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LOW-CARBON RUSSIA: A RISK-REDUCING STRATEGY FOR PROVIDING ENERGY AND ECONOMIC SECURITY: 2050 PERSPECTIVE

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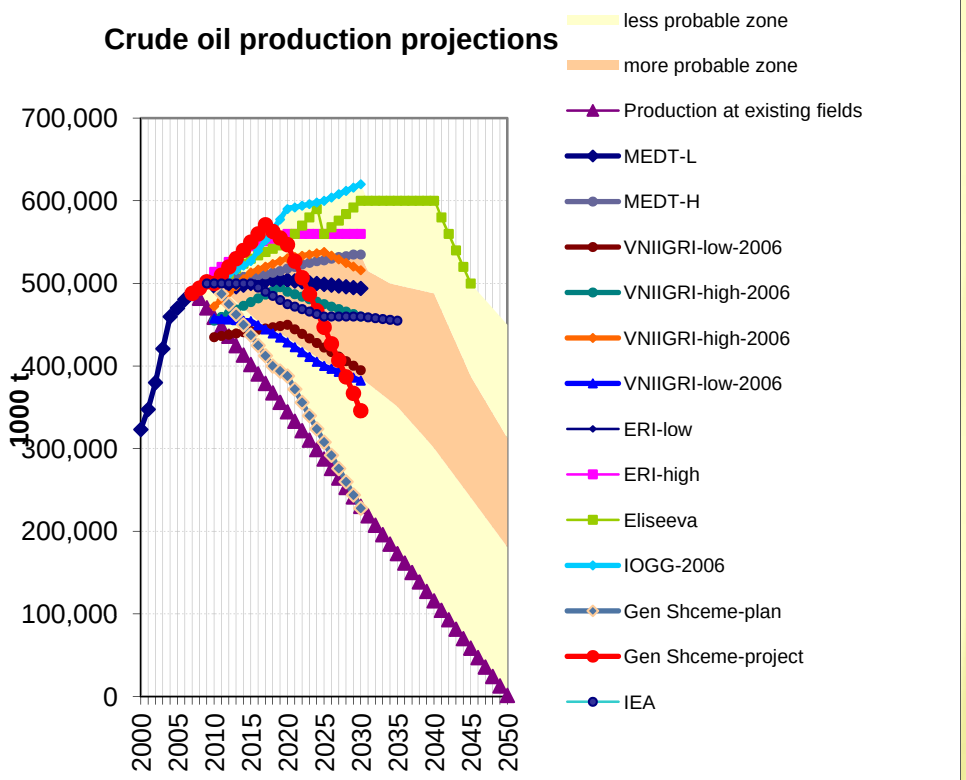
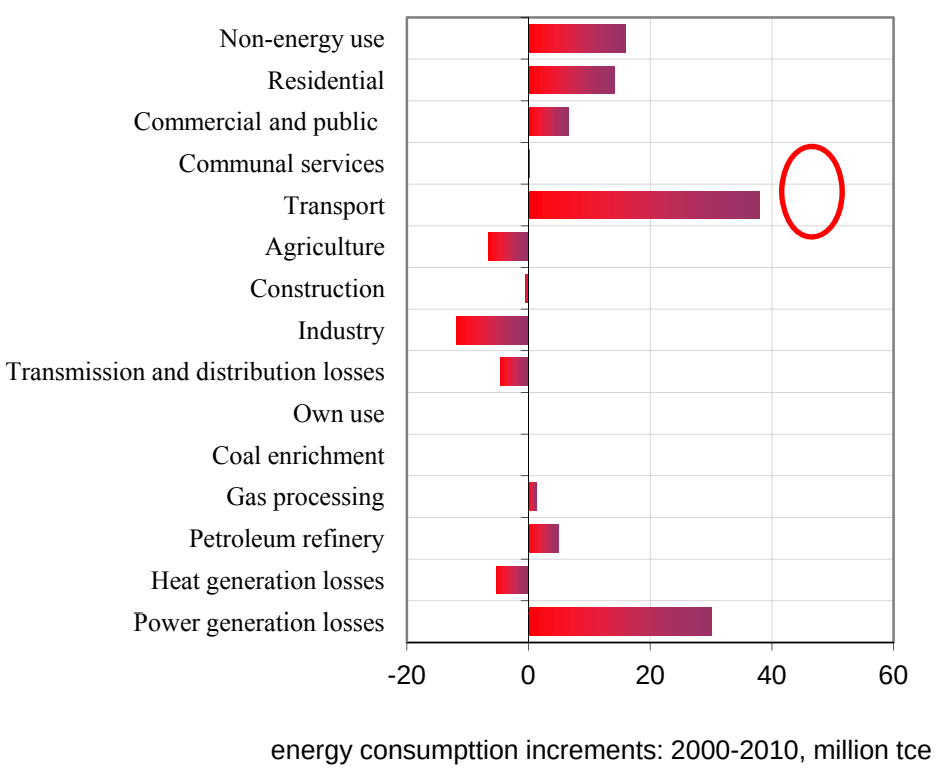
THE PROBLEM: DOES CLIMATE MITIGATION POLICIES IMPLEMENTATION INVOLVE LARGER RISKS FOR ECONOMIC SECURITY, THAN NEGLECTING THESE POLICIES?

- The position of the Russian Federation in climate change negotiations used to lack confidence in potential long-term consequences of various policy choices
- For a long time it had been generally believed, that Russia can sustain its economic growth based on the oil and gas export model
- Transition to a low-carbon economy is still perceived as a not urgent strategy for Russia, or as a growth-braking strategy
- Such strategies for EU and other countries are viewed as exotic and involving a high risk of failure
- No systematic studies have been made so far to identify long-term (beyond 2030) risks for Russia's energy and economic security, if Russia fails to increase its oil and gas production or is slow in modernization and transition to a low-carbon economy
- Official strategic documents and expert studies are mostly limited to the 2020 or 2030 time horizon, and therefore are unable to identify real long-term risks associated with a highly probable oil production decline in Russia after 2015-2020 and gas production decline after 2030-2040
- To make its position more robust, Russia still needs better scientific grounds to assess the costs and benefits of a potential transition to a l carbon economy

RUSSIAN OIL PRODUCTION IS PROJECTED TO STABILIZE AND THEN TO DECLINE. IN CONTRAST, RUSSIAN DOMESTIC OIL CONSUMPTION IS GROWING AND PROJECTED TO GROW

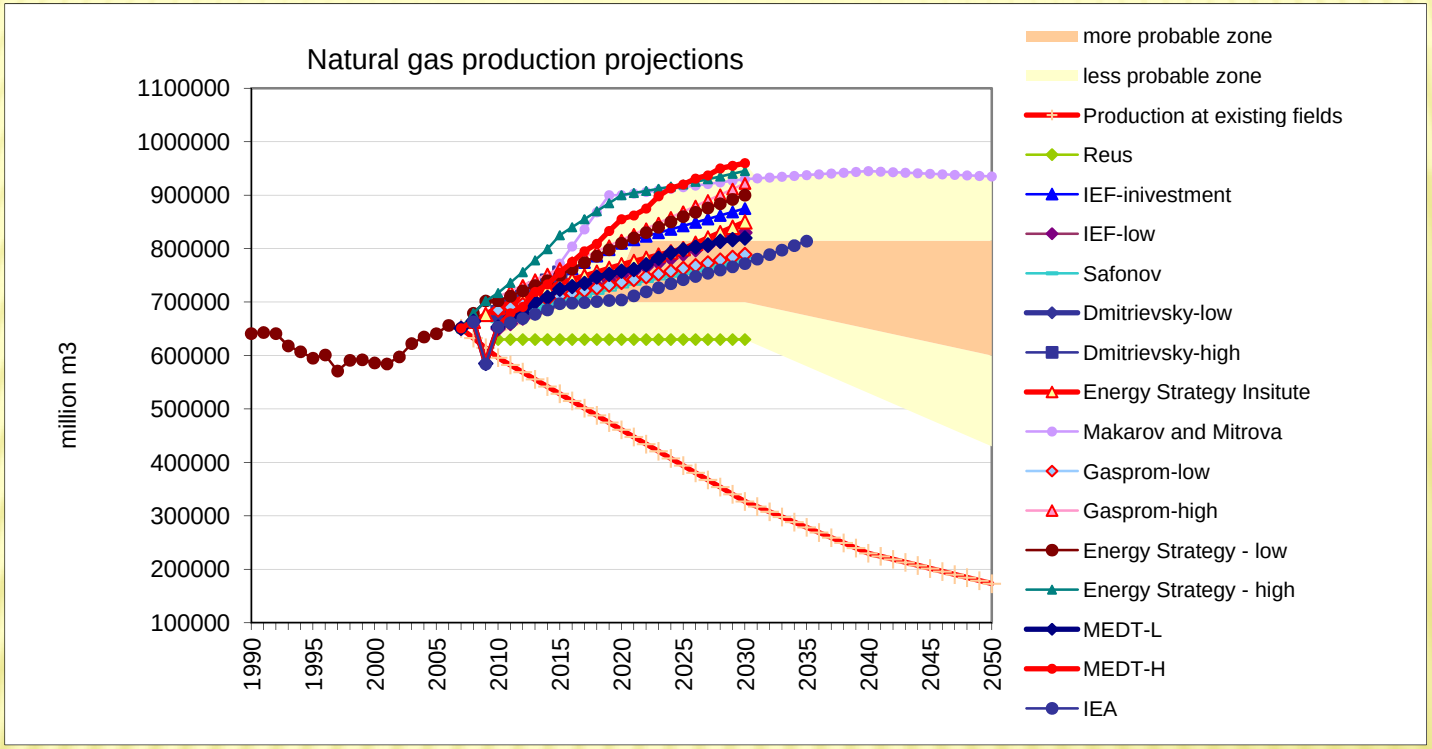




The most recent projections do not report Russian crude oil production and crude oil export growth after 2015-2020

In 2010-2050, domestic consumption of petroleum products is expected to grow by 1.7-2.2% annually in current policy scenario

RUSSIAN GAS PRODUCTION MAY BE GROWING FOR A WHILE, BUT STABILIZATION OR DECLINE IS EXPECTED BEFORE 2040



No limitations on Russian gas export are assumed

In 2010-2050, domestic consumption of natural gas is expected to be growing. So, for BAU case gas export potential will start shrinking after 2030-2035

The share of Russian oil and gas GDP is over 20% of the total GDP

With oil and gas export shrinking, Russian energy and economic security is at risk

Revenue from oil and gas sector are responsible for a large part of aggregated demand, thus impacting both capital flows and consumption in non-oil and gas-sectors

HOW SUSTAINABLE IS ECONOMIC GROWTH WHEN OIL AND GAS CONTRIBUTION TO GDP SHRINKS?

Analysis tools

- Macroeconomic model – RUS-DVA-2050
  - Two sectors:
    - oil and gas sector (production, refinery and delivery of oil and gas). The products - crude oil, petroleum refinery products and natural gas
    - non-oil and gas sector (one product for the rest of the economy).
  - Model blocks: GDP production, aggregated demand, balance of payments, consolidated budget and prices
  - One year calculation step and time horizon to 2050
  - Parameters are calibrated based on the 1995-2010 data
- Energy balance model ENERGYBAL-GEM-2050
  - Based on the energy balance concept, includes energy production, transformation and energy demand blocks
  - Has a detailed structure which, after long debates, was officially recognized by the government as energy balance for the Russian Federation in the State Program "Energy conservation and energy efficiency until 2020"
- A "cloud" of sectoral models, where parameters of energy demand functions are calibrated to reflect policies
  - (power generation, heat supply, industry, buildings, transport)

A MATRIX OF 17 PROJECTION SCENARIOS

Groups of scenarios	Population	Crude oil production	Oil refining	Natural gas production	Crude oil price	Energy efficiency improve-ment	Productivity of production factors
Russia – Gods' favorite	High	High 2	High	High 2	MED-Inn	High	High
Oil and gas optimizm-1	High	High 2	High	High 2	MED-Inn Inn-E1 MED-E2	Base	Base
Oil and gas optimizm-2	High	High 1	High	High 1	MED-Inn Inn+E1 MED-E2	Base	Base
Hydrocarbon depletion -1	Low	Low2	Low	Low2	MED-Inn Inn+E1 MED-E2	Base	Base
Hydrocarbon depletion -2	Low	Low1	Low	Low1	MED-Inn Inn+E1 MED-E2	Base	Base
Modernization with moderate energy efficiency improvement	Low	Low2	Low	Low2	Inn+E1	Base	High
Effective modernization	Low	Low2	Low	Low2	MED-Inn Inn+E1 MED-E2	High	High

OIL AND GAS PRICES EVOLUTION AND POPULATION GROWTH ASSUMPTIONS

Russia is facing a future with declining population

Labor force is assumed to be declining 0.4-0.9% per year until 2050

In 2010-2020, population of the working age may be declining by 1 million per year

Four assumptions covering a wide range of oil price evolution are made

Gas export prices are a function of oil prices

If the relationship changes, the study findings are even more robust

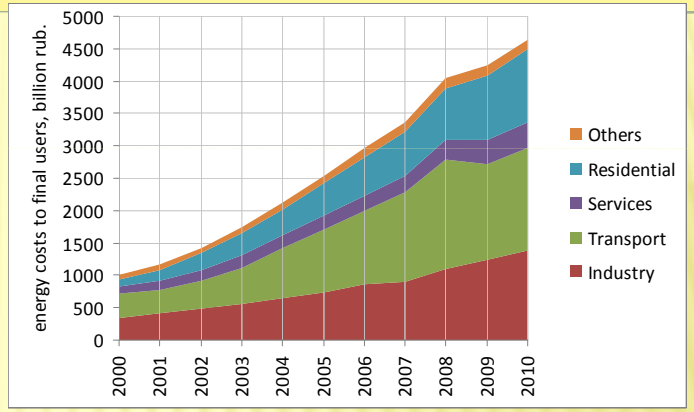
Domestic gas prices are driven by export gas prices and exchange rates

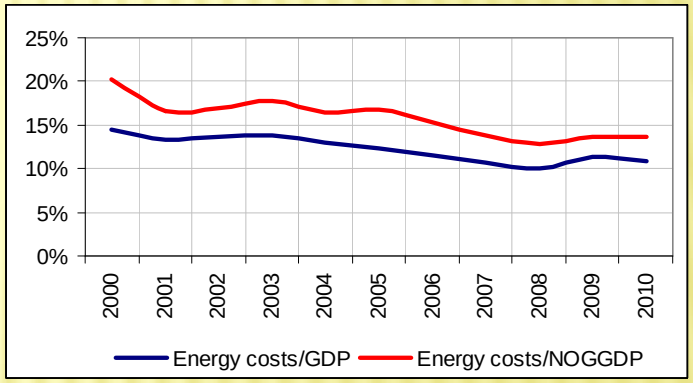
The tighter is the balance of payments due to low oil and gas exports, the higher are exchange rates and domestic gas and electricity prices

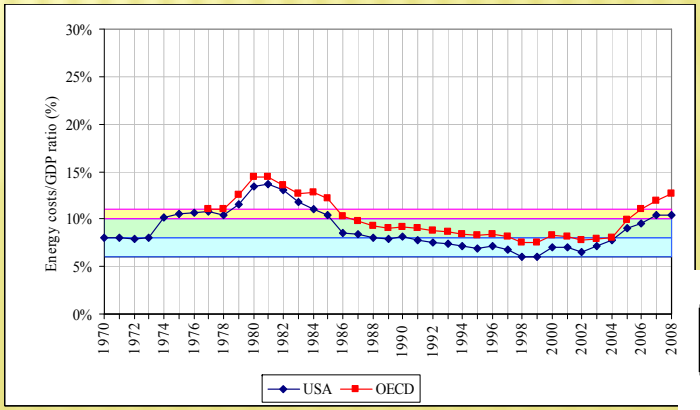
Energy affordability issue comes out on stage. With low oil and gas export revenues, domestic energy prices go up so much, that domestic demand for these resources is squeezed by the lack of purchasing power, thus leaving more fuels for export

IN 2000-2010, IMPROVED ENERGY EFFICIENCY CONSIDERABLY REDUCED THE BURDEN OF ENERGY COSTS, BUT ENERGY PRICE GROWTH KEEPS IT CLOSE TO THE AFFORDABILITY HURDLES

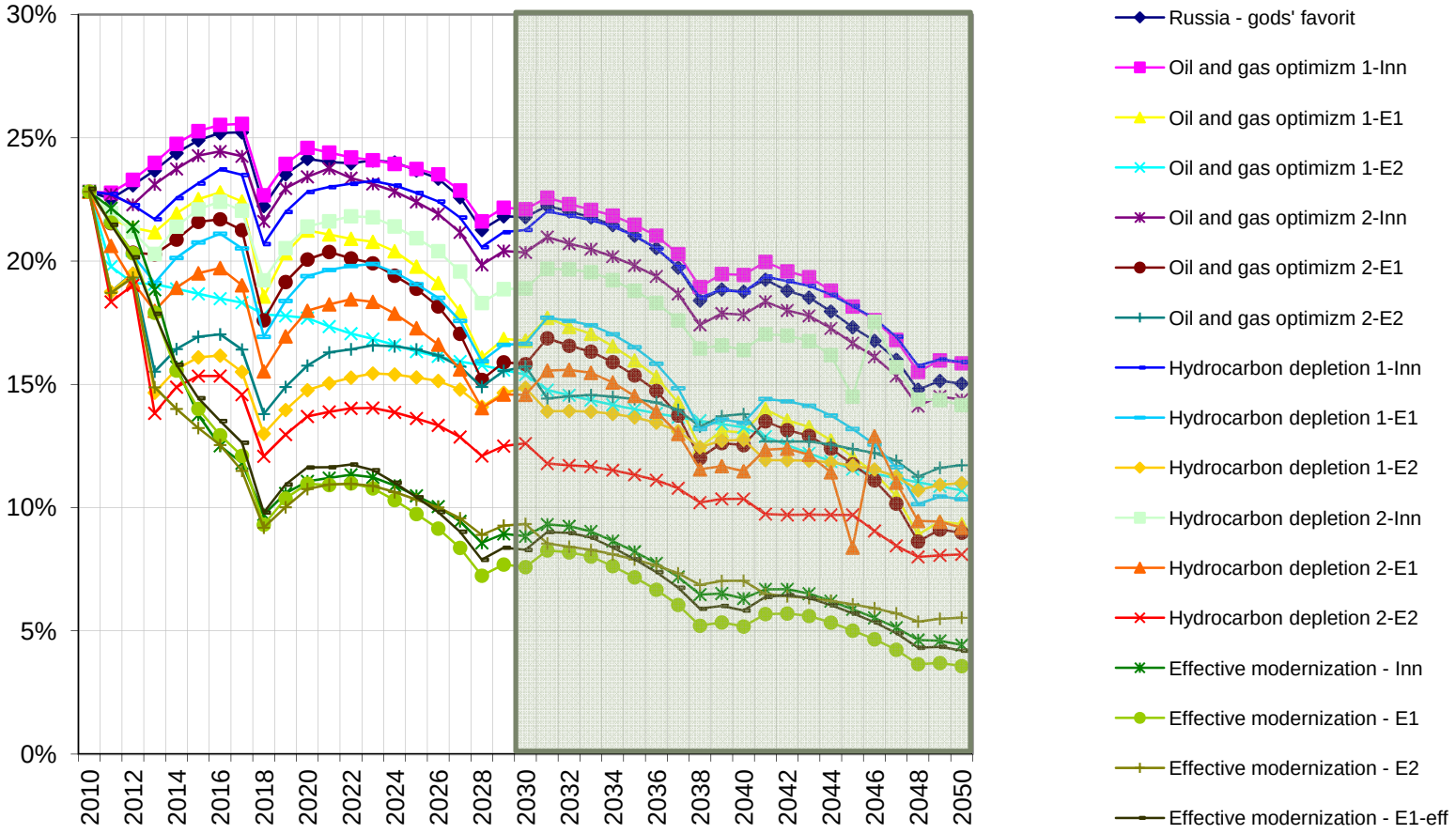
- In 2000-2010, energy costs to final users more than quadrupled and reached 5 trillion rub.
- Nevertheless, due to efficiency improvements energy costs to GDP ratio declined from 14.5% in 2000 to 10.8% in 2010
- When energy costs are compared with non-oil and gas GDP, the progress is also impressive, but the ratio is quite high
- Energy costs to industrial shipments ratio in 2005-2010 varied in the range of 7-9%, which is much above of the same ratio for many advanced economies (4-5%) and undermines the competiveness of Russian industry
- In the long-term, energy costs to income ratios are relatively stable with only a very limited range of variations
- In the USA ,sustainable range of energy costs to GDP ratio is 8-10% and 9-11% for the OECD
- When these thresholds are much exceeded, the economic activity slows down
- The ratios of housing energy costs and fuel costs for personal transport to personal income (before taxes) vary in the range of 2-4% in many countries. In Russia, in 2009



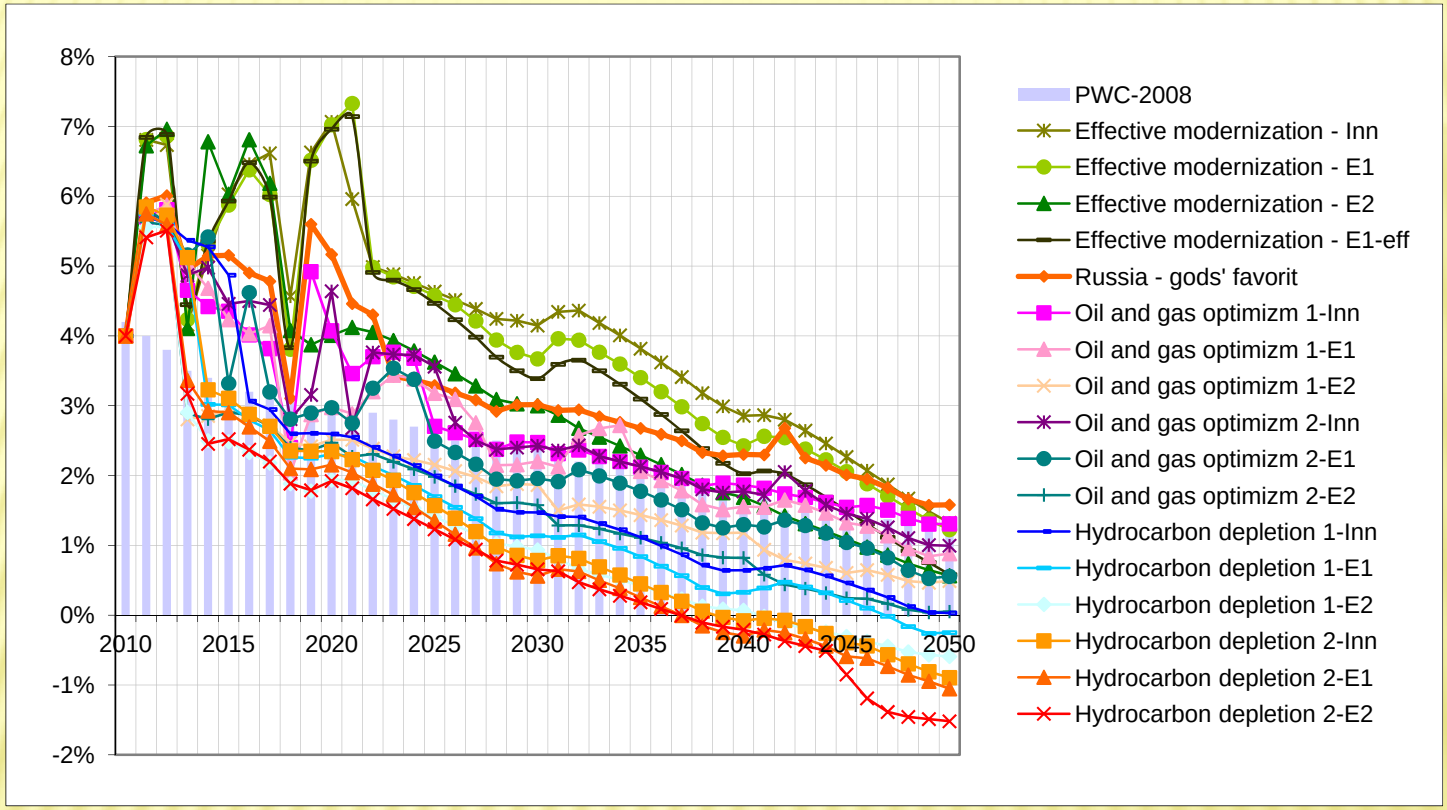




SINCE 2028, THE SHARE OF OIL AND GAS SECTOR IN GDP FOR ALL 17 SCENARIOS IS LOWER, THAN IN 2010



WITH LOW OIL PRODUCTION AND A FAILURE OF ECONOMY MODERNIZATION THERE WILL BE NO GDP GROWTH IN RUSSIA IN THE MIDDLE OF THE 21ST CENTURY

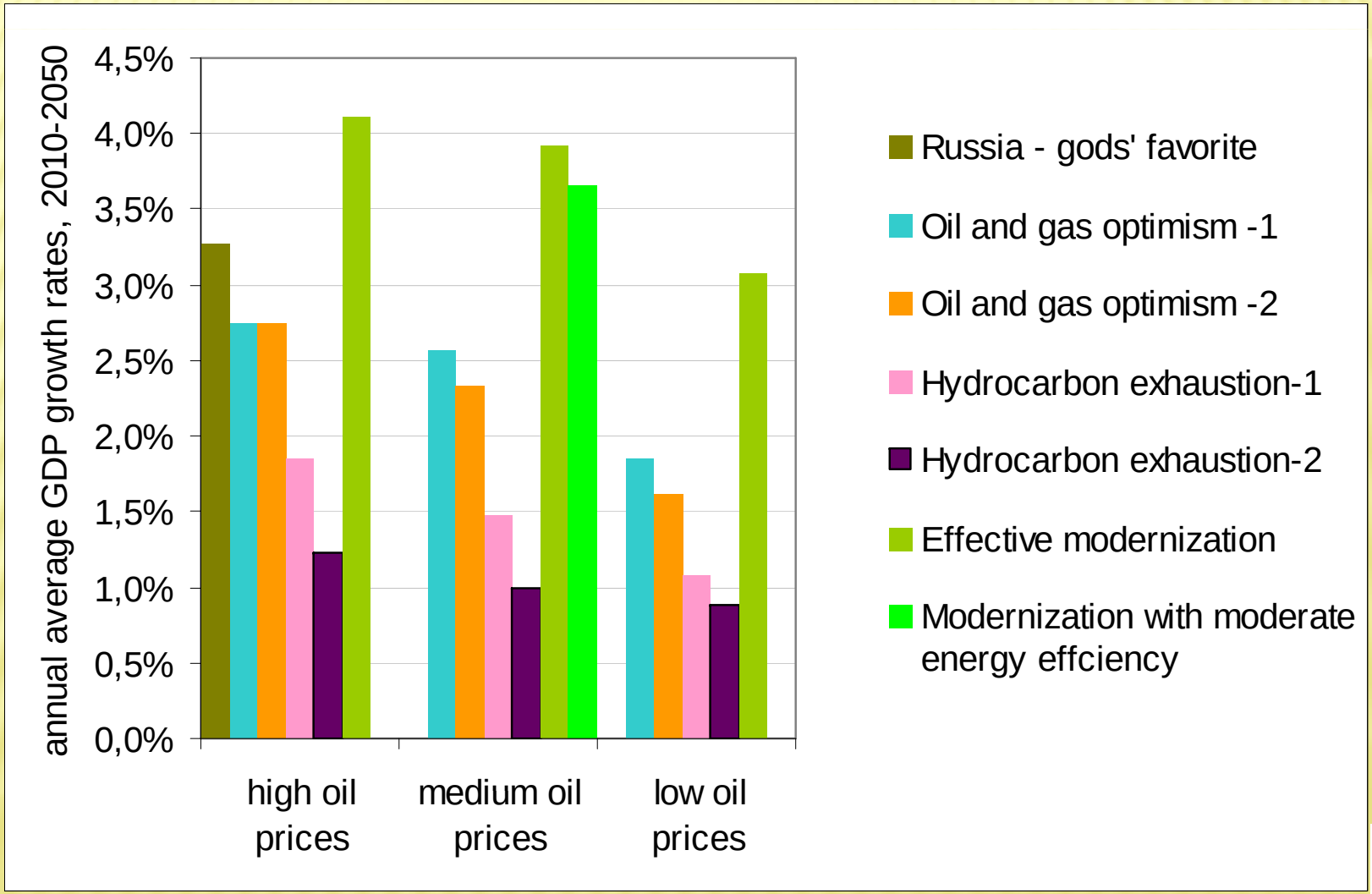


Russia may become one of the first countries with "shagreen skin" economy – continuously shrinking GDP

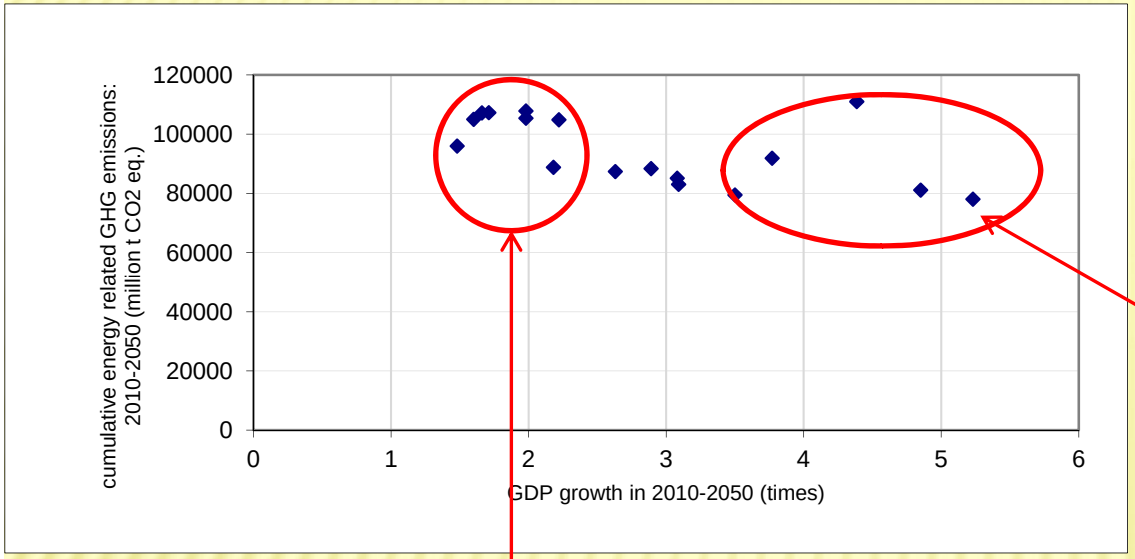
In the hydrocarbon depletion scenarios family, Russia becomes an oil importer and does not benefit from high oil prices anymore

There will be a need for a new economic theory of shrinking economy

TRANSITION TO THE "LOW-CARBON RUSSIA" SCENARIOS MUST BE ACCOMPLISHED IN 2020-2030 OR SOONER, OTHERWISE ENERGY SHORTAGE AND COSTLINESS WILL SLOW DOWN OR STOP ECONOMIC GROWTH



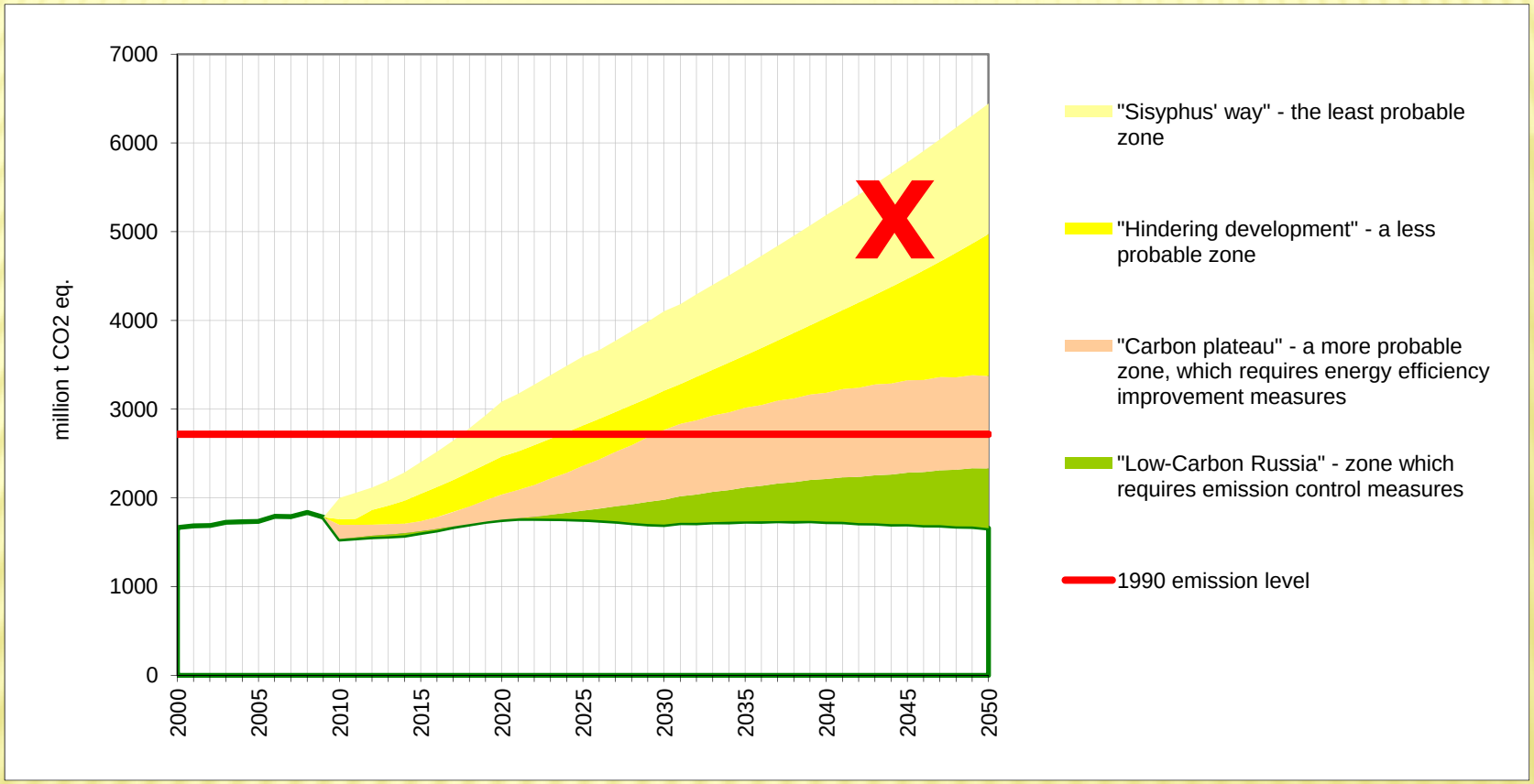
NO POSITIVE RELATIONSHIP BETWEEN CUMULATIVE ENERGY-RELATED GHG EMISSIONS AND GDP GROWTH WAS FOUND ACROSS 17 SCENARIOS



- This relationship is rather inverse
- More dynamic economic growth is possible only if modernization (including improved energy efficiency and more renewables to reduce domestic fuels consumption) is successful and accompanied by lower cumulative emissions

- Slow growth - large emissions causality. Domestic gas price is a function of world gas price and exchange rate. When oil and gas export revenues decline, ruble becomes cheaper and domestic gas prices are growing faster, than electricity and coal prices, thus promoting their use and corresponding emissions growth
- Hydrocarbons depletion scenarios require the doubling of coal production from 2010 level, which is hardly possible. Therefore, implementation of these scenarios is hardly probable, and economic growth would be even slower
- **More studies are required to investigate the relationship between economic growth and low-carbon development**

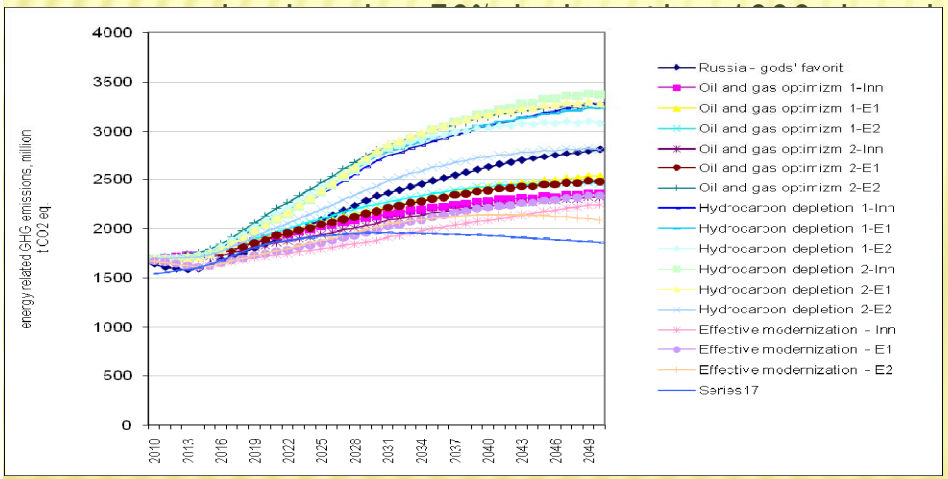
OF FOUR SCENARIOS FAMILIES DEVELOPED IN 2008, THE FAMILY “SISYPHIAN WAY” DIDN’T SURVIVE THE CRISIS

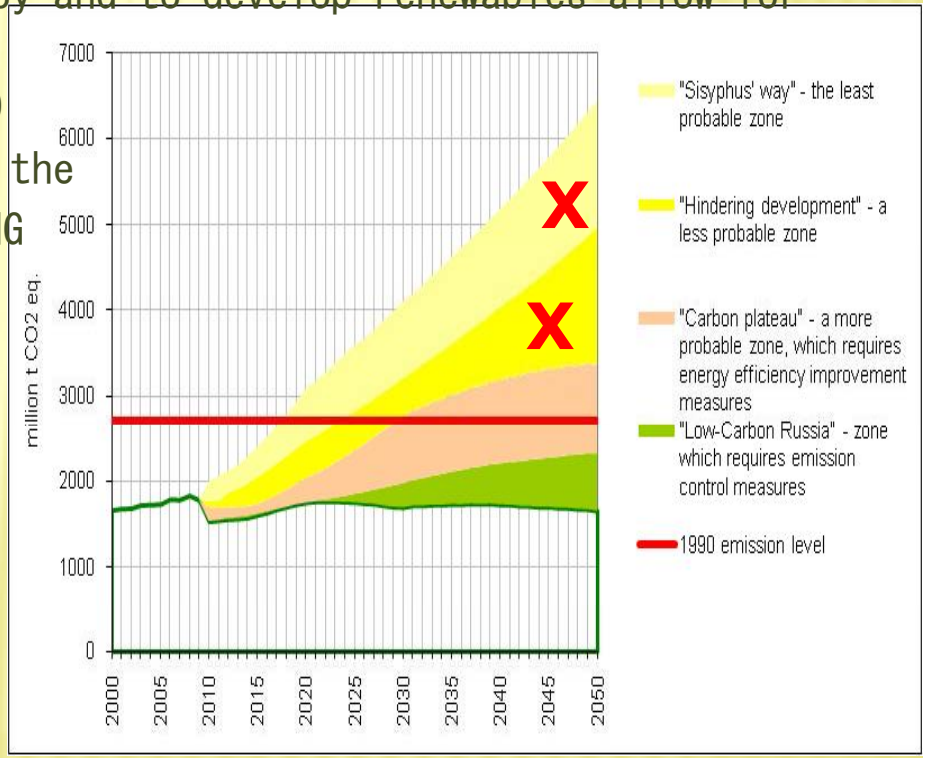


- The probability of what was labeled in 2008 as “the least probable zone” today is practically equal to zero
- The economic crisis and more realistic future economic vision has crossed out from the picture a larger zone, than potentially may be erased by specific policies to control GHG emissions

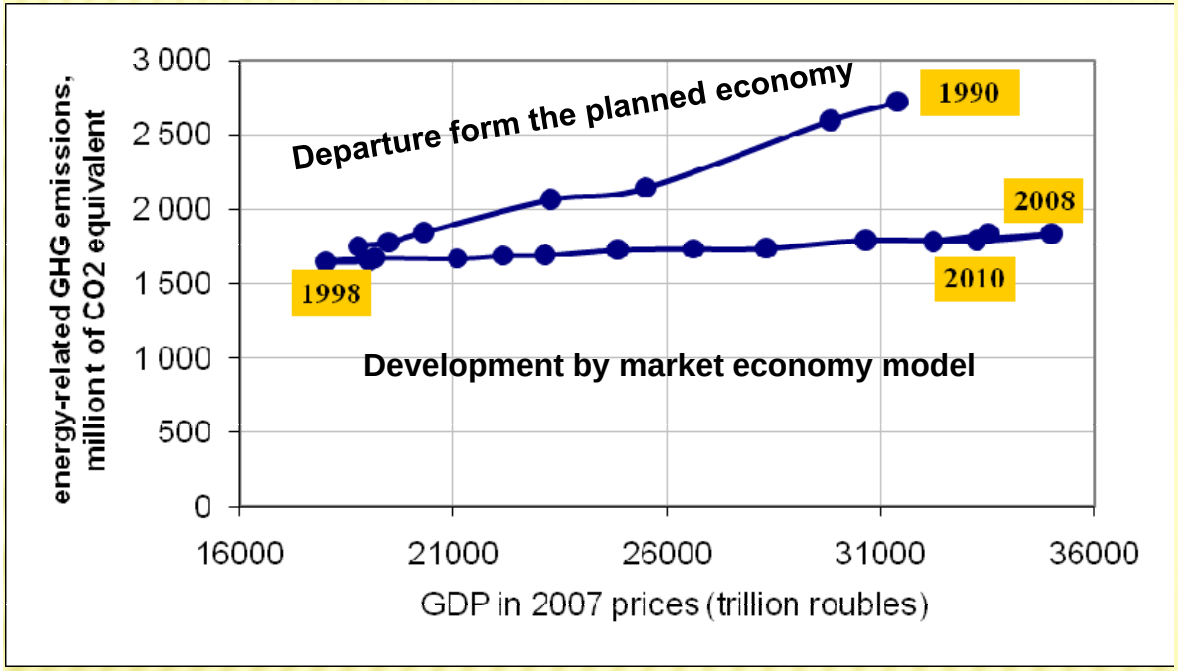
THE "HINDERING DEVELOPMENT" SCENARIOS FAMILY HASN'T SURVIVE THE ANALYSIS ABOVE. IN NONE OF THE 17 SCENARIOS ANNUAL GHG EMISSIONS EXCEED 3500 MILLION T CO2 eq. BEFORE 2050

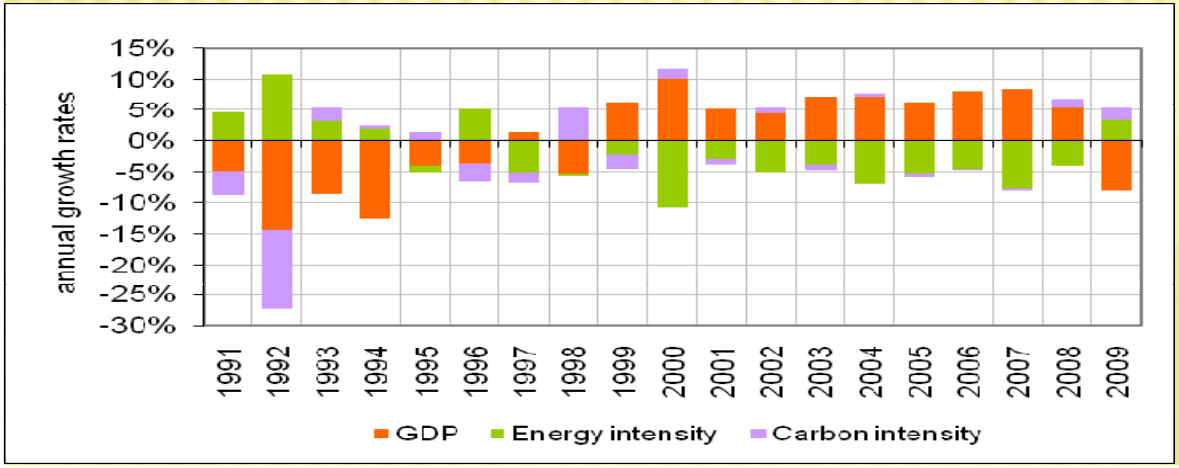
- In many scenarios, especially in those with successful modernization, even without special strong policies to reduce GHG emissions, they are staying until 2050 below the 1990 level
- Strong policies to improve energy efficiency and to develop renewables allow for keeping emissions below the 1990 level till 2050
- Additional studies are required to explore the possibility for Russia to reduce its GHG





RUSSIA ALREADY HAS A 12 YEARS' EXPERIENCE IN DECOUPLING ECONOMIC GROWTH AND ENERGY-RELATED GHG EMISSIONS





Reality confused Illarionov's conclusions based on cross-country analysis

Downhill in1990-1998:

- Transition to a market economy accompanied by:
  - Structural changes determined by demilitarization and removal of ineffective enterprises from the market
  - Growing share of natural gas in the energy balance

Cross-country in 1998-2010:

- Economic growth revived based on the market economy model
  - In 1998-2010, GDP went up by 86%
  - Energy-related GHG emissions were only 12% above the 1998 level