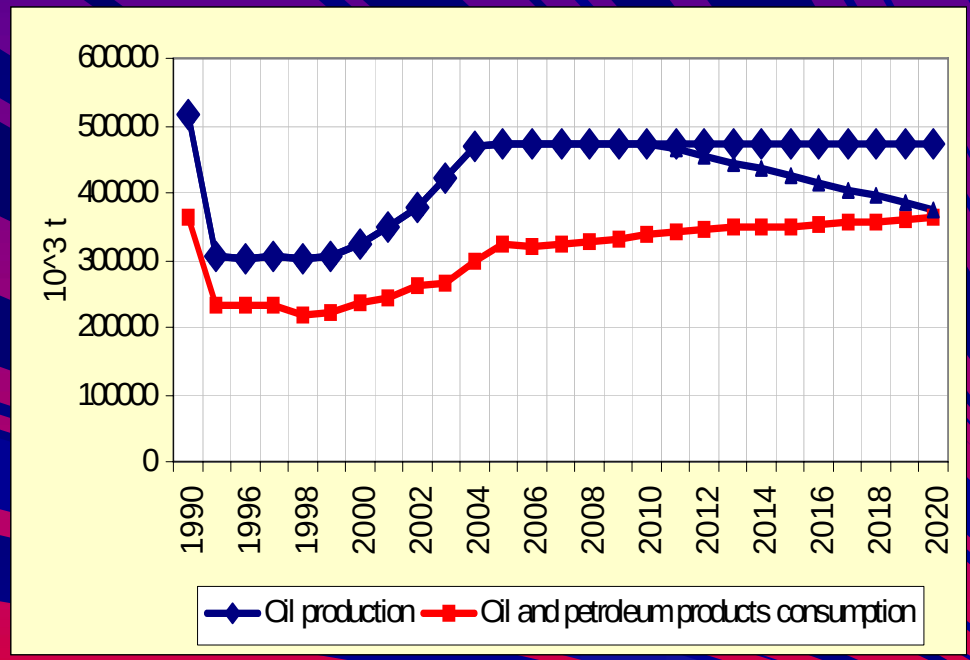
# Russian energy sector and carbon emissions scenarios: coming to 2050

AIM Training Workshop

October 16-20, 2006
Tsukuba, Japan

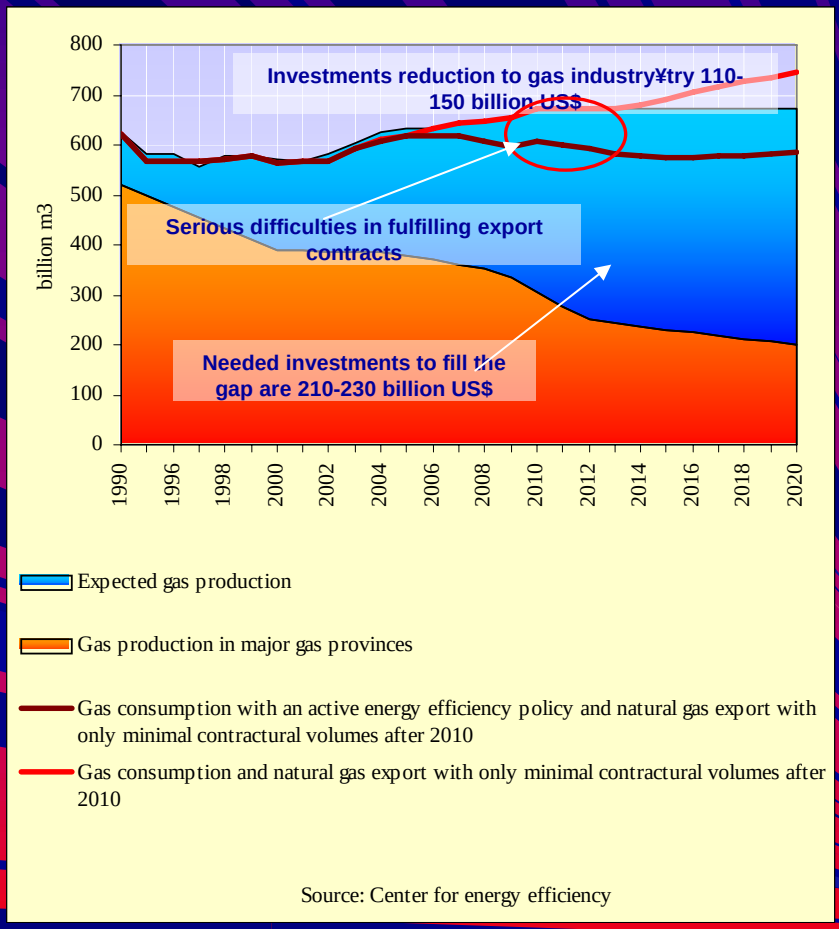
# Oil production

- Oil resources are 44 billion t
- Proven reserves are estimated at 19-25 billion t.
- Exploratory drilling isn't sufficient
- Only reserves developed 30-40 years ago are being exploited
- At least US$ 3 billion annual investments in exploration are needed, otherwise oil production may start declining sharply after 2010 -2015
- The legislation does not guarantee to the explorer a right to develop recovered field
- The government is back to the oil industry, partly through expropriating and by purchasing the assets
- Private business does not have clear investment perspectives
- The current tax system doesn't stimulate oil production



# Natural gas: production stagnates, domestic consumption grows, export may decline

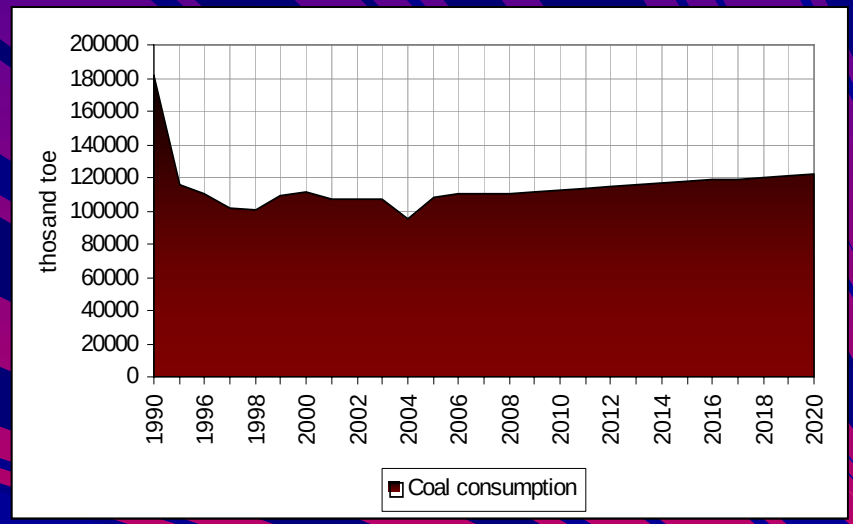
- Proven reserves of Russian natural gas are 29.1*10^12 $m^3$
- Gas production in 2004 amounted to 509.2 toe
- In 2005 for the first time after 1993 reserves additions exceeded the production
- Gasprom blocks potential production growth from independent private producers
- Expanding gas production is not Gasprom's investment priority
- Transport capacity is limited, and transportation system is obsolete
- Inefficiency of gas use brings demand up and export down
- Domestic prices are growing. After they are around US$ 100 per 1000 $m^3$, local consumers will be as attractive as foreign ones
- Gas price growth not necessarily will stop the growth of domestic demand
- Gas production will be increasing till 2020 (approximately 775-805 billion m3) and then slowly down to 650-620 billion m3 in 2050




Source: Center for energy efficiency

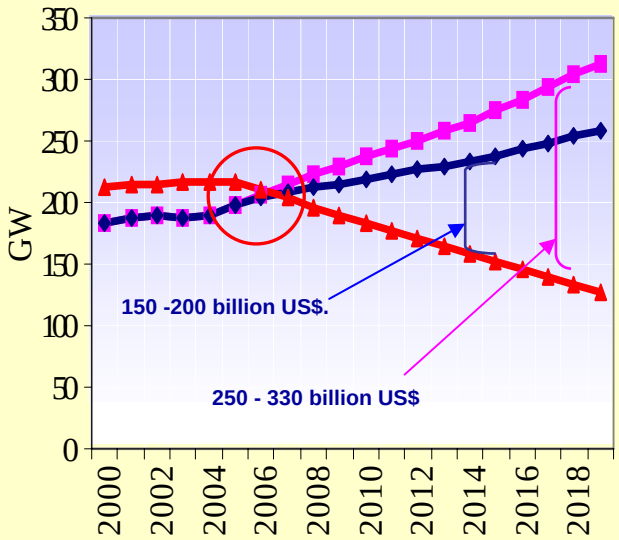
# Coal: lack of clean technologies limits the scale of application

- Proven reserves of Russian coal is more than 200 billion tones
- The share of coal in TPES declined from 21% in 1990 to 17% in 2005
- The share of coal in electricity generation went down from 66% in 1955 to 25% in 2005
- Lack of coal enrichment facilities
- Small number of dual fuel (coal and gas) power stations
- The costs of coal transportation for long distances are high
- There are efficient breakthrough technologies, but their application experience is very limited
- Possibility to switch back from gas to coal is very limited: maximum of 7 billion m3 may be replaced with coal
- Coal production growth will be going on till 2050



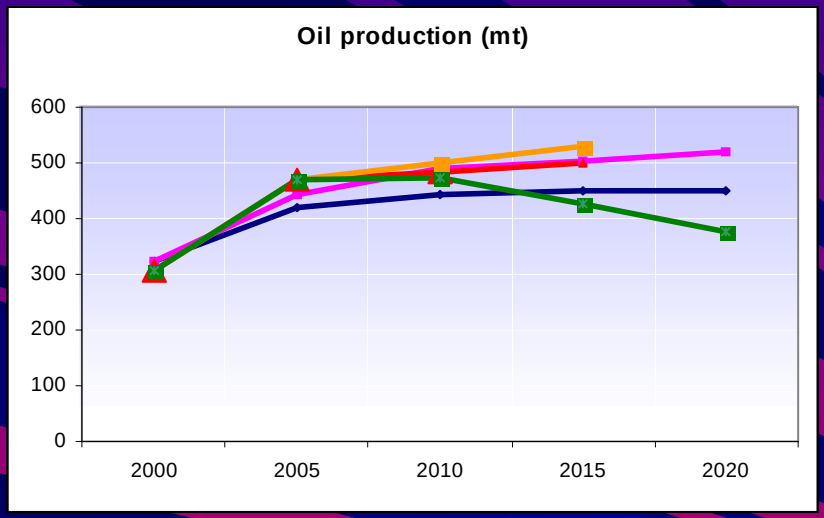
# Power sector: Russian economy faces shortage of power capacities

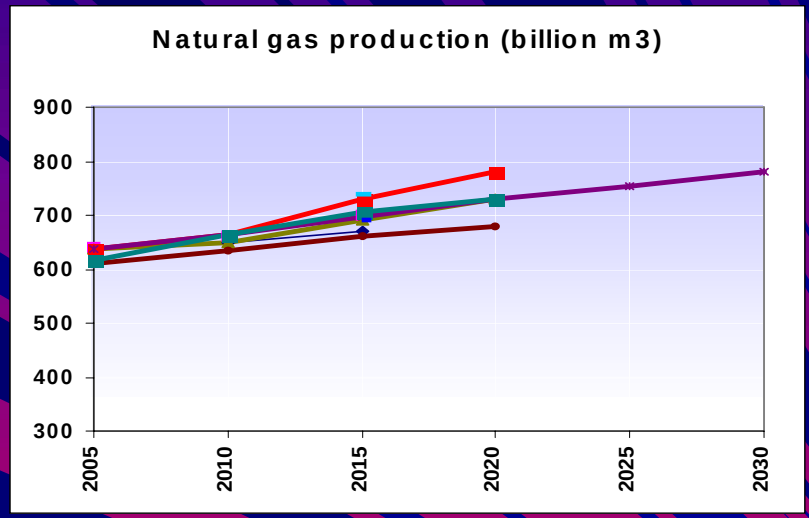
- Power generation amounts to 930 TWh in 2004
- Power capacities built in the Soviet Era are fully loaded in some regions
- In 2004, only 32% of industrial applications for power connections were met; in 2005 - 21%, in 2006 - 16%, in 2007 – 10%
- Before 2010, US$ 87 billion are to be raised, and US$ 250-330 billion before 2020
- Only a small part of the market is liberated.
- With the “inertia” strategy, efficiency will keep declining every year
- Blind tariff policy squeezes the CHP market niche with a “competitive vice”
- Power machinery industry is not ready for large-scale investments
- “Efficiency” scenario is able to save US$ 150-200 billion in the power sector
- Power generation in 2050 is expected to be 1700-2100 TWh

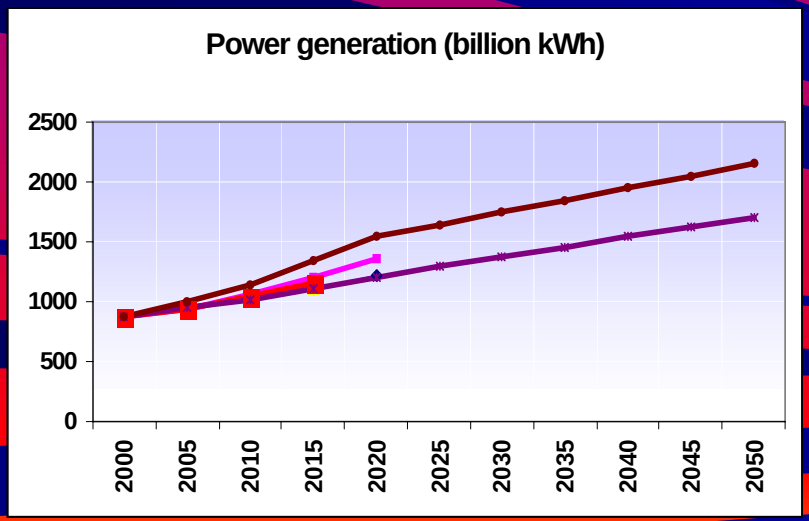


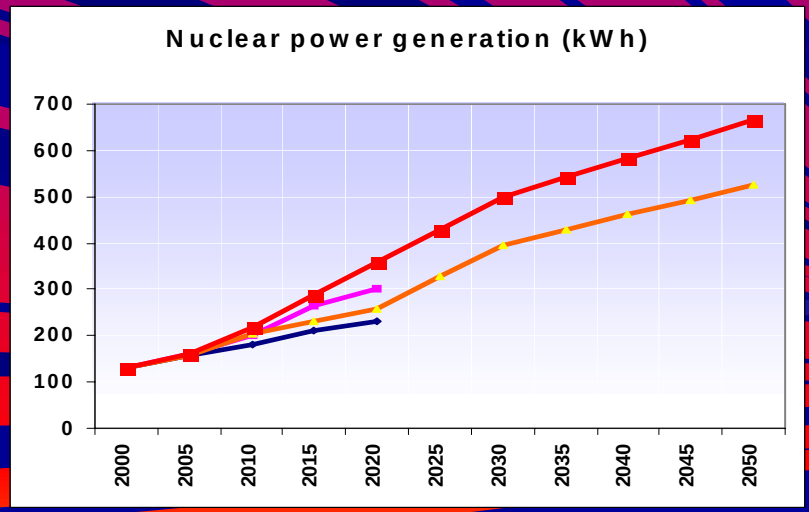

Source: Center for Energy Efficiency

# Projections of Russian energy supply in 2000-2050 according to different estimations



# Two Projections of GHG emissions for Russia

- Russian GHG emissions in 1990 amounted to 3039 $MtCO_2$ including:

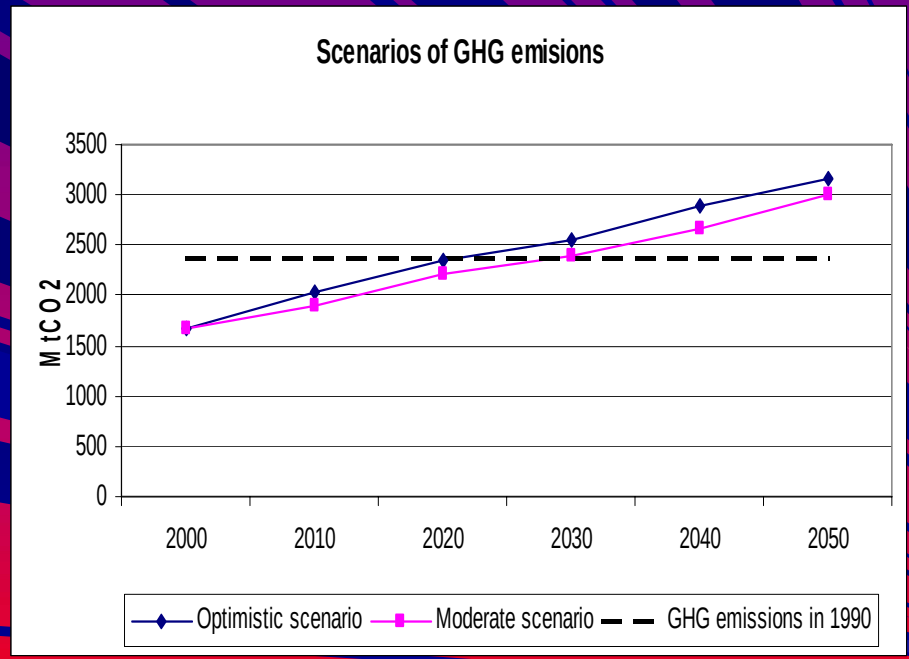
  $CO_2$ – 2372;

  $CH_4$ – 557;

  $N_2O$ – 70;

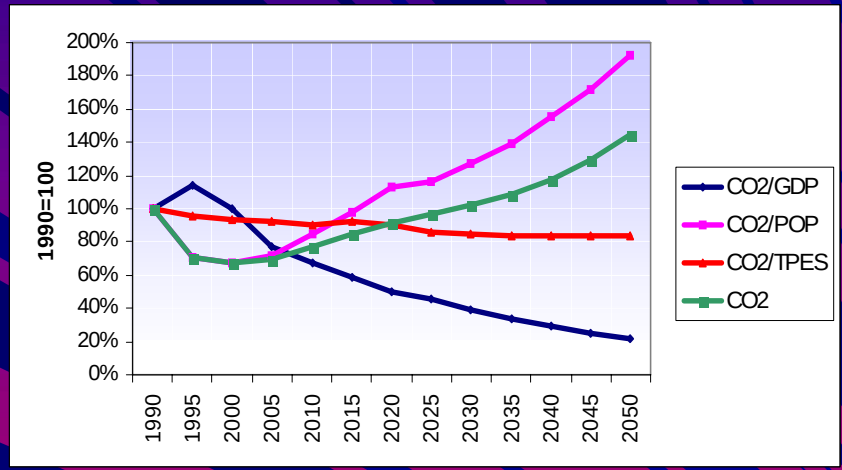
  others – 40.
- GHG emissions in 2000 aggregates 1678 $MtCO_2$ (78%)
- 1% growth in GDP entails 0.2-0.3% growth in GHG emissions
- No one scenario for Russia won't exceed GHG emissions quote of 1990

## First projection



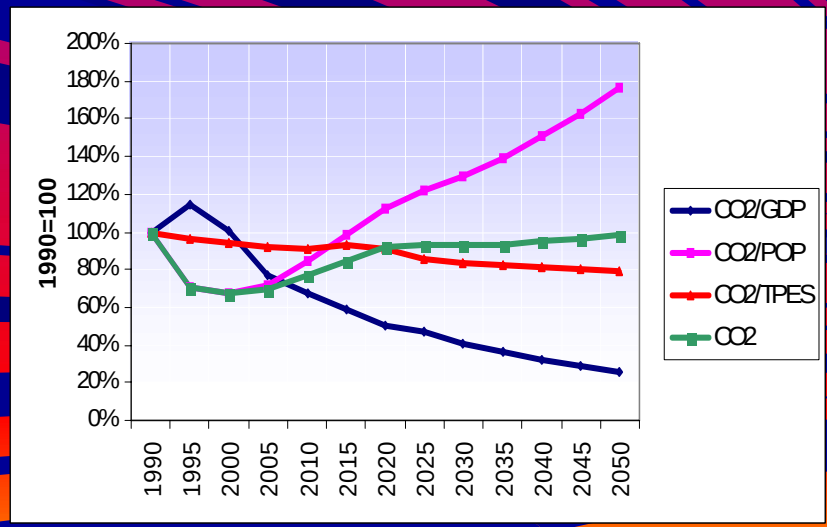
# The Second Projection
# RUSEN - 2050 model outcomes: high emission scenario

- This scenario isn't realistic: needed gas production volumes exceed all overbold gas production
- To implement this scenario, Russia has to address as much proved gas reserves as it has today



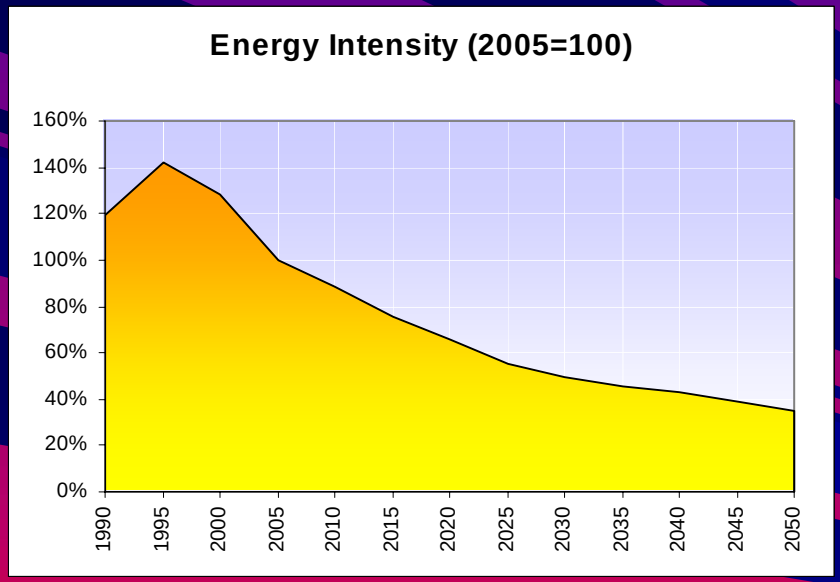

# RUSEN - 2050 model outcomes: realistic emission scenario

- It is very likely that Russia will nor exceed its 1990 emissions level before 2050
- The less energy efficiency improvements Russia will manage to achieve, the lower economic economic growth it will have, with CO2 emissions nearly stable all foreseen scenarios

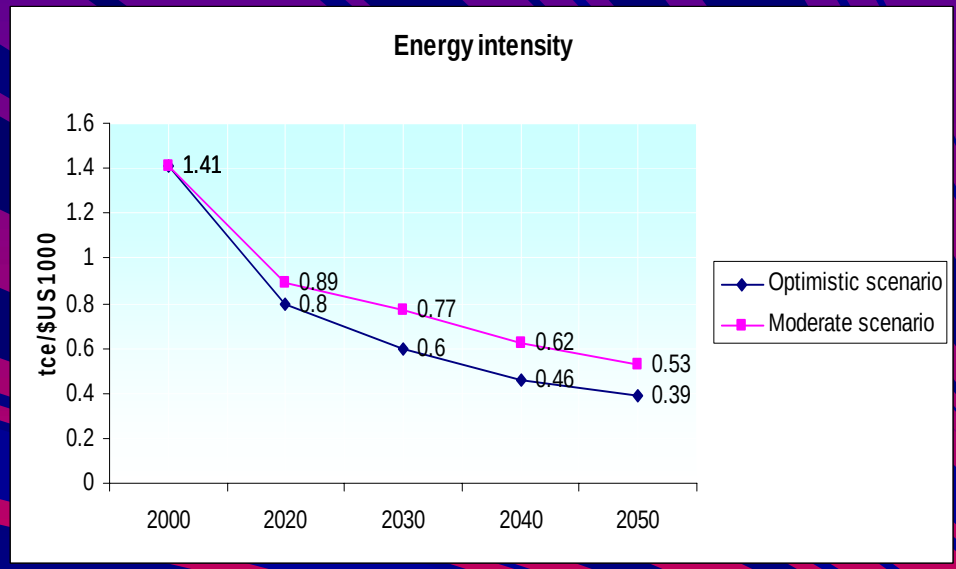


# Energy intensities

First Projection:
Realistic case

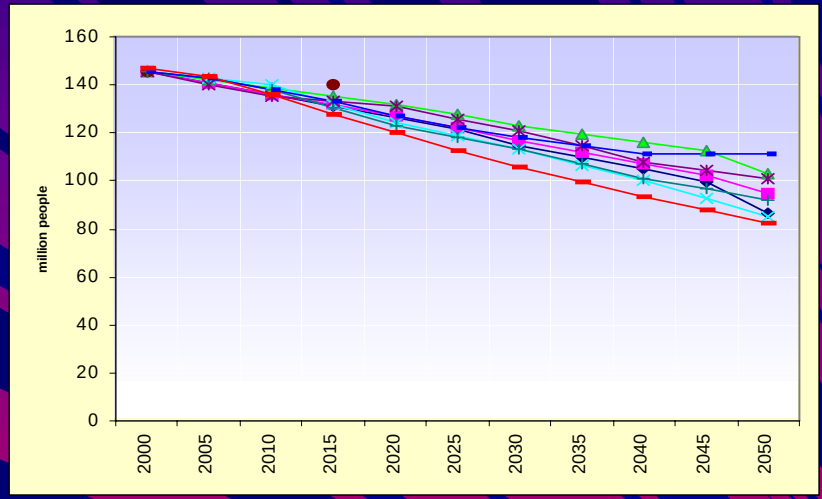


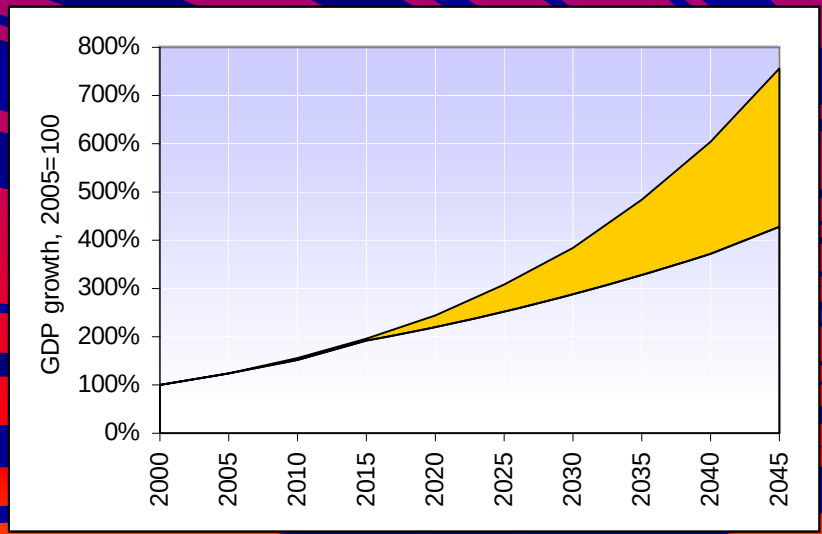

Second Projection



# Visions of long–term energy demand drivers

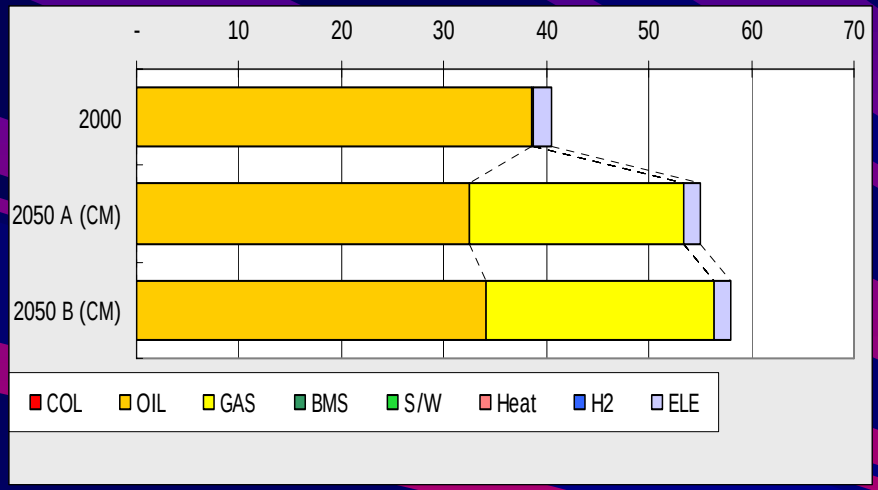
- Russian population may decline from 143.6 million people in 2005 to 82-121 million people in 2050
- Barriers to immigrate in Russia
- GDP may grow by 4.3-7.3 times in 2005-2050, depending on the growth of population and oil and gas price evolution
- Growth of Russian industry and commercial sector
- Total building area will go up; total portion of dwellings with high insulation will go up as well
- More energy efficiency technologies will penetrate the market in all sectors
- Active expansion of electrical appliances
- Dissemination of metering devices and comfort regulation technologies among consumers



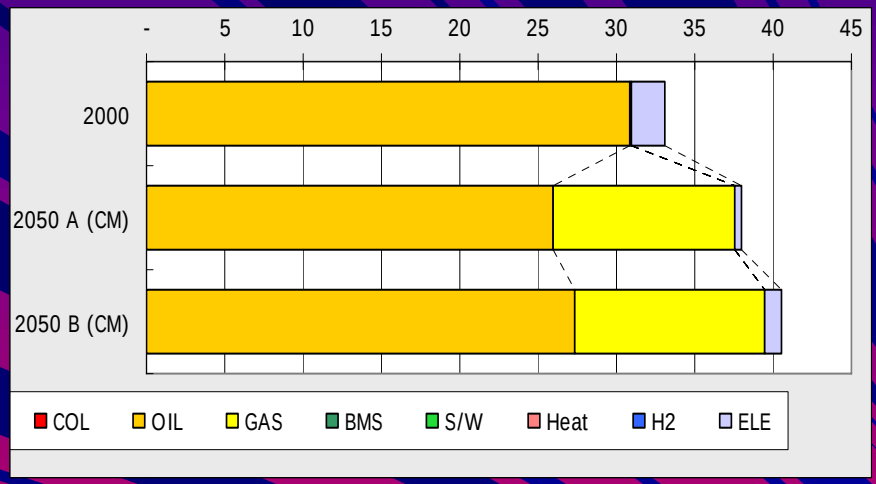



# Application of ESS to Russian passenger transportation sector

## Energy consumption, Mtoe




## $CO_2$ emissions




## Factor Analysis