Energy Security and Climate Change: Two Sides of the same Coin?

Prof. Pantelis CAPROS
E3MLab – NTUA

3d Energy Forum, Budapest, October, 2008

If no measures are taken, in the next 20 to 30 years 70 % of the Union's energy requirements, as opposed to the current 50 %, will be covered by imported products.

From 1998 to 2008

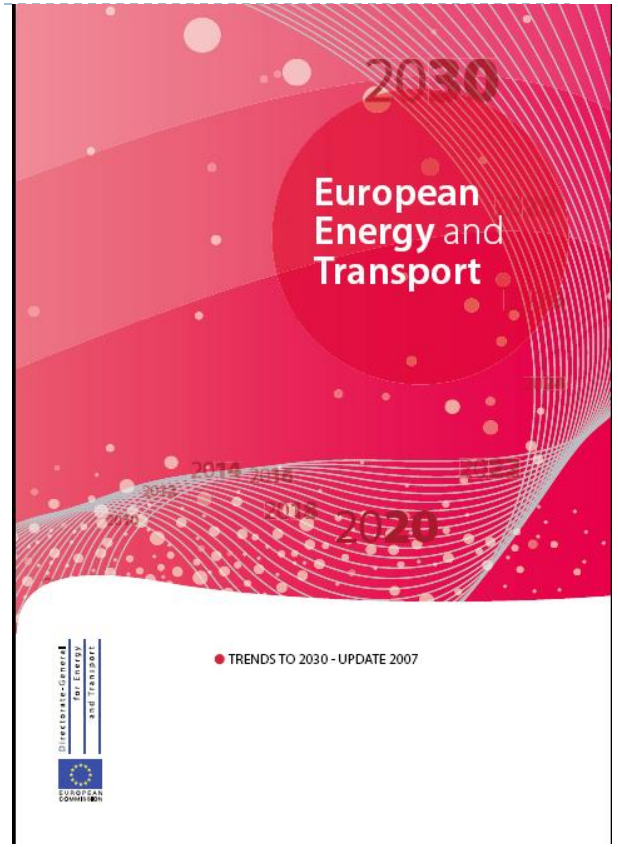
Oil, gas and coal prices are continuously increasing in constant money

Unsustainable Future

Climate Change

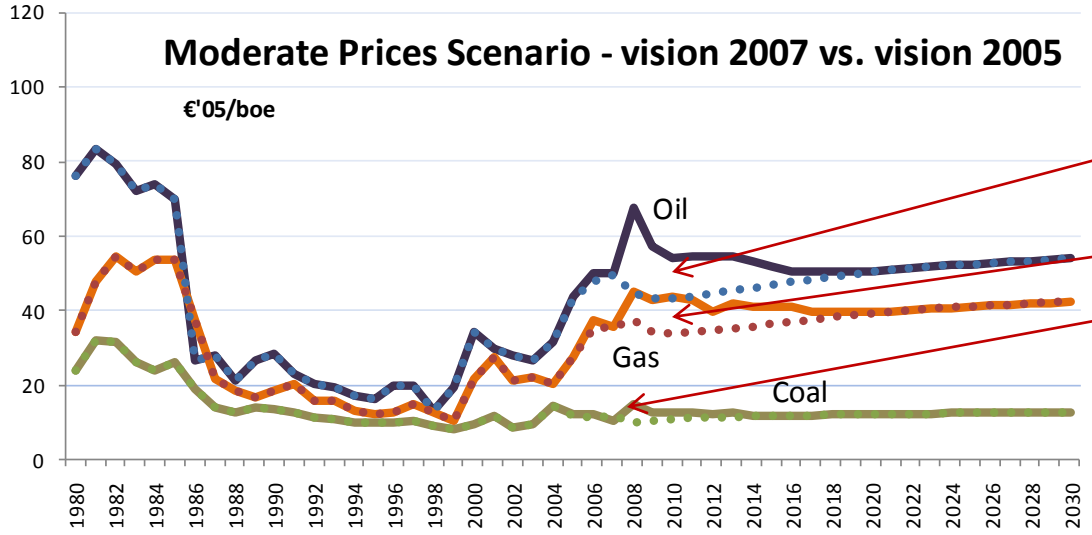
Dependence

Lack of Conventional Resources



2008: EU Climate Action and Renewables Policy Package

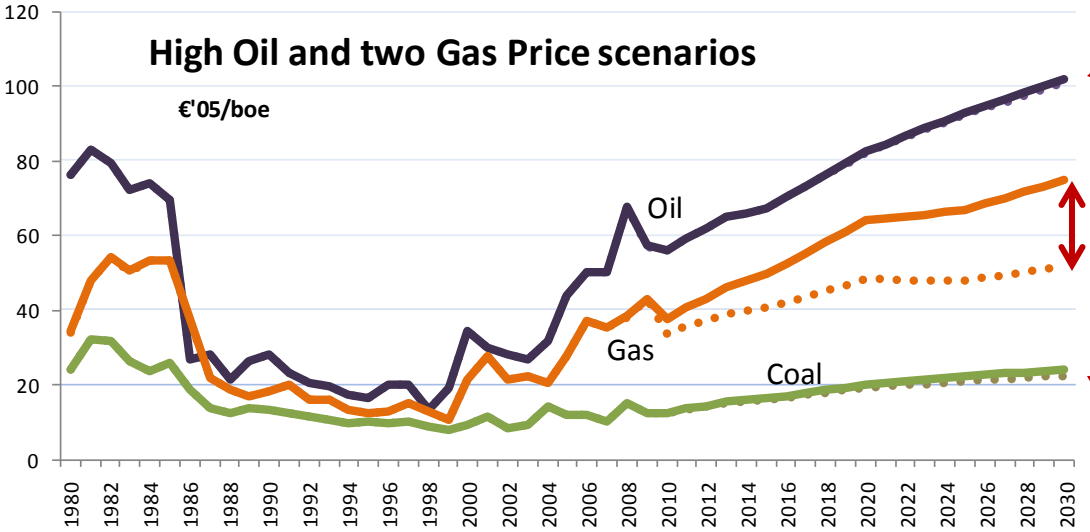
Import prices: major source of uncertainty. Prices in €'05 have increased less than in rest of world. Soaring prices are possible.



Oil price in €'05
50% higher than expected

Gas prices follow oil

Coal prices also increase



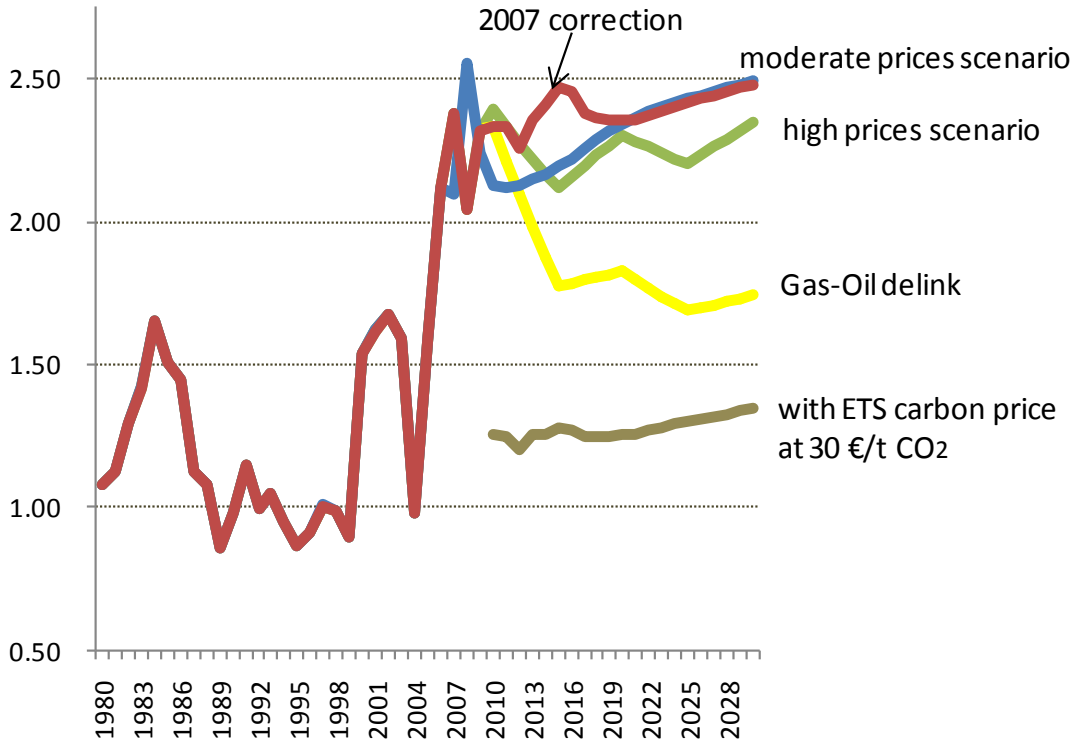
Oil prices stay between 100 – 120 $/boe nominal

Uncertainty about degree of gas and oil price linkage

Coal prices increase driven by demand and opportunity costs

- From 2004 onwards gas/coal ratio in terms of marginal power generation costs change considerably compared to history. A carbon price would reestablish the gas/coal ratio at its historical level.

Gas over Coal in terms of marginal cost of baseload electricity



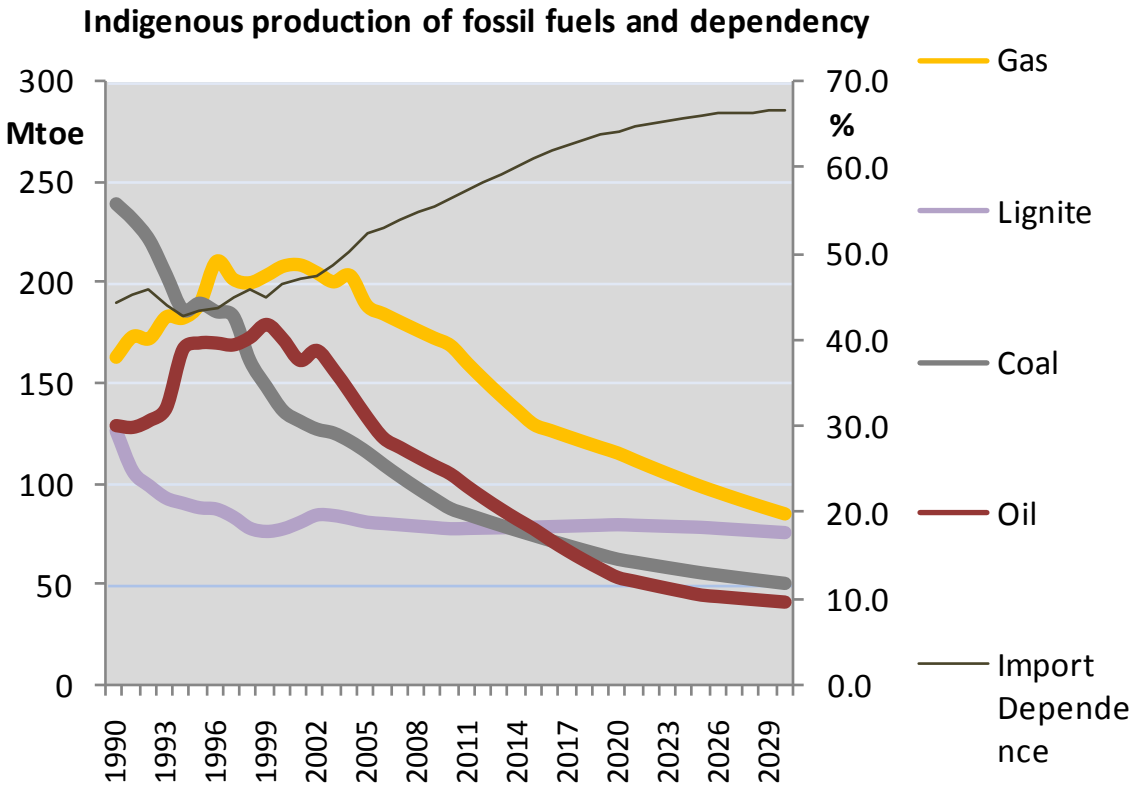
Gas vs. Coal in Power Generation

Based on historical values of the gas/coal ratio between 1 and 1.5 the power sector decided massive investment in GTCC

Recent experience and expectations about a high gas/coal ratio drives re-emergence of coal power

Uncertainty about future ETS carbon prices implies delaying investment. Back to gas is also uncertain depending on conditions of future gas supply.

- Strong decline of indigenous production of fossil fuels in the EU27. Since demand increases and non fossil energy does not develop enough to replace the declining indigenous fossil fuels, import dependence on fossil fuels increases rapidly.



- *Baseline scenario (2007), PRIMES model*

Decline of Indigenous Fossil-fuel Production

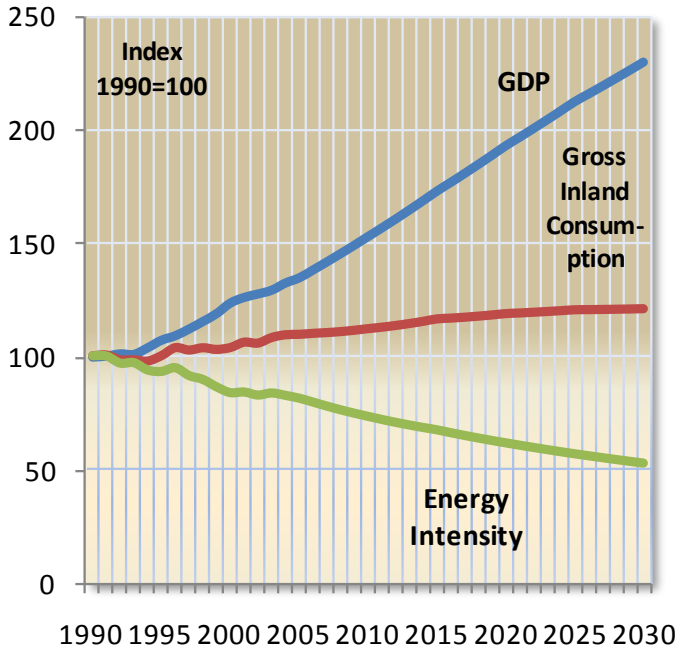
Oil and gas production in the EU27 peaked in 2001 – 2002

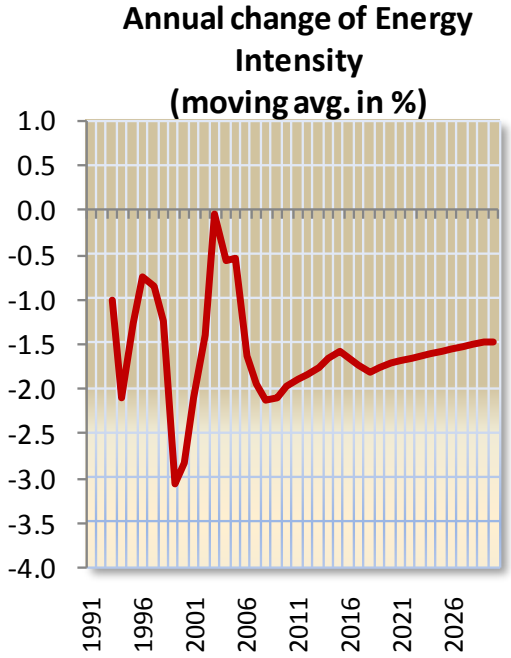
Coal production in 2005 halved compared to 1990. Imported coal outpass domestic coal by 2012.

Lignite production rather stable and does not expand because of opencast mining

Little evidence about new discoveries of fossil fuels

- Energy Intensity improvement under baseline assumptions is considerable, continuing past trends. The baseline projects implementation of energy efficiency policies and further market-driven technology progress in all sectors.
- Energy efficiency has avoided 22% of cumulative imports between 1990 and 2006 and will avoid another 25% until 2030.





- *Baseline scenario (2007), EU27, PRIMES model*

Energy Efficiency drives lower import dependence

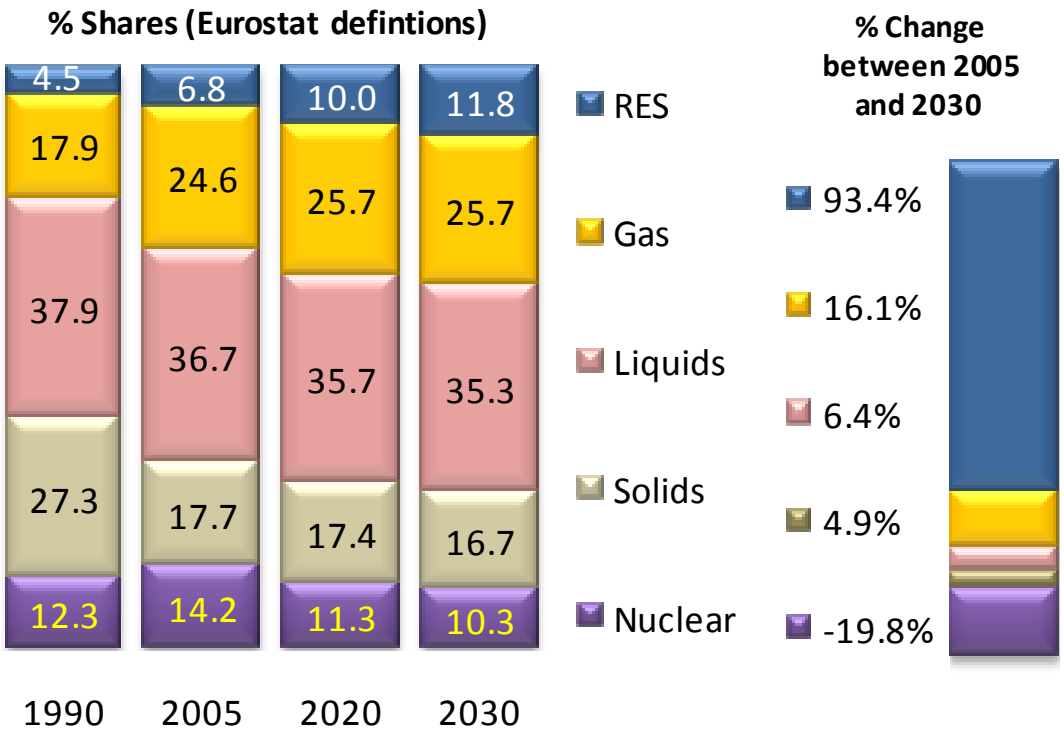
'90s: high energy intensity gains owing to restructuring of Eastern European economies

2001-2003: deceleration of gains because of low growth and EU integration (e.g. trucks)

2004-2006: high energy efficiency gains observed

Future average efficiency gains: 1.7% per year in the Baseline scenario (in last 15 years 1.5% per year)

- Structure of Gross Inland Consumption



- Carbon intensity of Energy declines by 0.1% per year (2005-2030), more slowly than it has declined between 1990 and 2005 (0.8% per year)

- *Baseline scenario (2007), EU27, PRIMES model*

Non fossil fuels

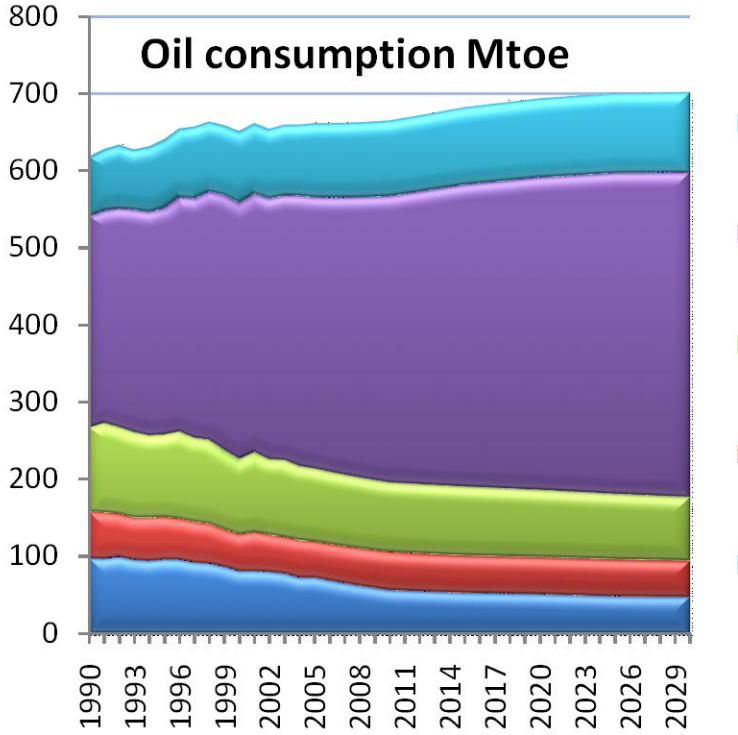
Renewables are expected to increase considerably under baseline assumptions but its share remains low in 2030

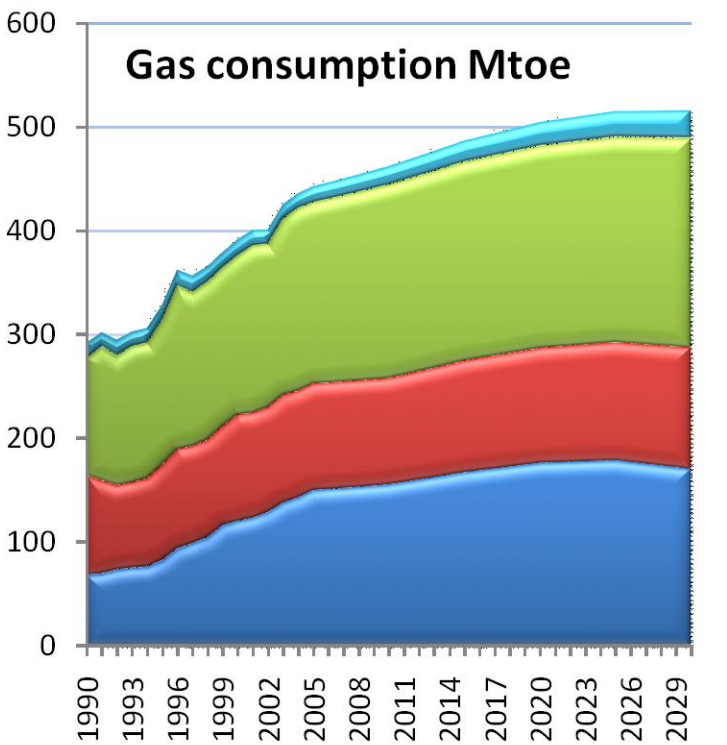
Nuclear energy declines in the Baseline as a result of phase-out policies and non full replacement of decommissioned units

The indigenous non fossil fuels do not compensate for the decline of indigenous fossil fuel production

Oil and Gas Demand

- Oil and Gas have different roles in the EU energy system. Oil is increasingly a sectoral fuel (transport and petrochemical). Gas is widely used by final consumers and power generation.



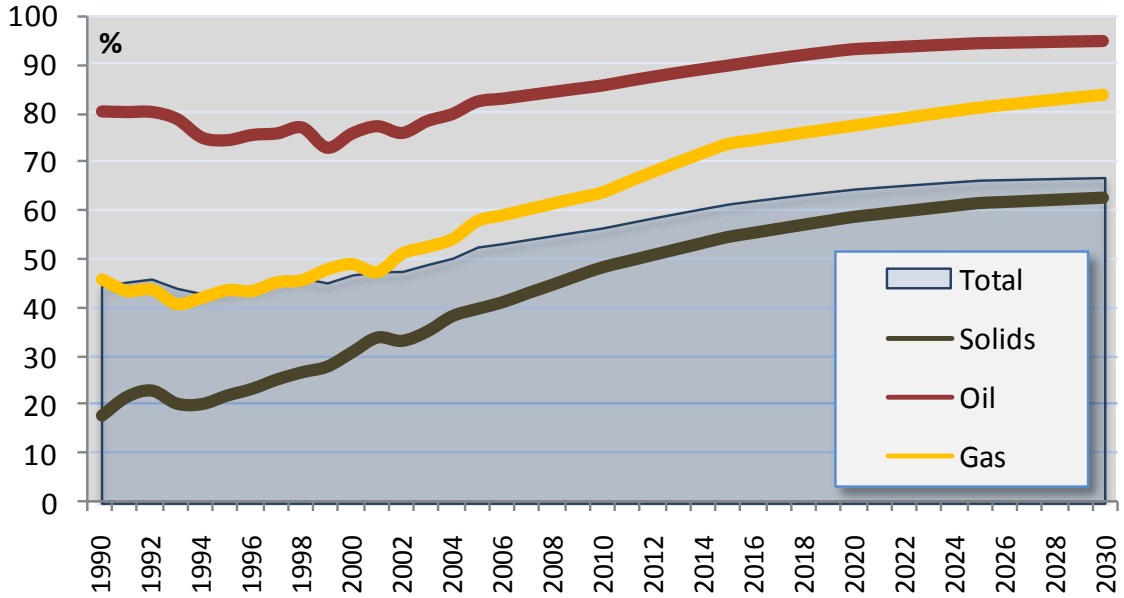


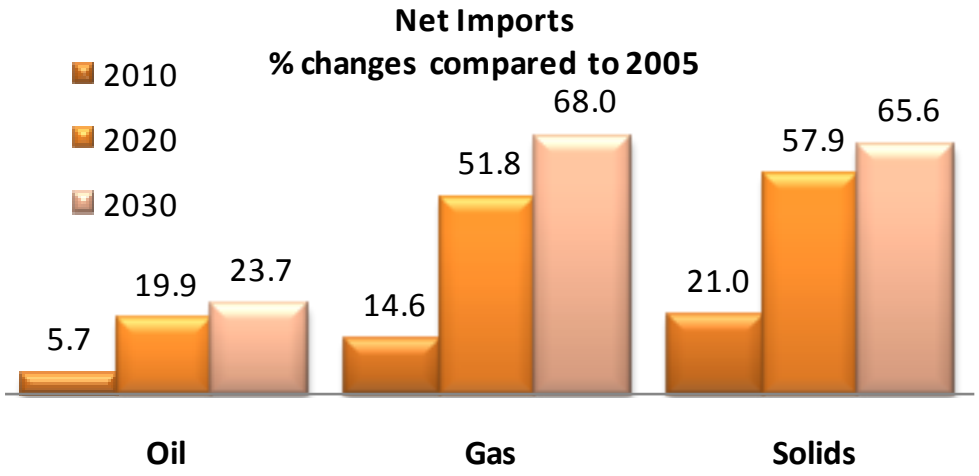
	1990-2005	2005-2020	2020-2030
% change pa	0.45	0.32	0.12

	1990-2005	2005-2020	2020-2030
% change pa	2.81	0.87	0.22

- *Baseline scenario (2007), EU27, PRIMES model*

- Imports as % of Gross Inland Consumption





- *Baseline scenario (2007), EU27, PRIMES model*

Import Dependence

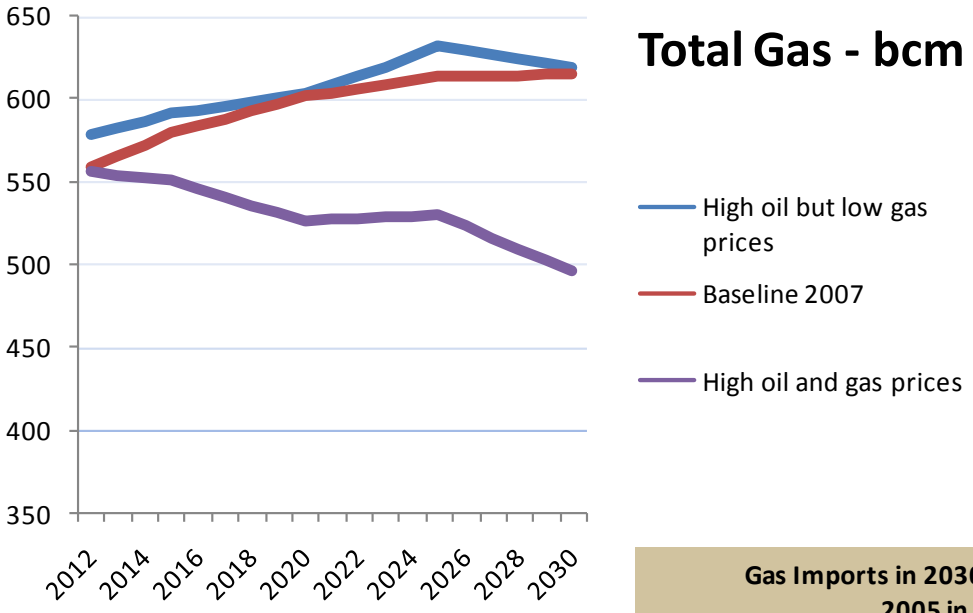
Lack of indigenous resources drive increasing dependence on imported fossil fuels up to 67%

Gas import dependence increases by 25 percentage points. The EU will need 514 bcm gas to import in 2030, 208 bcm up from 2005.

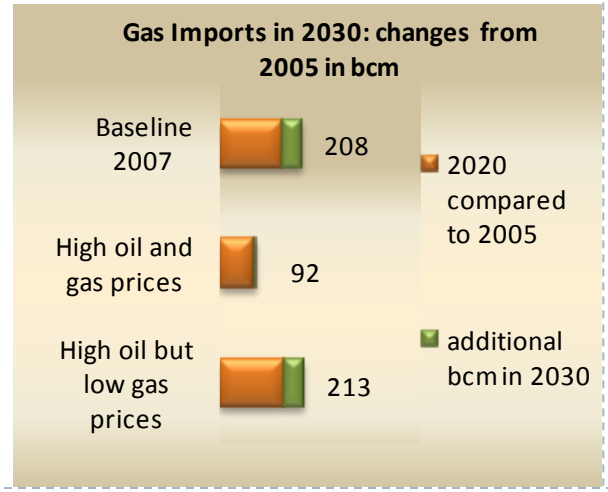
Coal imports also increase substantially

Dependence on oil increases at slow pace but oil remains the most important single source of energy in the EU

High world prices influence demand for gas in the EU



- *EU27, PRIMES model*



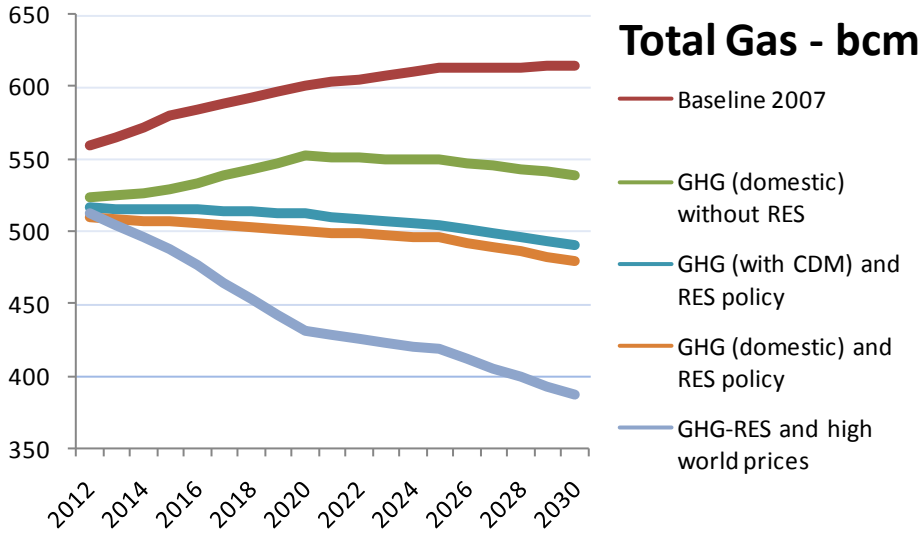
Sensitivity to import prices

Based on ex-post calculations on PRIMES results, long term price elasticity of gas is -0.2 but in power generation it is -0.45

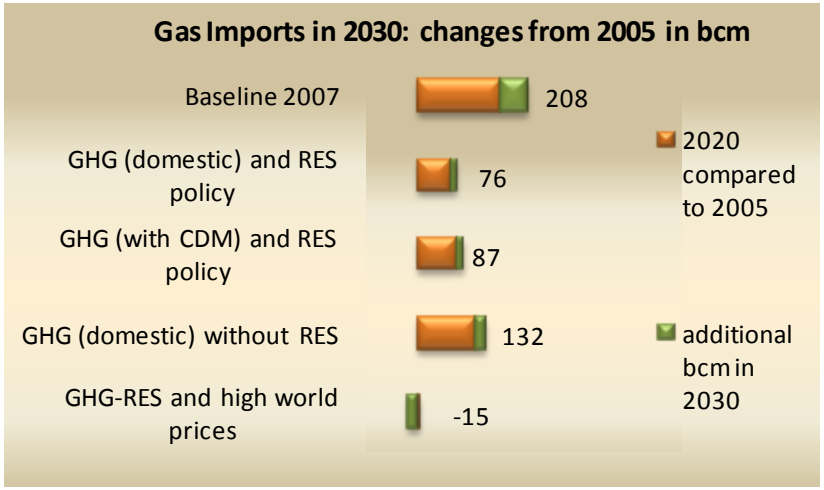
High gas prices relative to coal is likely to drive decline in gas demand and considerable reduction in incremental gas imports

Gas-Oil price delink implies only slightly more gas demand and imports compared to Baseline, because high energy prices induce lower energy demand, offsetting substitution effects

Climate Change Actions and Renewables policy reduce gas demand



- *EU27, PRIMES model*



Impact of GHG and RES policies

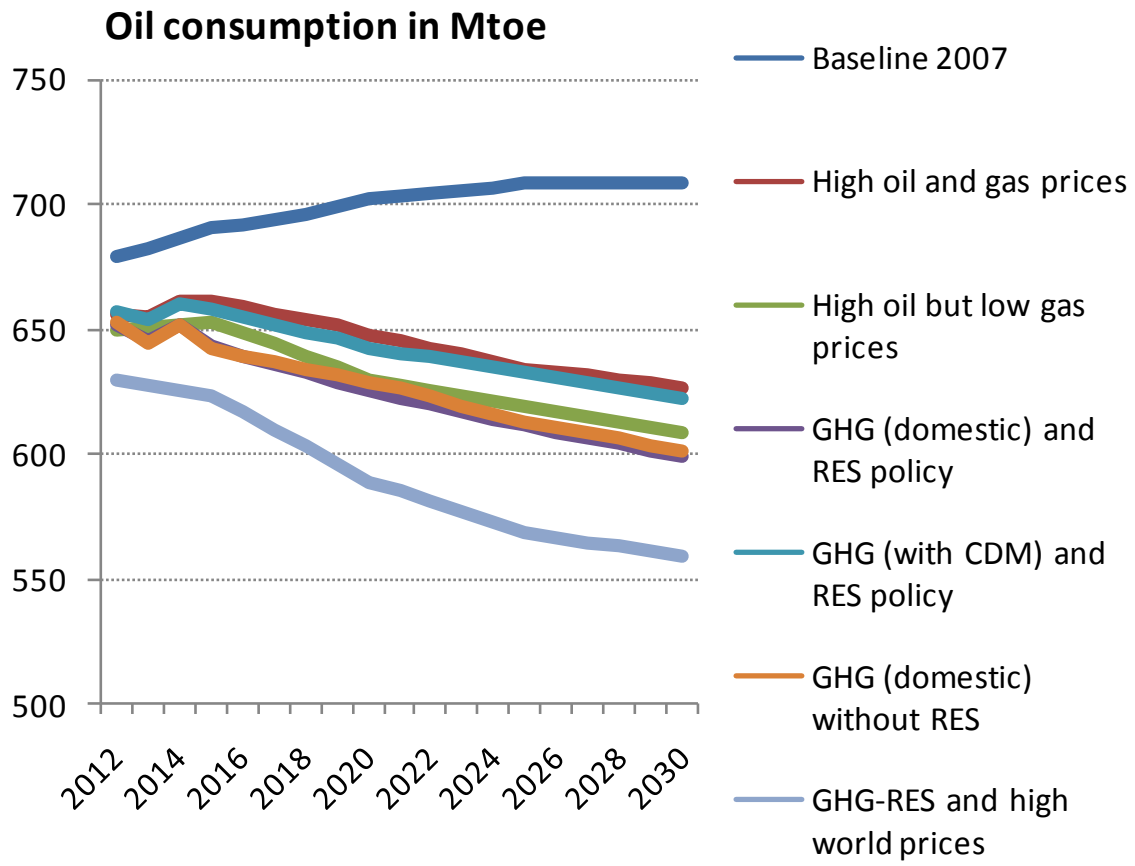
GHG emission reduction policies induce energy efficiency gains which reduce energy demand and prevail against substitution effects

RES obligation in addition to GHG target further reduce gas demand

The EC's Climate Change and RES Package of 2008 implies that the EU will require less gas in 2030 than today

GHG and RES policies in the presence of high oil and gas prices imply more energy efficiency gains and more non fossil fuels; hence gas demand drops considerably

Either soaring oil prices or the EC's GHG-RES curb oil demand



EU27, PRIMES Model

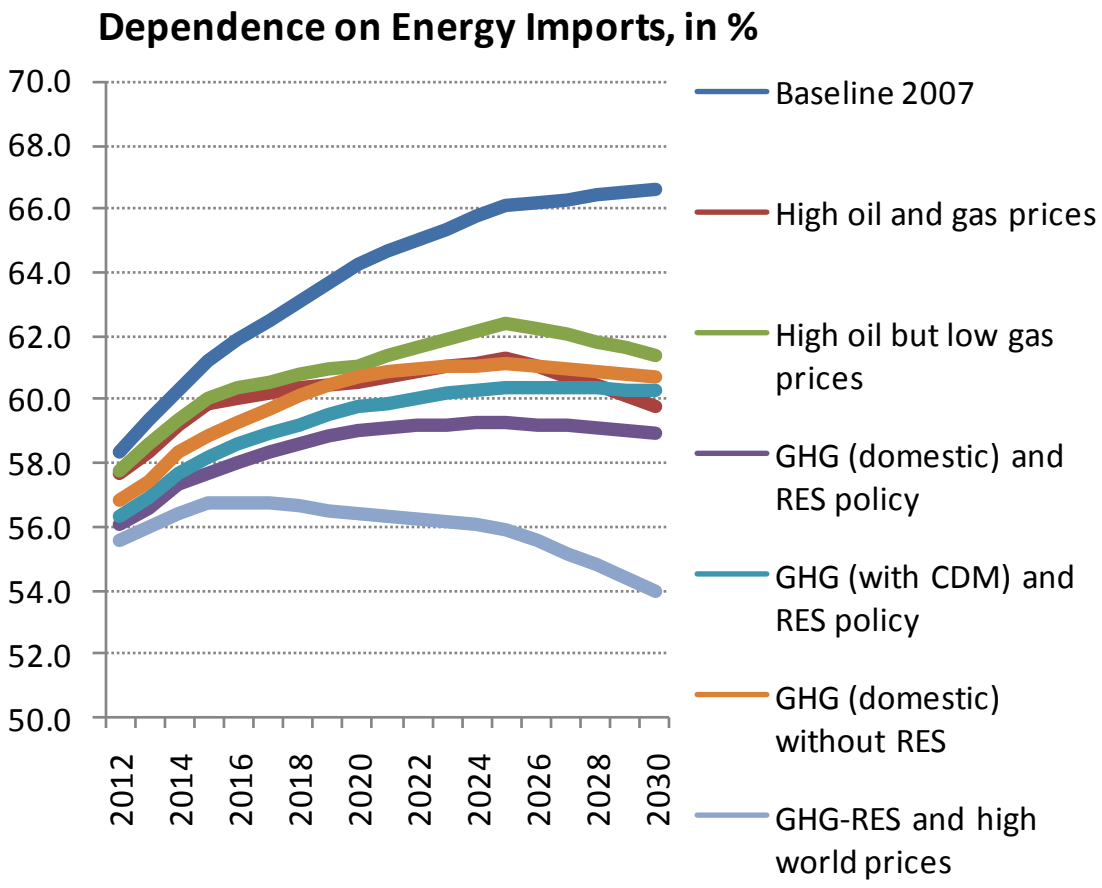
Impacts on Oil demand

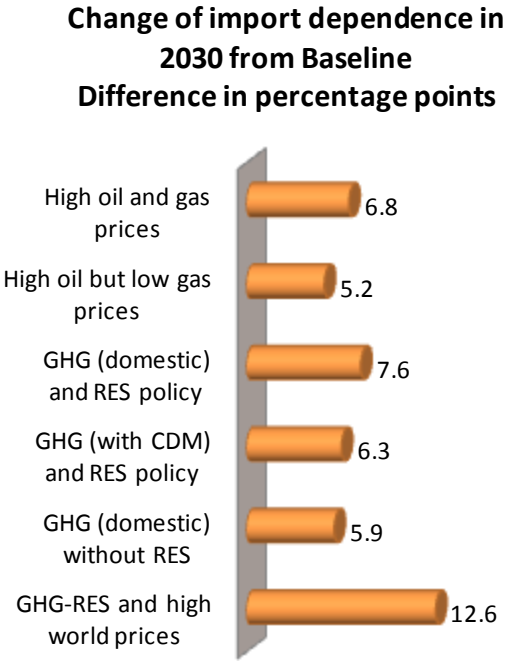
Elasticity of oil demand with respect to crude oil prices is low because consumer prices of oil in transportation also include excise taxes

The transport sector shows low responsiveness to carbon prices. Active policies for transport modal changes would make larger differences.

GHG-RES policies together with high oil prices could bring oil demand in 2030 16% down from 2005.

The EC's Climate Change and RES package brings benefits in security of energy supply





The RES target of the EU adds 1.8 percentage points in terms of lower dependency, compared to the GHG target alone

Oil-gas price delink increases dependency by 1.6 percentage points

- *EU27, PRIMES model*

Economic Impacts

For 2020	Add. Total energy system cost as % of GDP	Carbon Prices €/tCO2	% Change of avg. Electricity Prices from Baseline
High oil and gas prices	1.8	20	17.2
High oil but low gas prices	1.4	20	10.7
GHG (domestic) and RES policy	0.6	40	22.6
GHG (with CDM) and RES policy	0.5	30	18.9
GHG (domestic) without RES	0.5	50	24.2
GHG-RES and high world prices	2.1	35	33.5

- *EU27, PRIMES model*
- Total energy system costs include all kinds of costs incurred by final consumers, including cost of energy savings, equipment and fuel costs. Total energy system costs exclude payments for purchasing GHG allowances in the auctions but includes their impact on prices. It includes payments for CDM emission credits, if applicable. Carbon prices in the two high oil prices scenarios, as well as in the Baseline, apply only on ETS which is under a grandfathering allowances regime. In all other scenarios, carbon prices apply on all sectors, but only ETS is under auctioning.

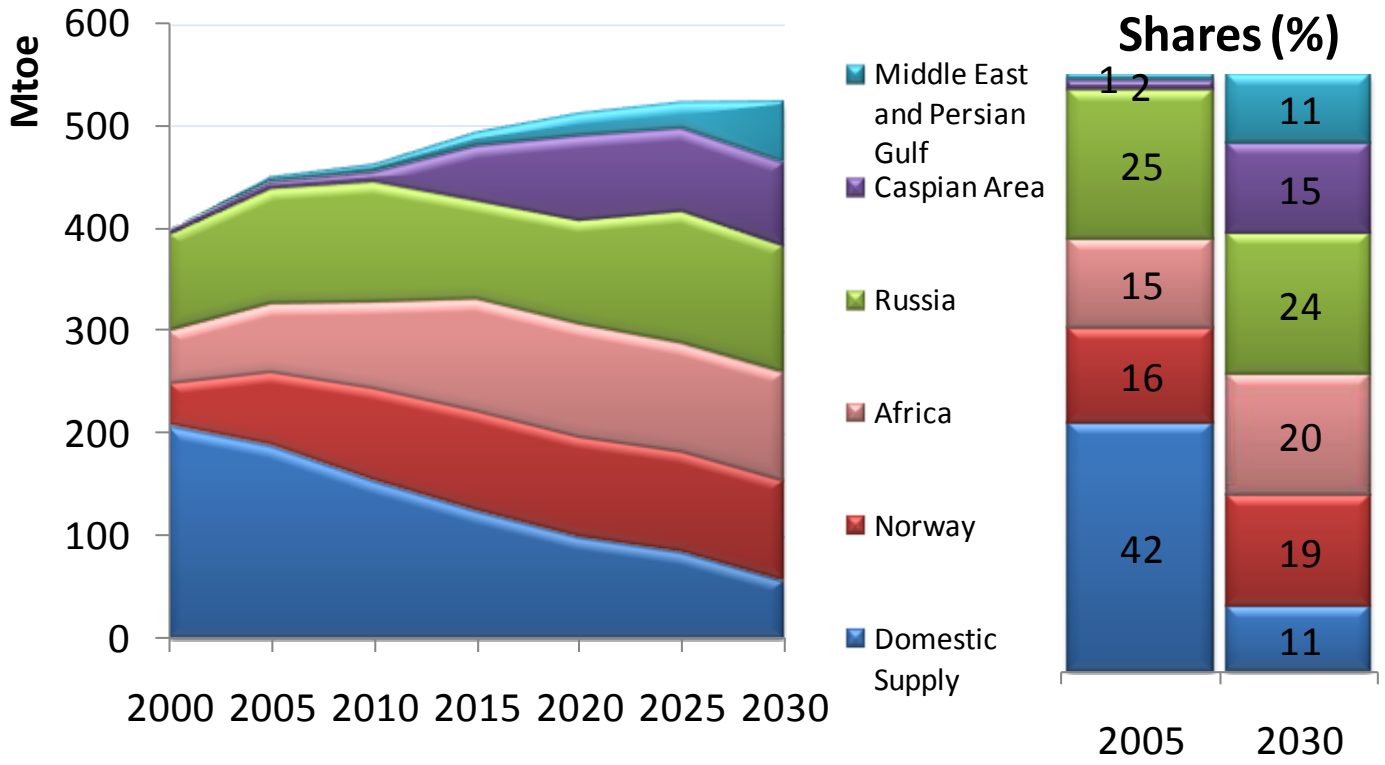
Energy System Costs

High oil and gas prices imply 275 billion Euros per year to be paid abroad. Oil-gas price delink saves 50 billion per year.

The GHG and RES policies imply 75-100 billion Euros per year extra spending by consumers of energy for products produced by the EU industry and saves 50-70 billion per year in import bill.

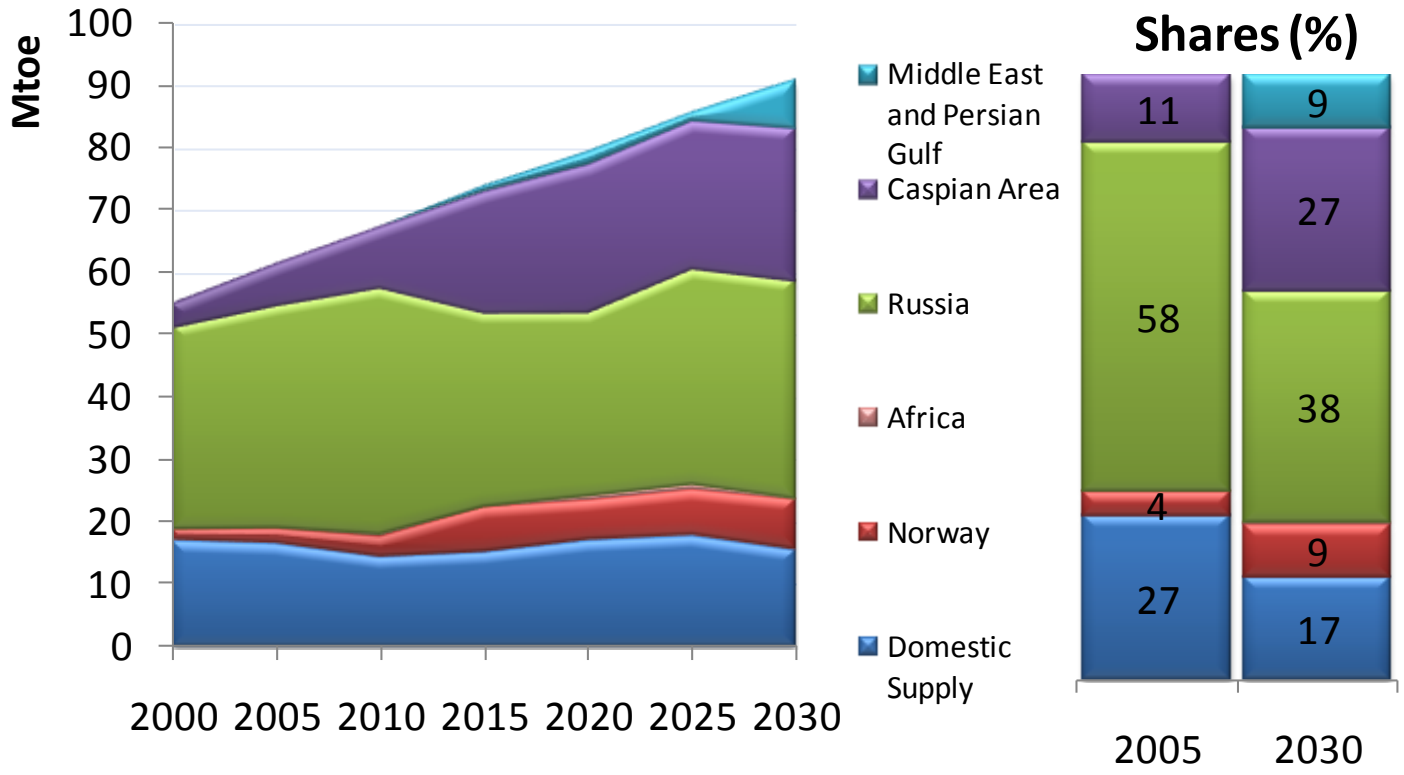
The absence of RES targets increases electricity prices but decreases the additional costs incurred by consumers for energy savings and equipment purchases.

Commercial Origin of Gas for EU27



- The Caspian area and the Middle East-Gulf emerge as commercial suppliers of the EU27
- Africa's share increases by 5 percentage points in 2030, compared to 2005
- The Norwegian share also increases
- Russia's commercial share remains around 25%
- Domestic gas represents only 11% of gas supply in 2030

Commercial Origin of Gas for NMS12



- New Member-States are more dependent on Russian gas however they also profit from development of gas supply from Caspian area

Conclusions

- Security of energy supply and vulnerability to import prices is an issue of concern under business-as-usual trends
- In response to soaring or highly volatile gas prices, the power sector may reduce gas demand considerably, contrary to final consumption of gas which is rather inelastic
- Climate Change actions and RES policy curbs gas and oil imports at the expense of consumer bills, but economic impacts are significantly lower than from soaring gas and oil prices
- Demand-side efficiency is the main driver rather than substitutions in the fossil fuel mix
- The coexistence of the RES target plays an important role for curbing fossil fuel import
- Concerning origin of gas supply, North African and Caspian development are of key importance. Increasing involvement in a global LNG market is imperative.

Thank you for your attention

http://www.e3mlab.ntua.gr
kapros@central.ntua.gr