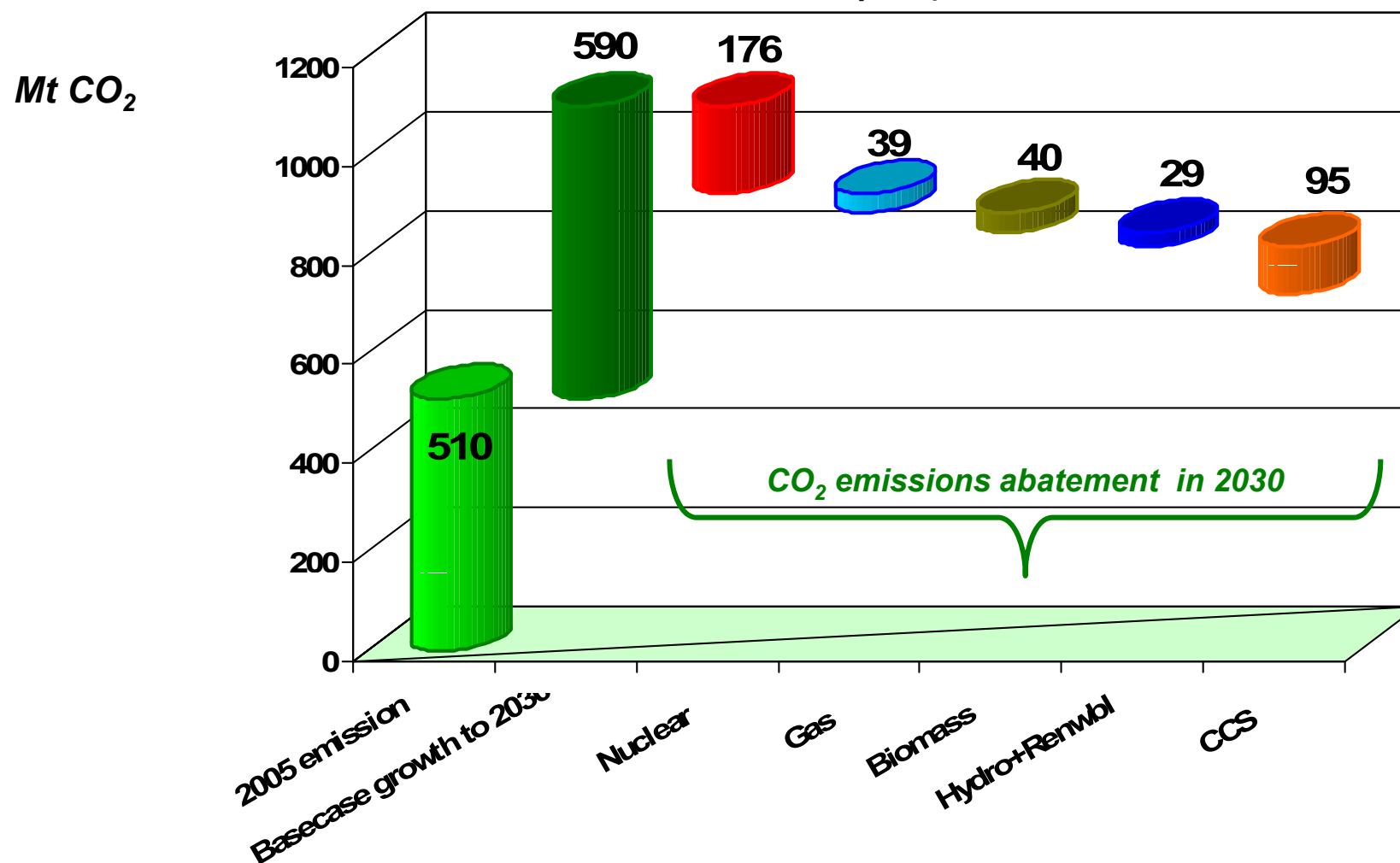
Due to the inertia of structural changes in the electric power sector the growing CO₂ emission trend will continue in the next decade. Later implication of the carbon prices will be able to reduce CO₂ emissions at 25-35% in 2030 in respect to the base case.

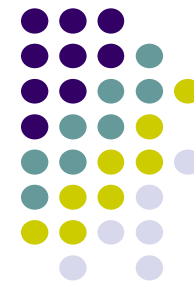




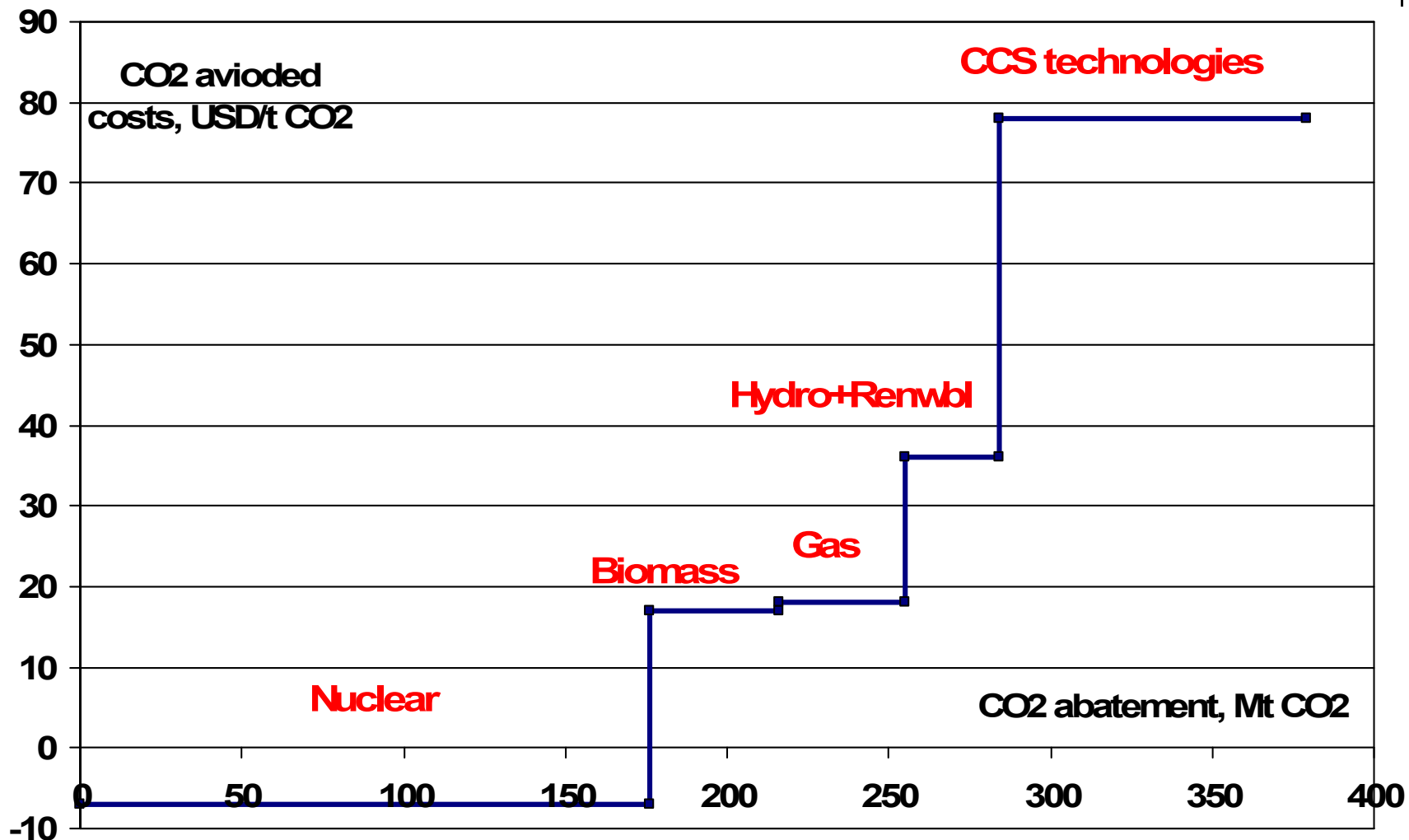
Coal substitution by the alternative energy resources will ensure most of the CO₂ abatement volumes to 2030. At the high carbon price CCS technologies will also make considerable impact.

Impact of low- and non carbon technologies in CO₂ emissions abatement (at the maximum carbon price)





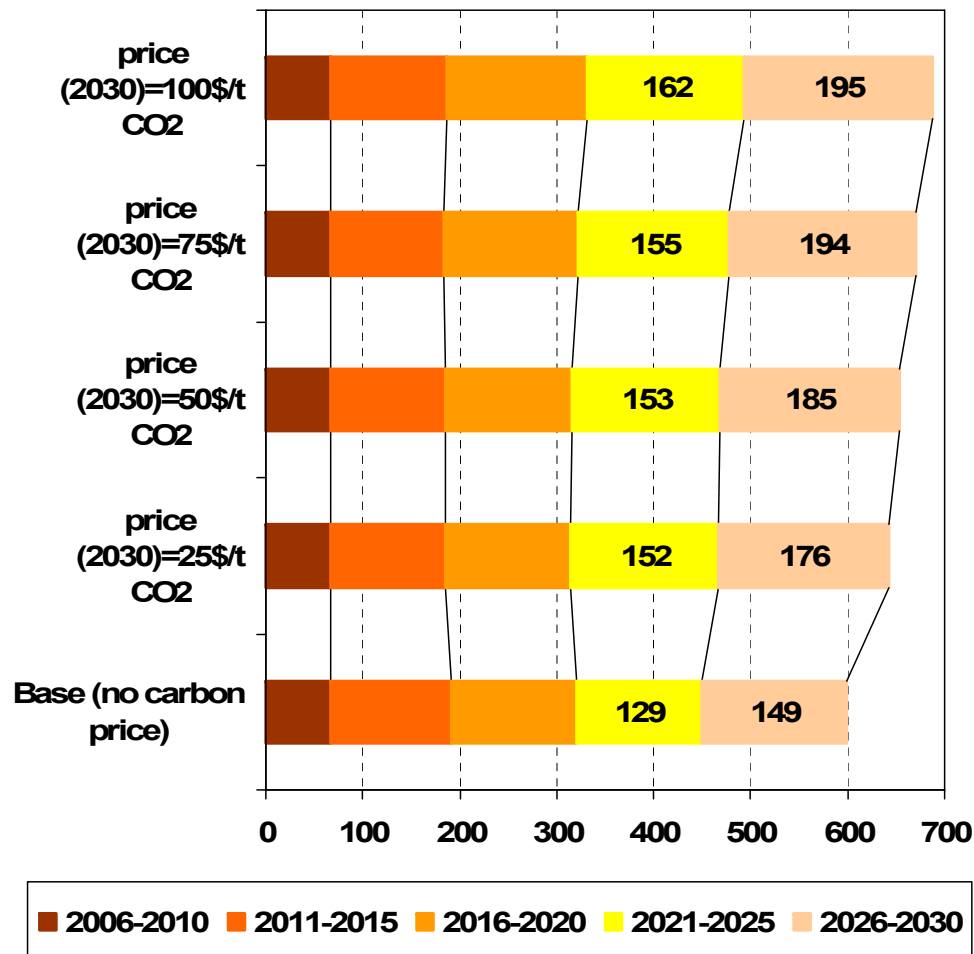
Resulting abatement cost curve represents opportunities for CO₂ abatement in the power sector based on the merit-order of low- and non-carbon technologies



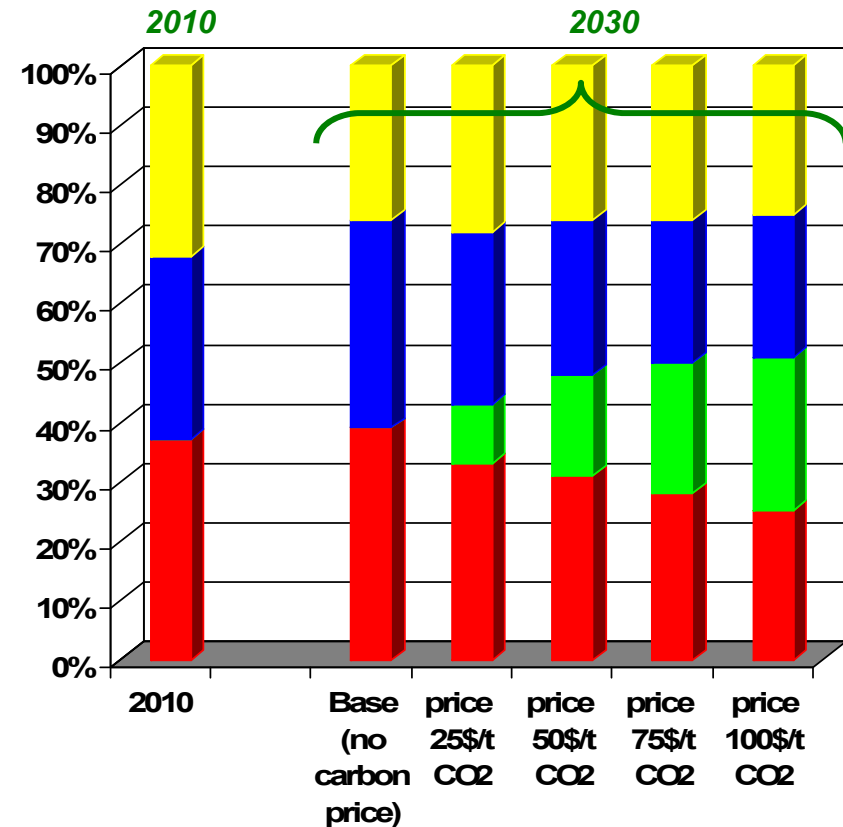
CO₂ abatement measures will require considerable additional capital costs since 2020. Introduction of the carbon price (similar to the tax for fossil fuels) will increase the power sector fuel costs by 50-100%



Capital requirement for generation, bln USD 07



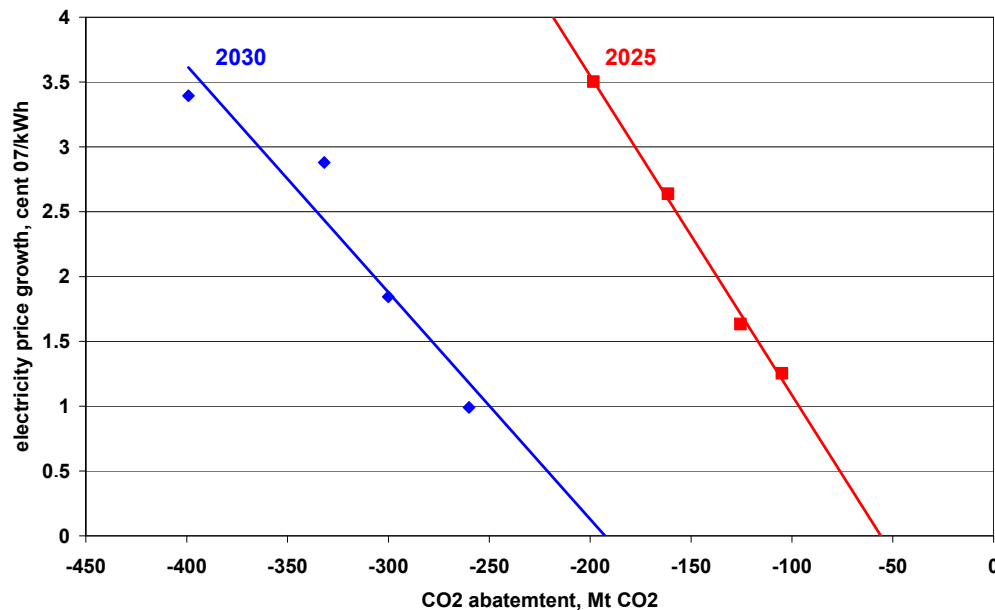
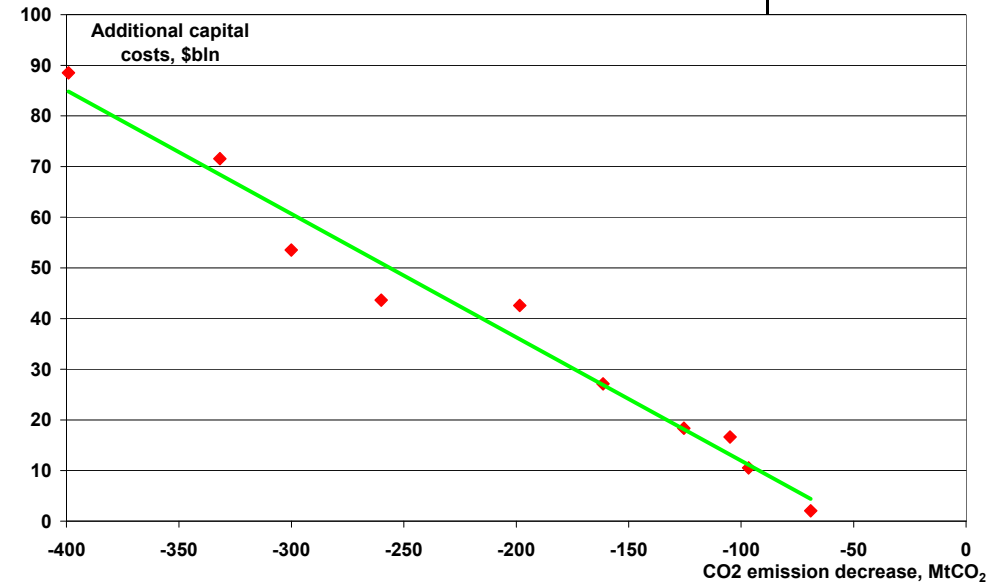
Power sector revenue requirement structure



Transition to the new ecology policy in the power sector will be accompanied by the additional investment and a negative pricing impact on the national economy



Each 100 Mt CO₂ abatement in the power sector will require **billion 25 USD 07** of additional investments for low- and non-carbon technologies



Each 100 Mt CO₂ abatement in the power sector will **increase the electricity prices by 2-2.5 cent 07/kWh**