

Geo-Political and Economic Consequences of Shale Gas

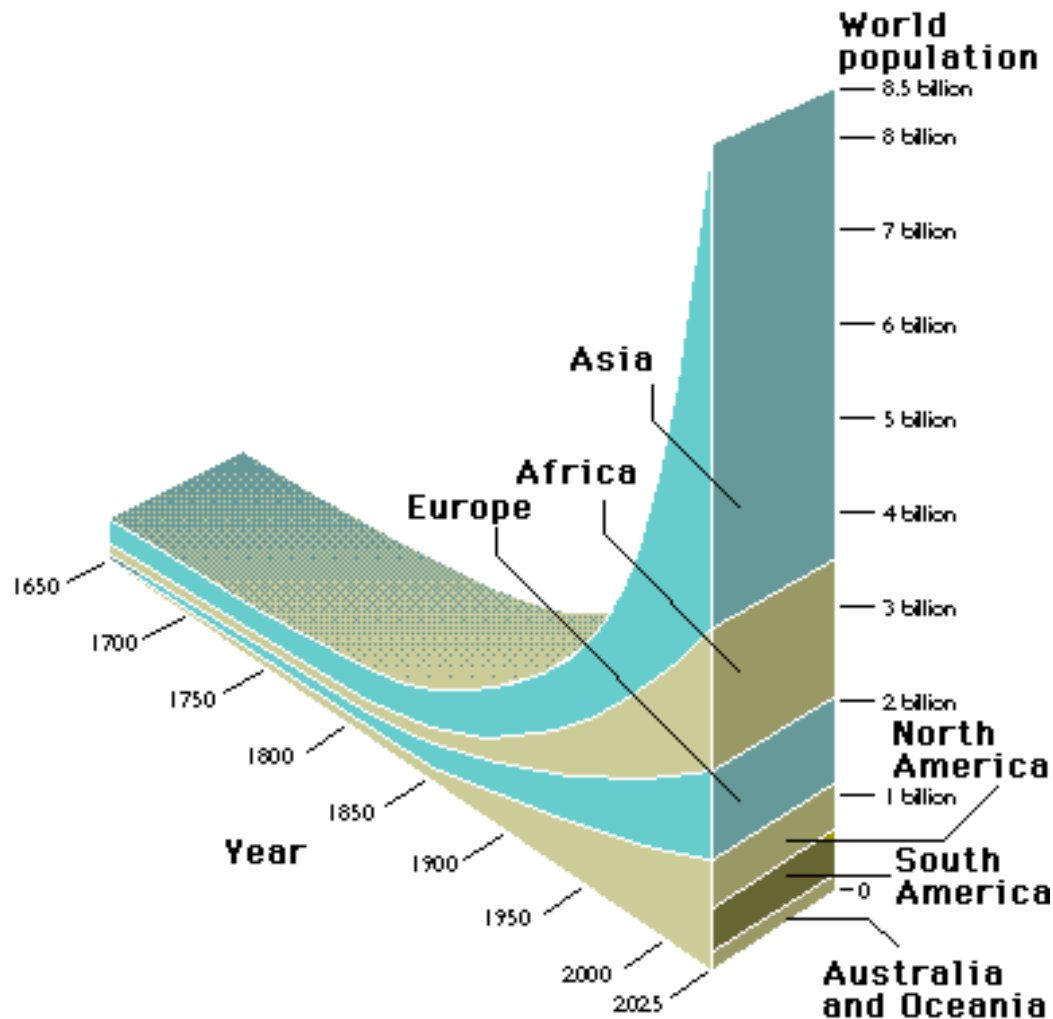


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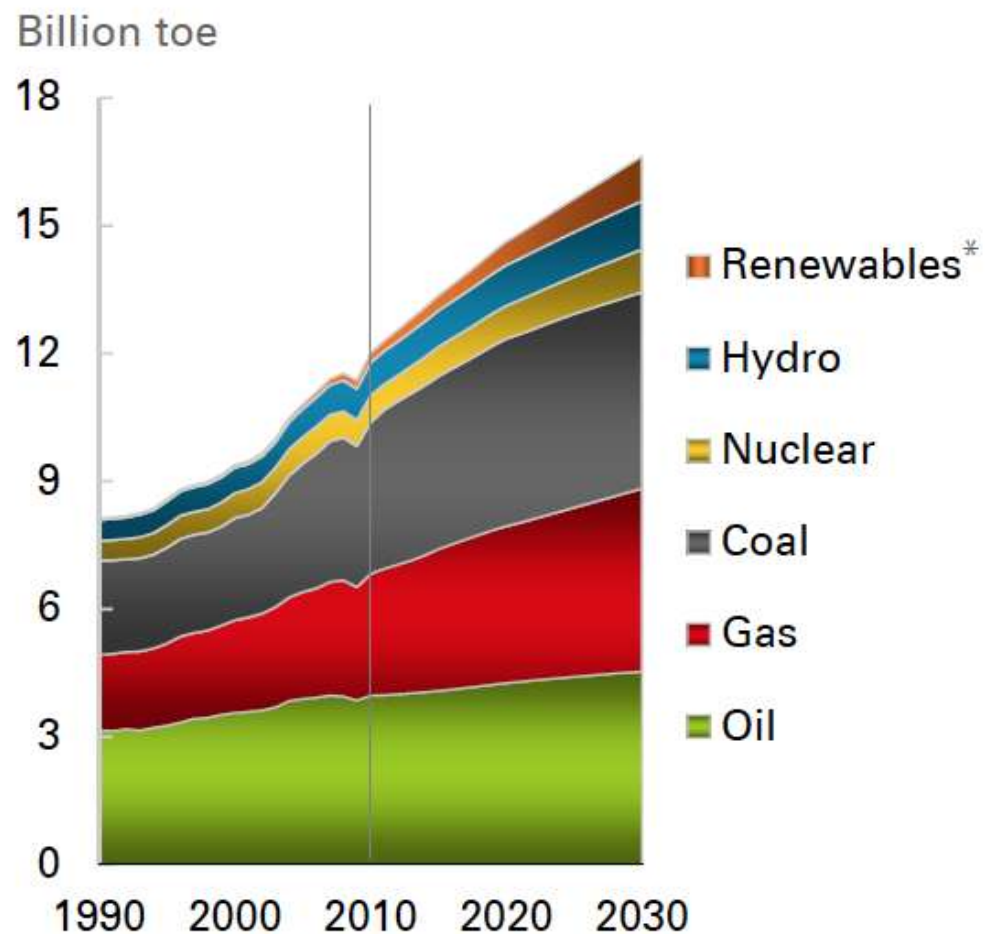
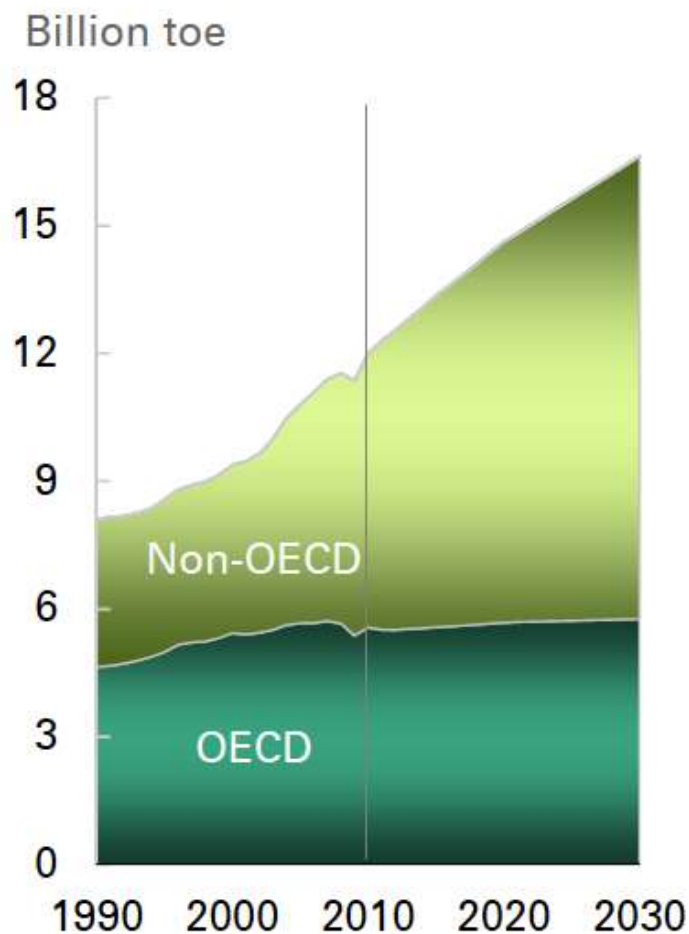
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- › What are the economic consequences of the “shale gas revolution” in US?
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World population is expected to grow....



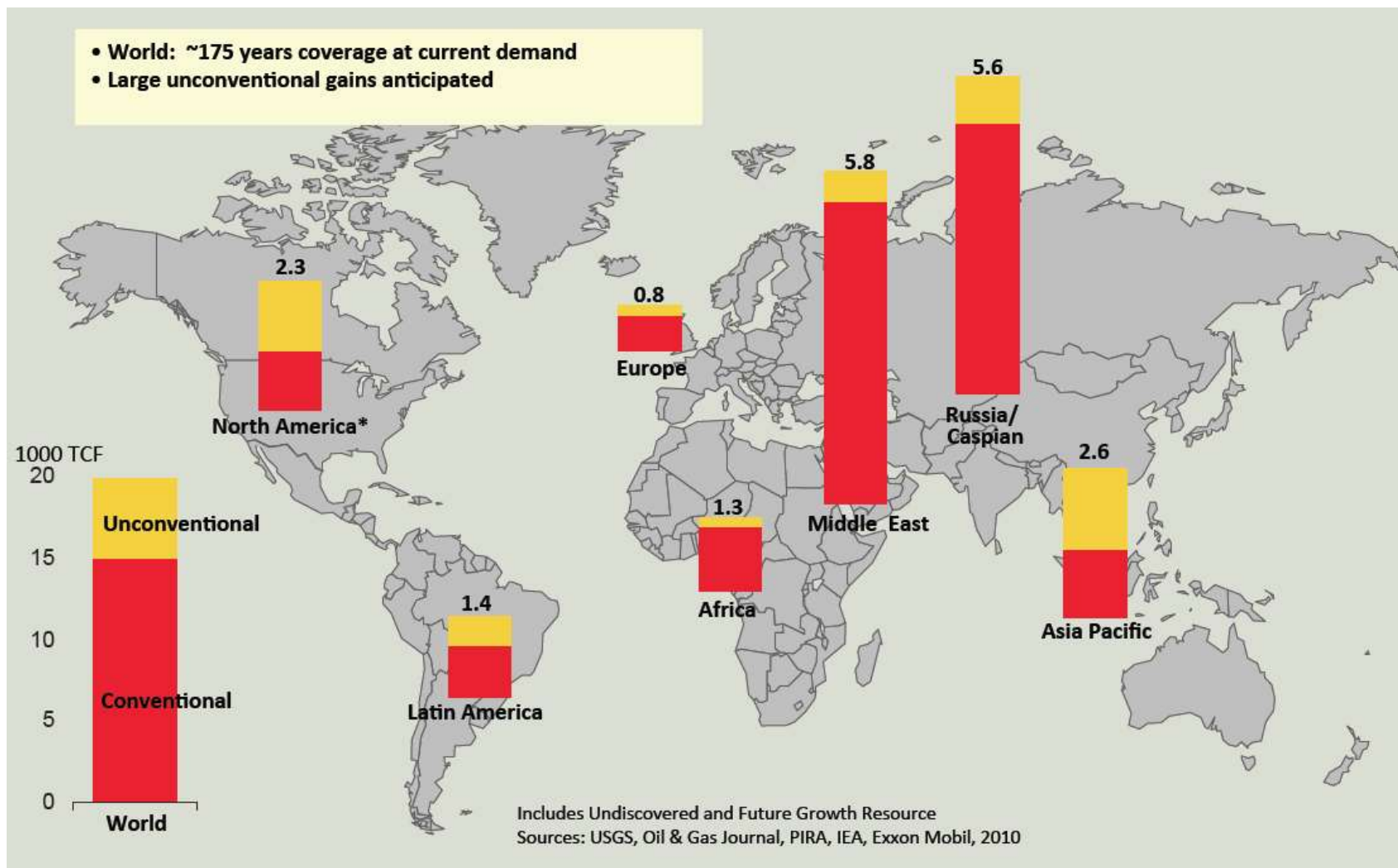
Non-OECD countries drive the growing demand



*Includes biofuels

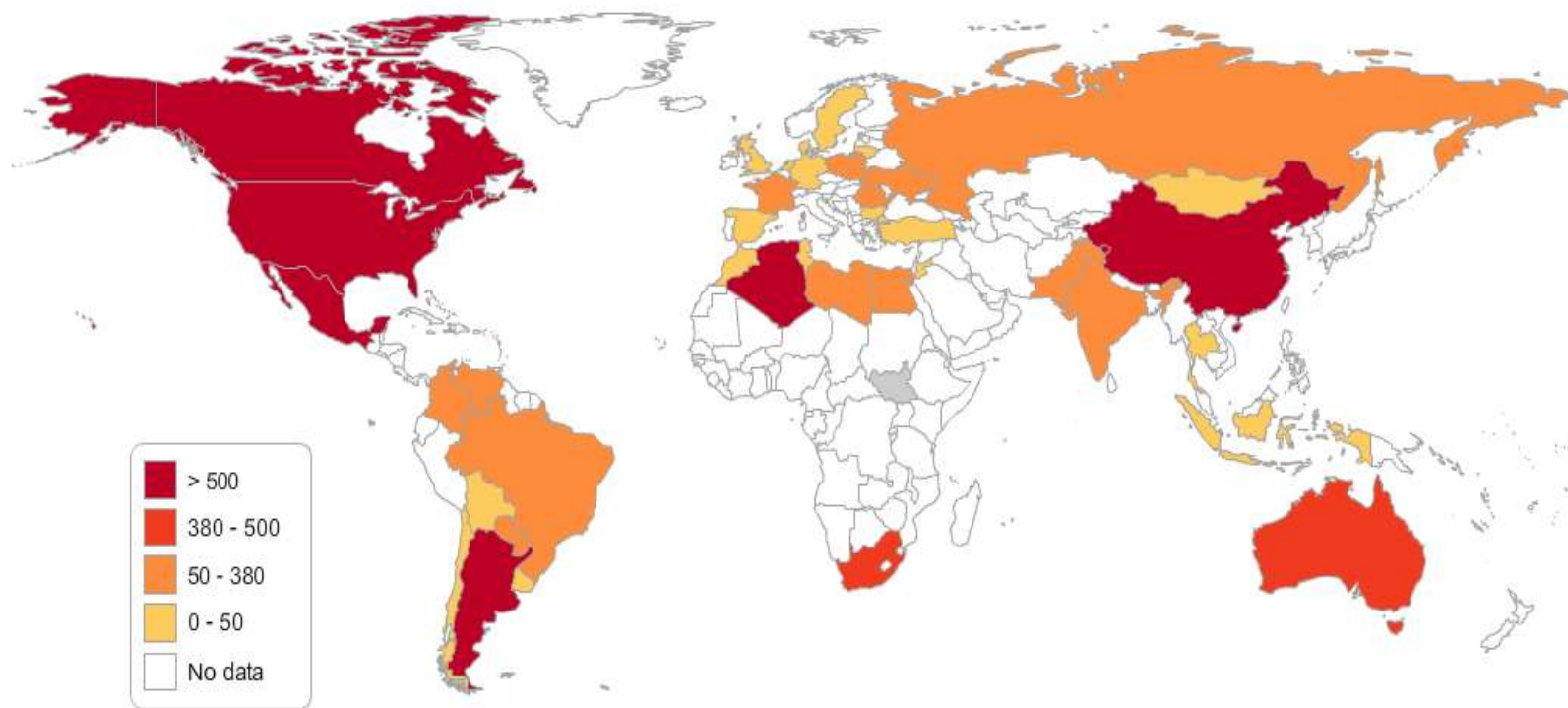
Source: BP energy outlook 2012

Global gas resources



Source Clingendael CIEP 2013

Shale gas resources



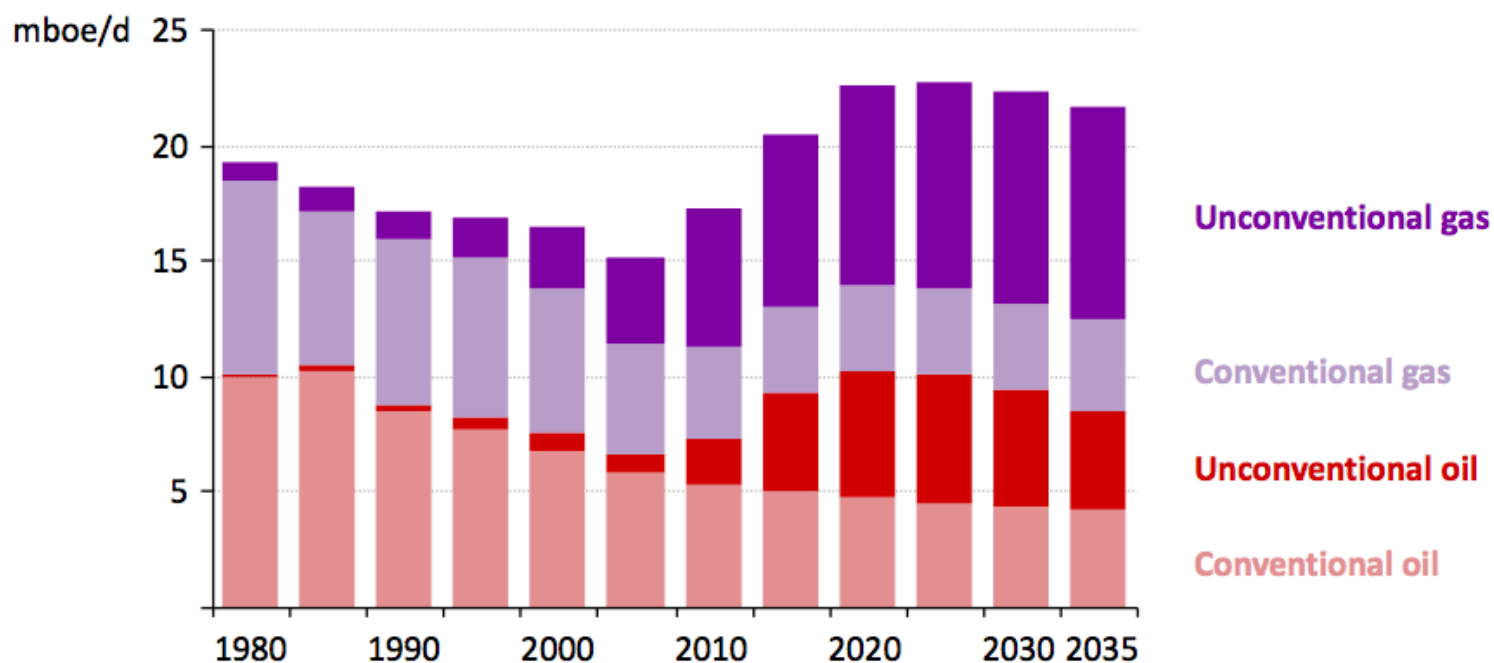
Technically Recoverable Shale Gas Resources Worldwide (Trillion Cubic Feet)

What are the economic consequences of the “shale gas revolution” in USA?

- › The evolution of the energy mix in the USA
- › What are the expectations for production?
- › What is the impact on CO₂ emissions?
- › Natural Gas Liquids; a new game changer?

USA oil & gas transformation

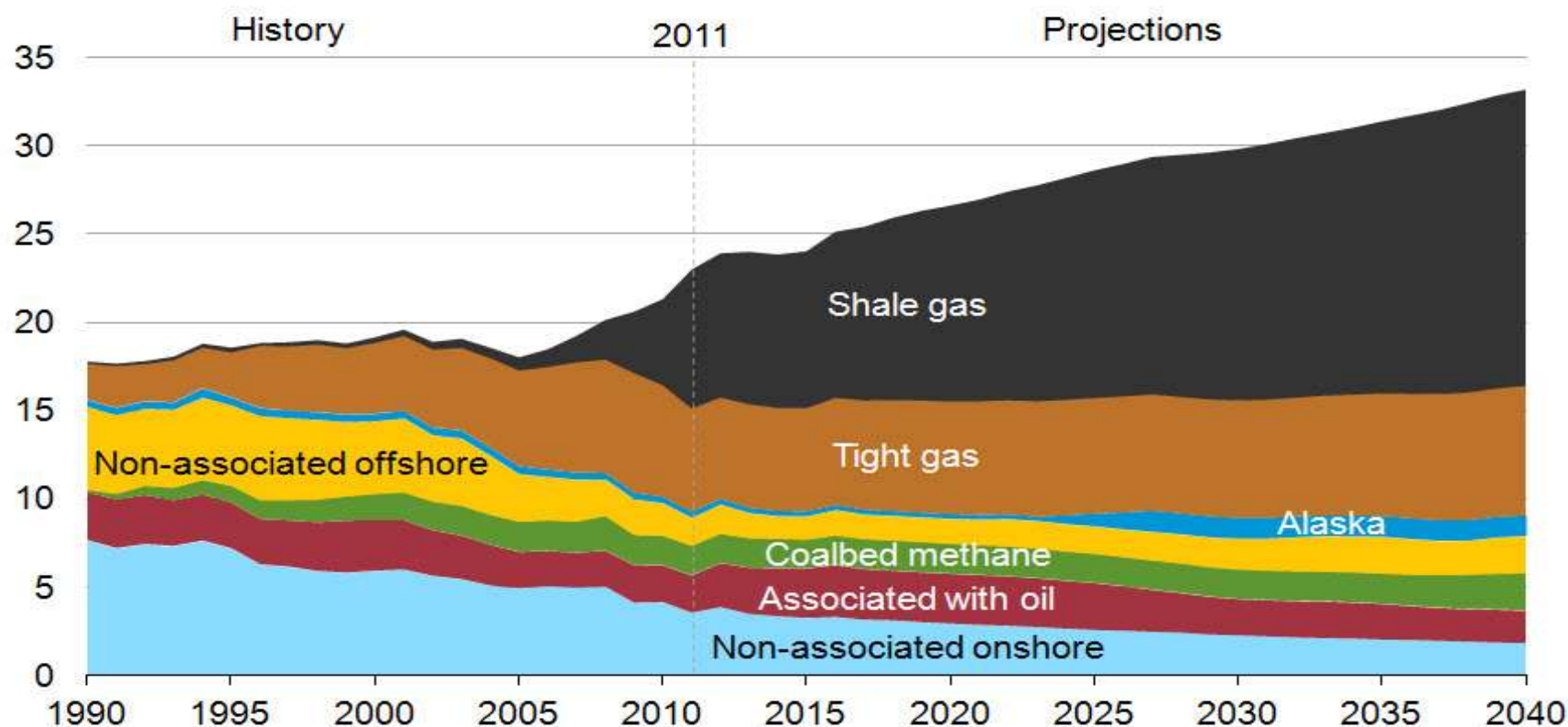
US oil and gas production



The surge in unconventional oil & gas production has implications well beyond the United States

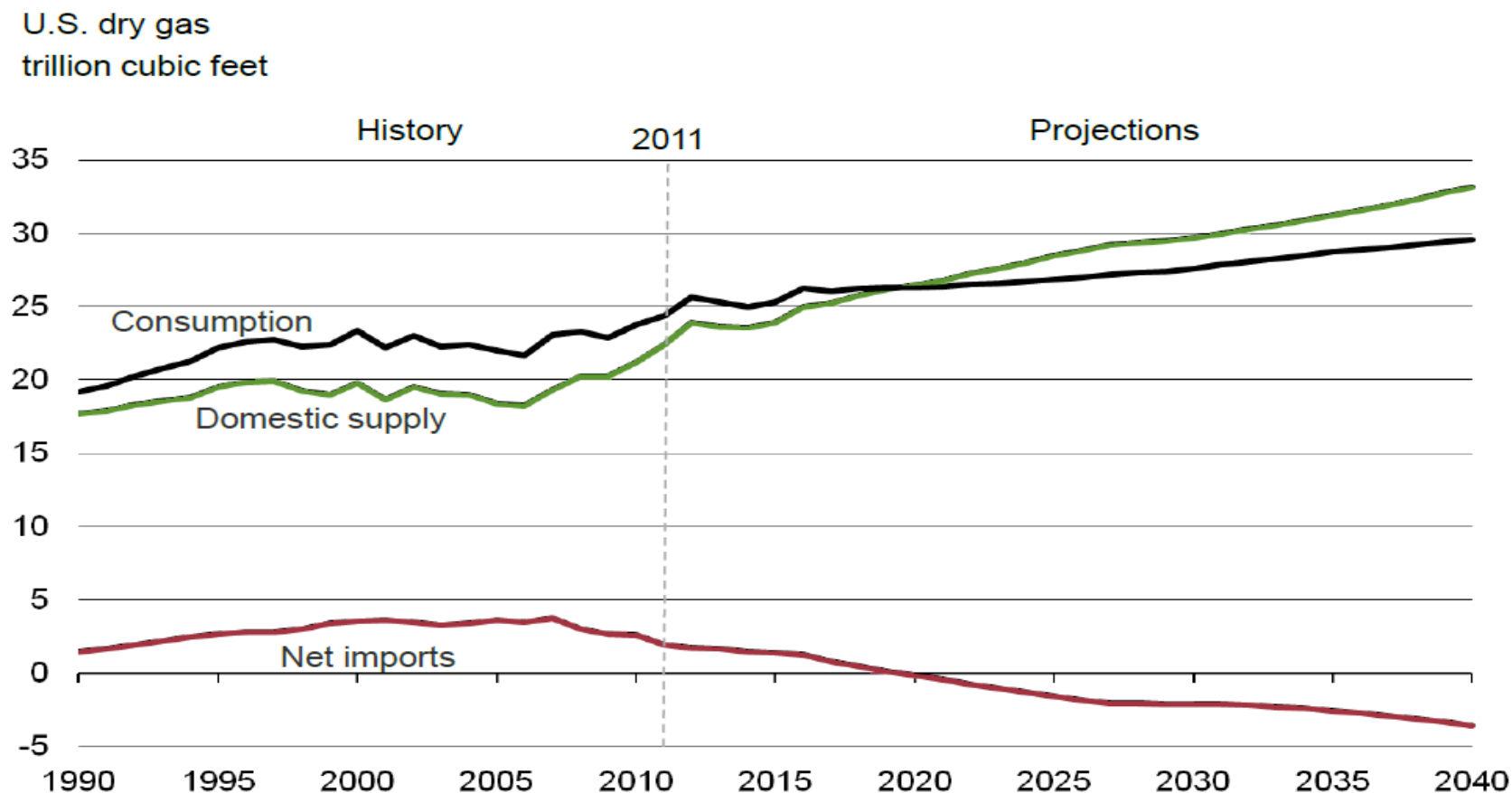
Shale gas production leads growth though 2014

U.S. dry natural gas production trillion cubic feet



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2013 Early Release*

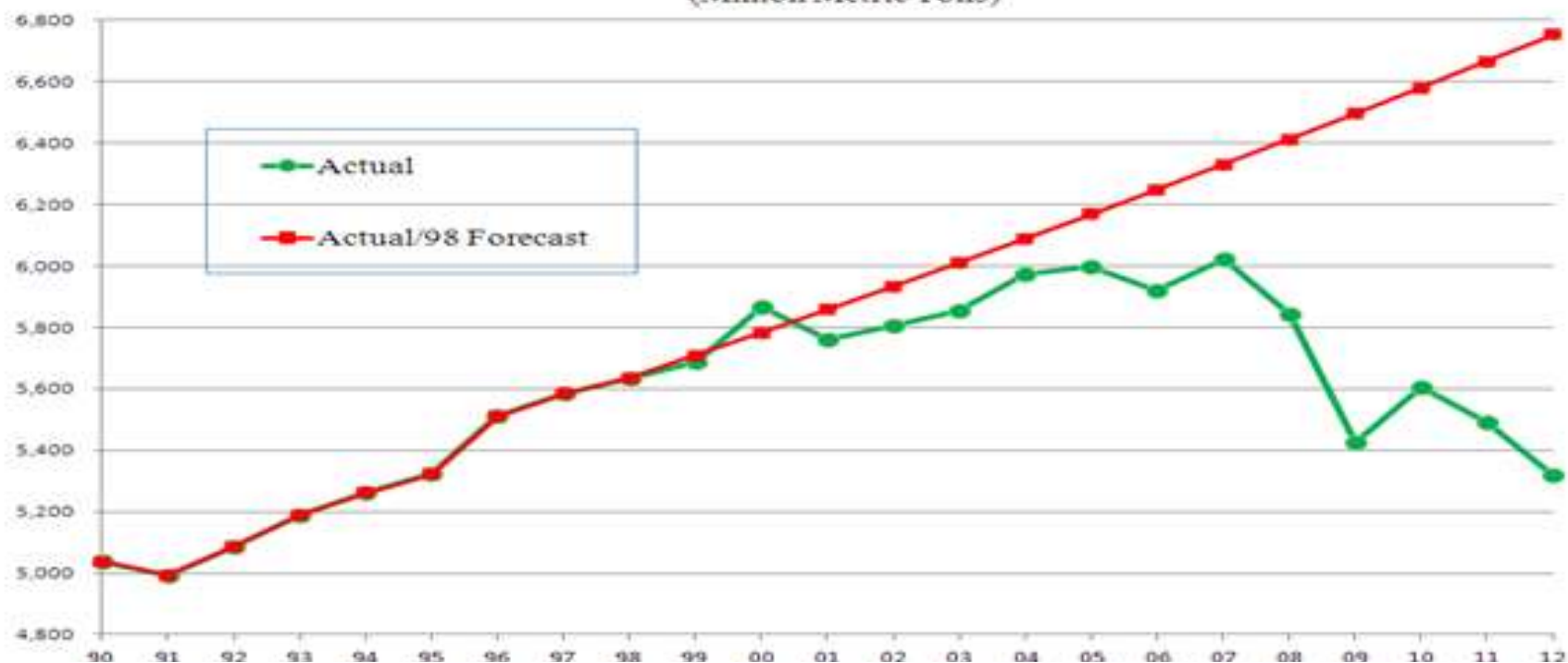
Domestic natural gas production grows faster than consumption and the US becomes a net exporter of natural gas around 2020



Source: EIA, annual energy outlook 2013 early release

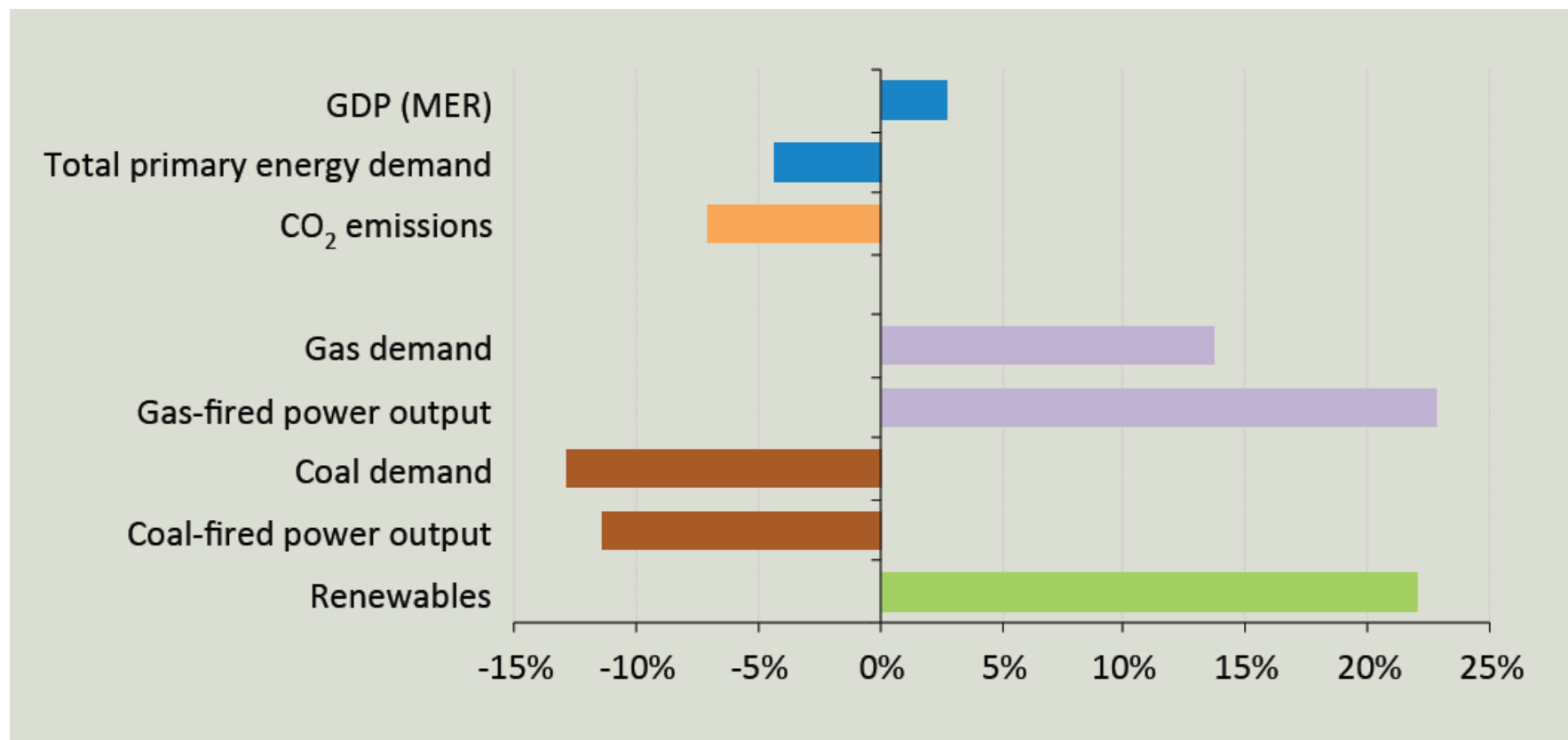
USA CO2 emissions decrease

US Carbon Dioxide Emissions from Energy Consumption
(Million Metric Tons)



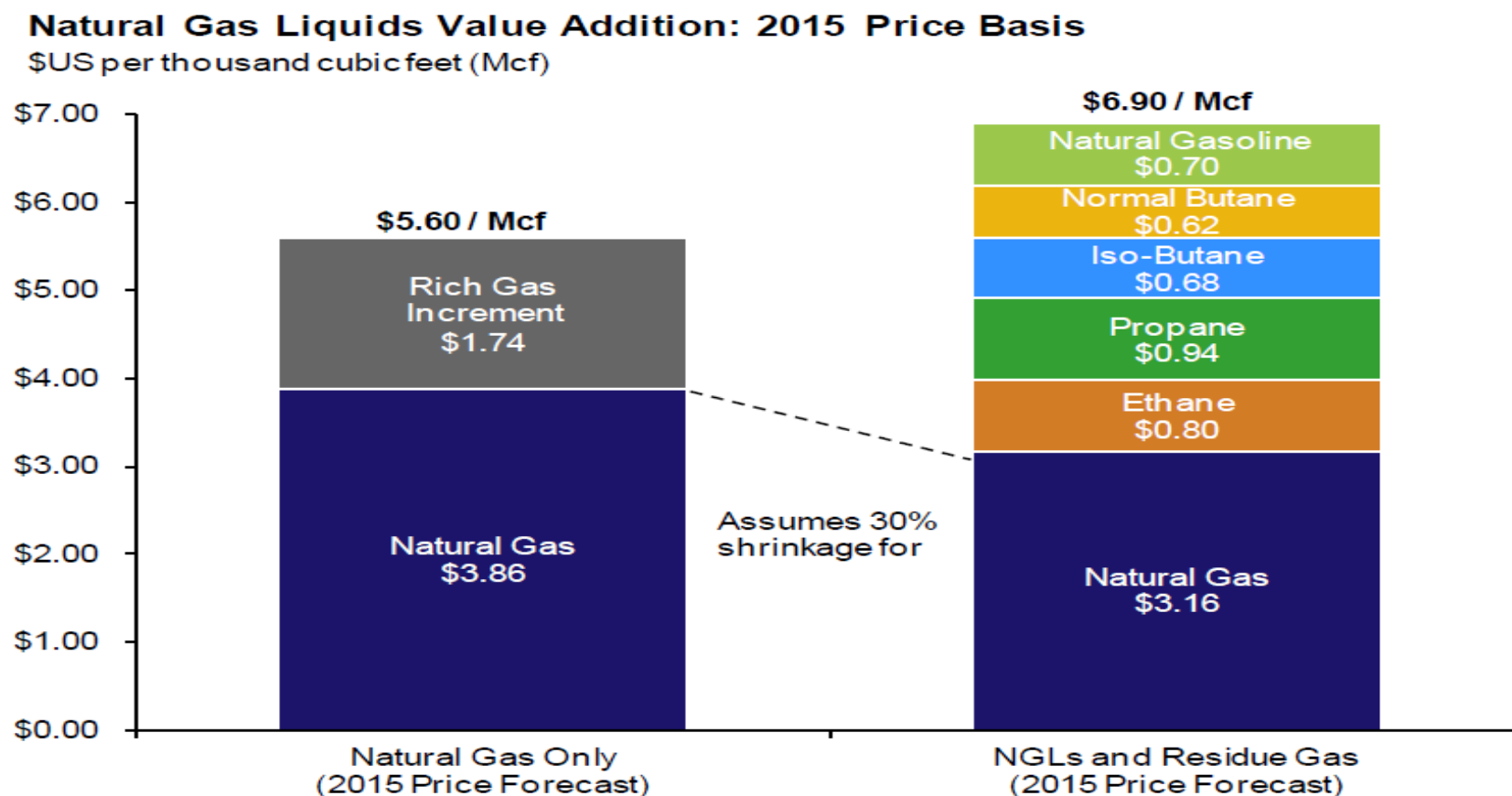
Source: Forbes 2012

Changes in USA energy mix 2006 - 2011

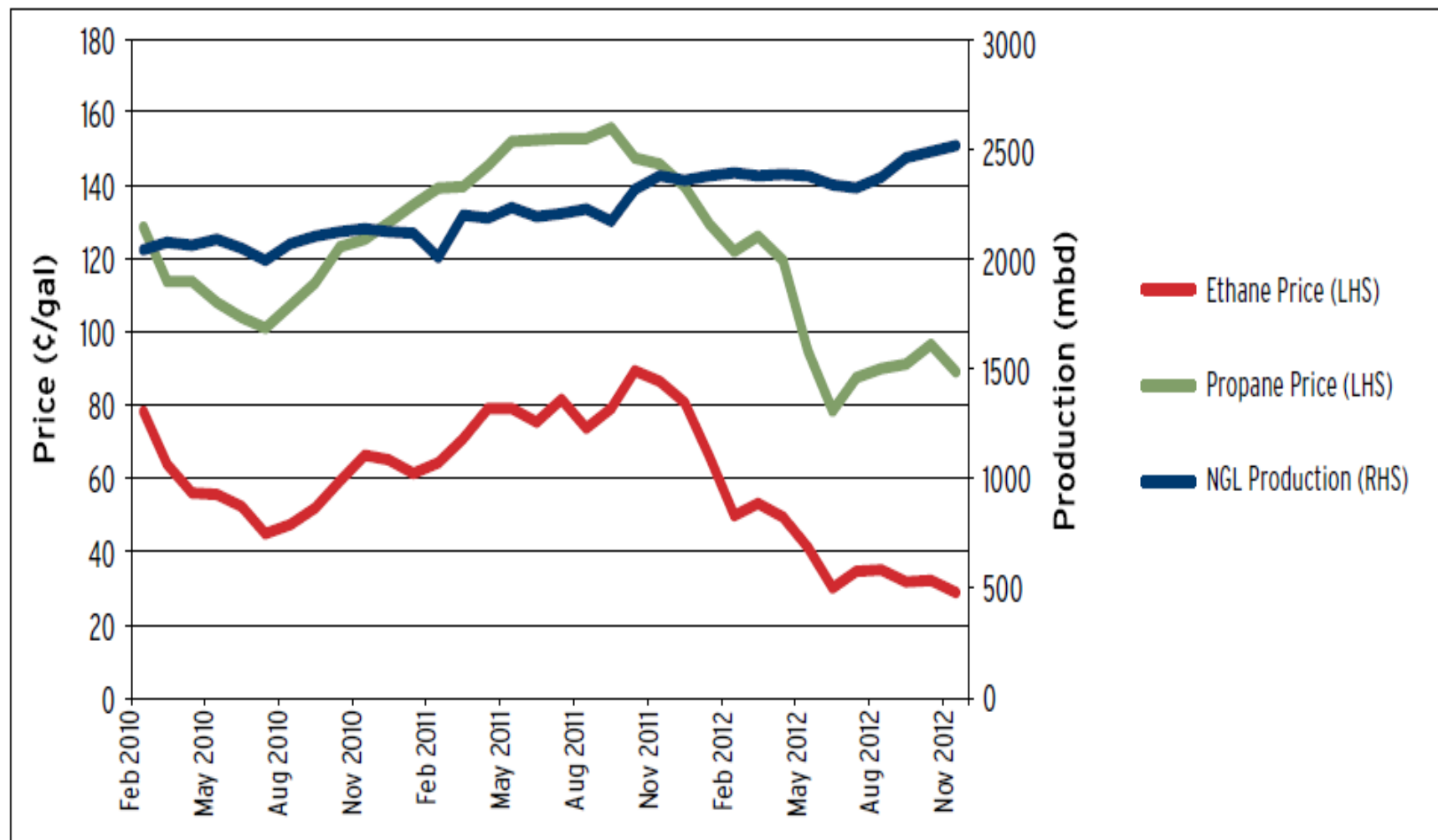


Source: IEA, WEO, 2012

Natural Gas Liquids (NGL) a new game changer?



NGL and propane prices Febr. 2010-Nov. 2012



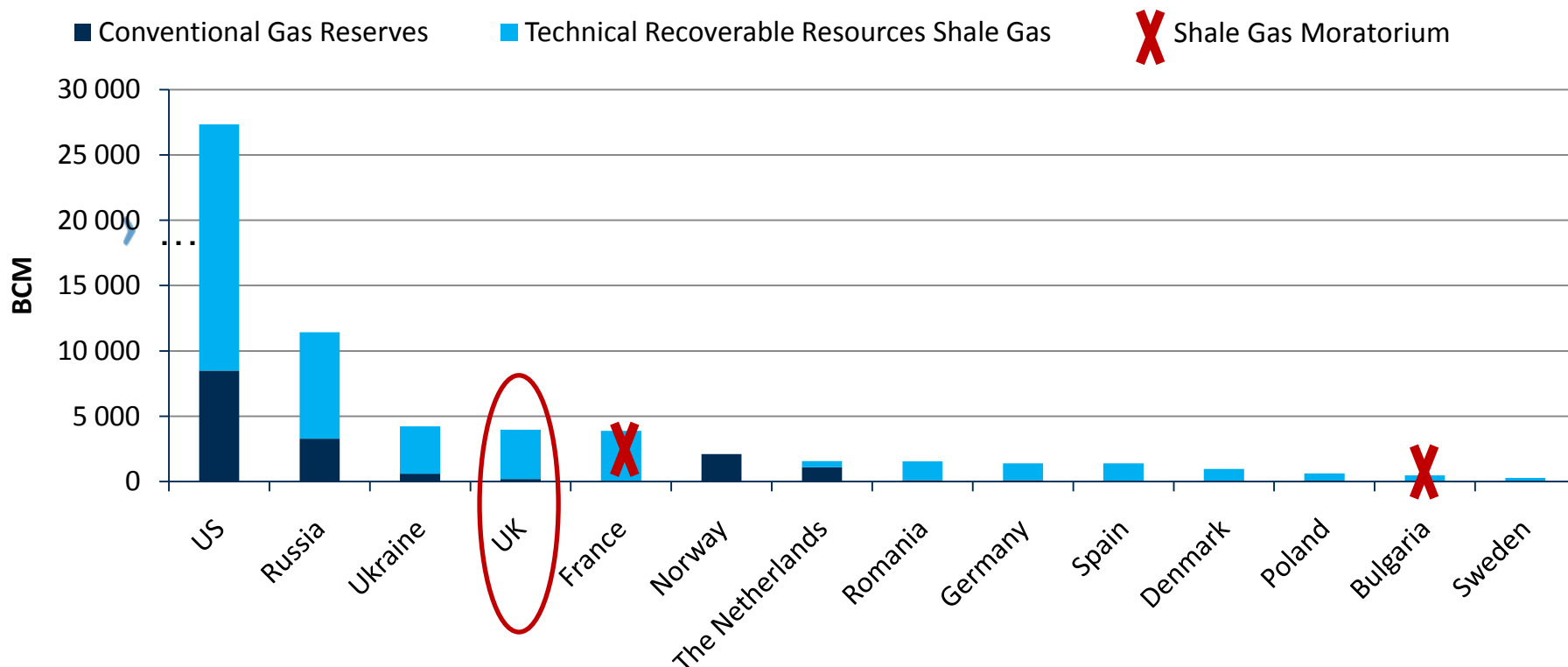
The success of shale gas in the US

- › In 2001, 1% of natural gas production came from shale compared to >20 % today
- › Prices dropped with positive effect on manufacturing (steel, petrochemical industry) by reducing cost of operations
- › The rapid expansion of shale gas production occurred because it was largely free of highly restricted government policies
- › Expansion took place almost entirely on private land and was not subject of extensive access restriction and other federal regulations
- › The local community benefits from shale gas production

Will Shale Gas be a Game Changer in Europe?

- › In the United States, there has been a 'shale gas revolution'. Shale oil is likely to follow. What about the EU?
 - › What are the reserves and economically recoverable resources in Europe?
 - › What are the expectations for import?
 - › What are the economics for European production?
 - › What impacts are expected on coal/gas switch in the power sector?

What are the Reserves and Recoverable Resources?



Sources: BP (2013) ; EIA (2013) ; BGR (2012) ; BGS, DECC (2013) ; PGI (2012) ; ACIEP (2013) ; TNO (2012)

Recoverable Resources in the EU are Relatively Small

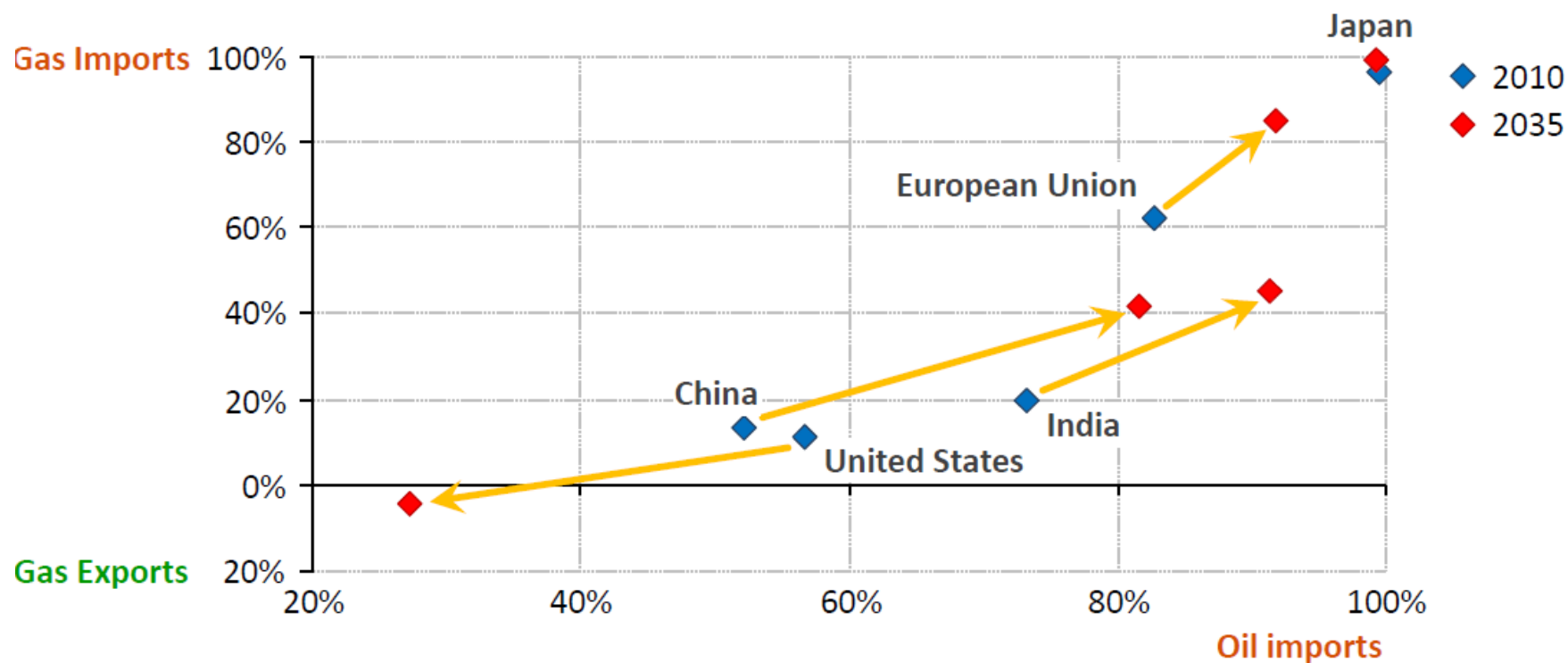
Expectations EU shale gas production

- › Shale gas production will not make Europe self sufficient in natural gas
- › The best case scenario for shale gas development in Europe is one in which declining conventional production can be replaced and import dependence maintained at a level around 60%
- › IEA estimates the production of unconventional gas in Europe at 15 bcm per year by 2030

Sources: JRC 2012

Net oil & gas dependency in selected Countries

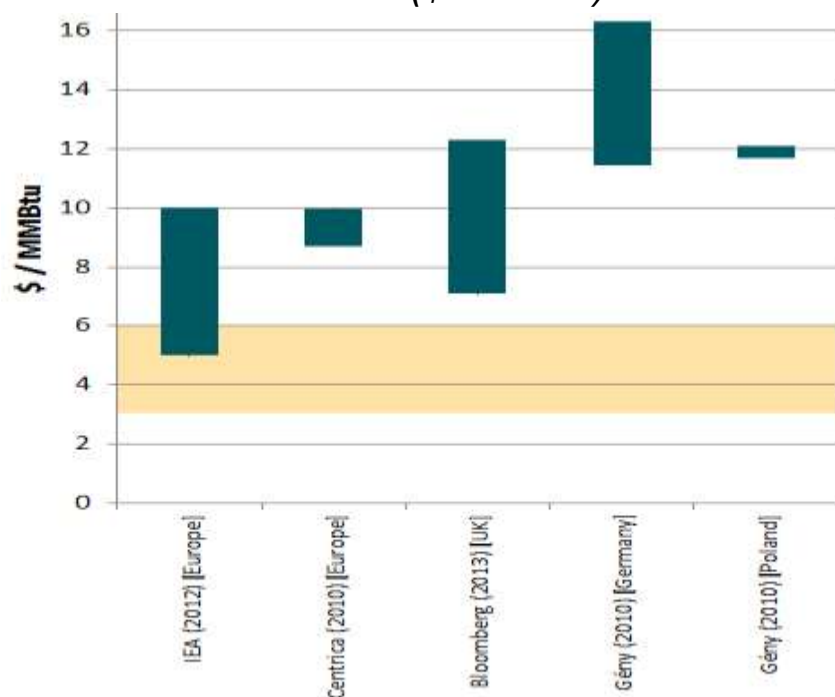
Net oil & gas import dependency in selected countries



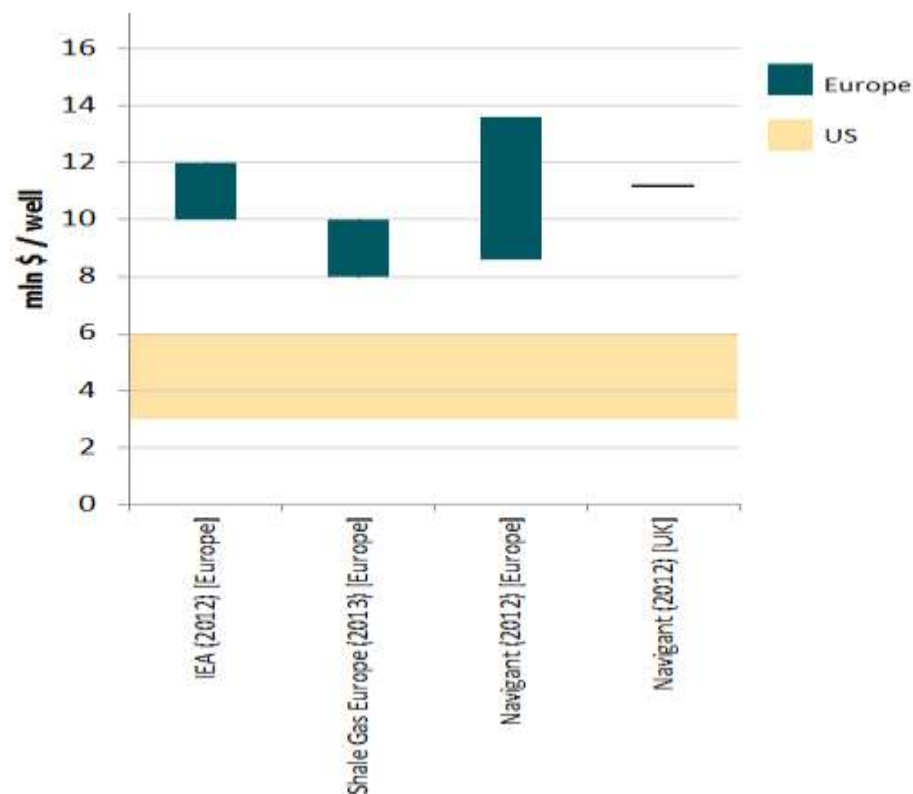
Source: IEA

What are the economics for European production?

*Exploration costs per unit of gas
(\$/MMBtu)*

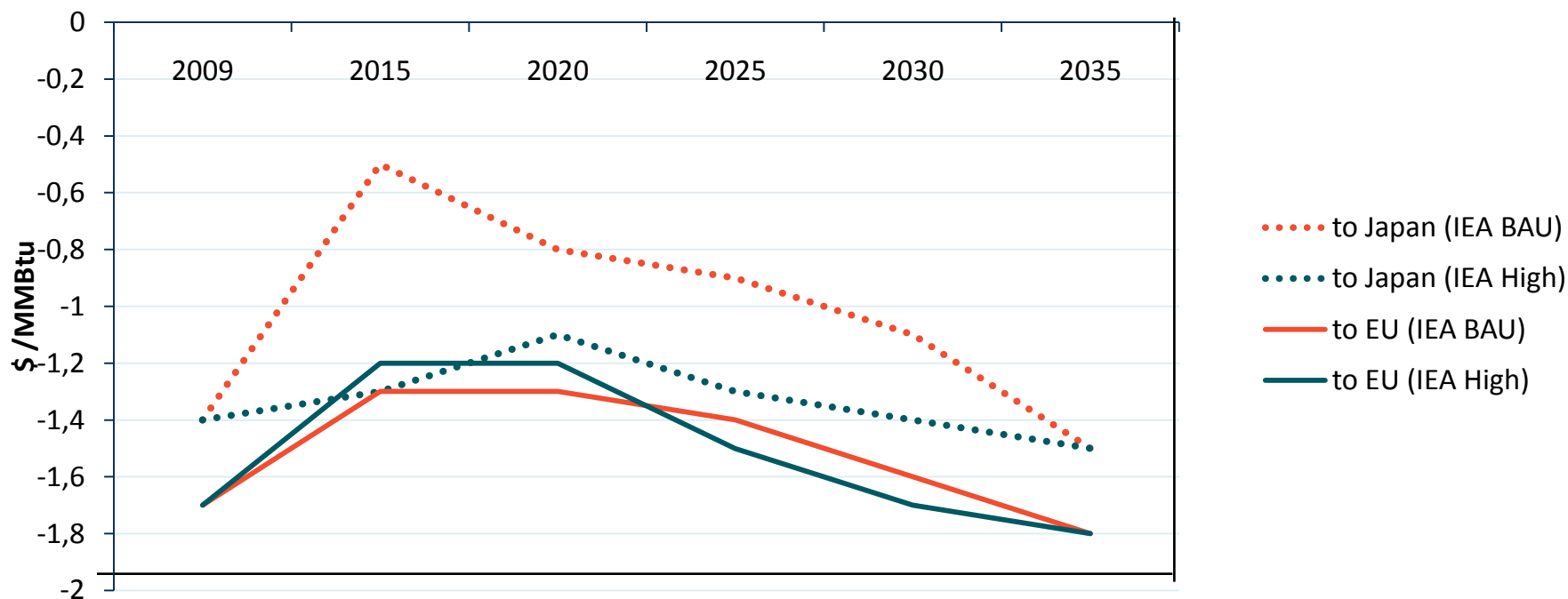


Costs of drilling wells (MLN \$)



Costs for Drilling and Exploration in the EU are much higher than in the US.

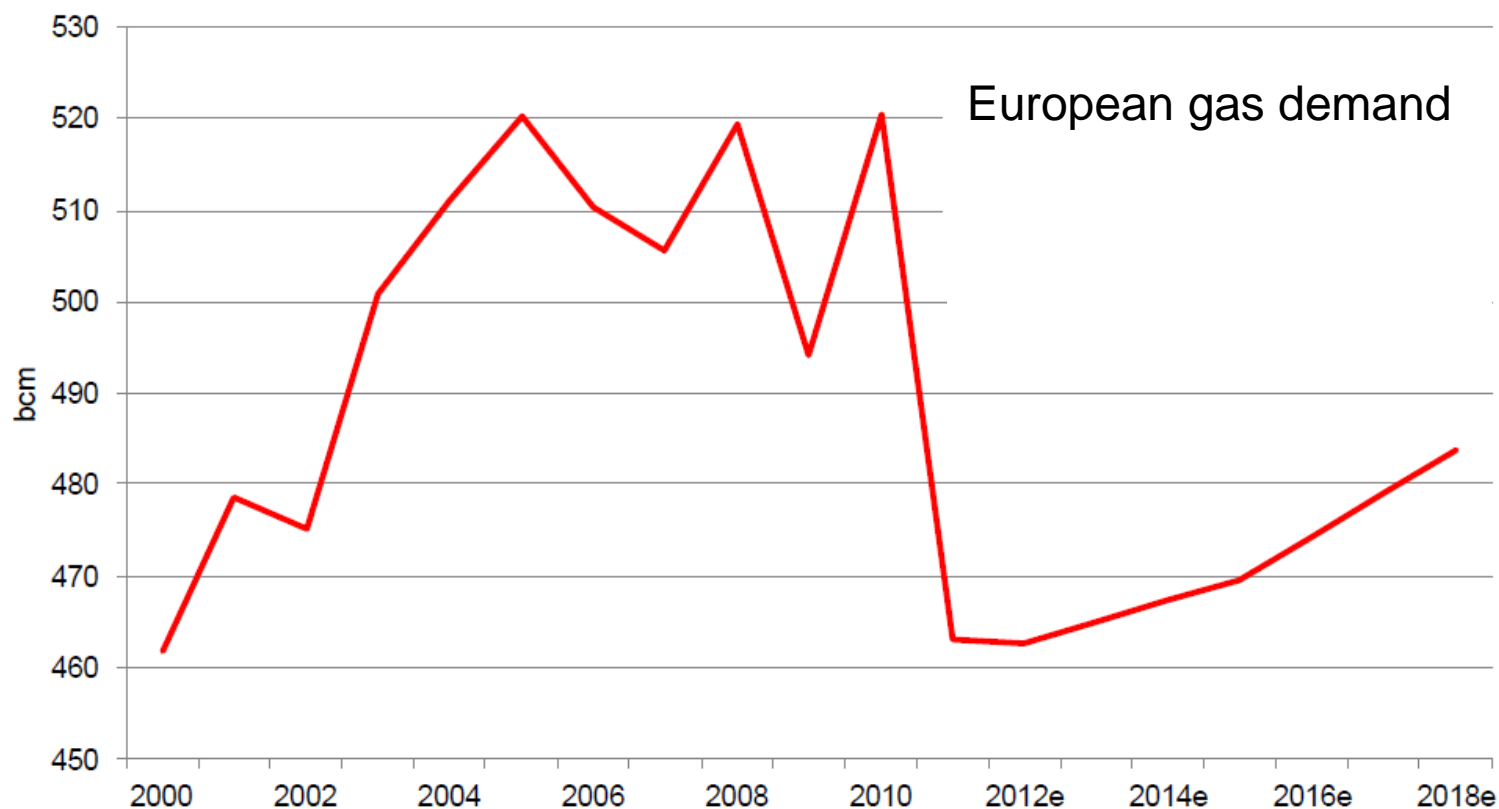
What are the expectations for shale gas import?



Sources: Triple E consulting (2013)

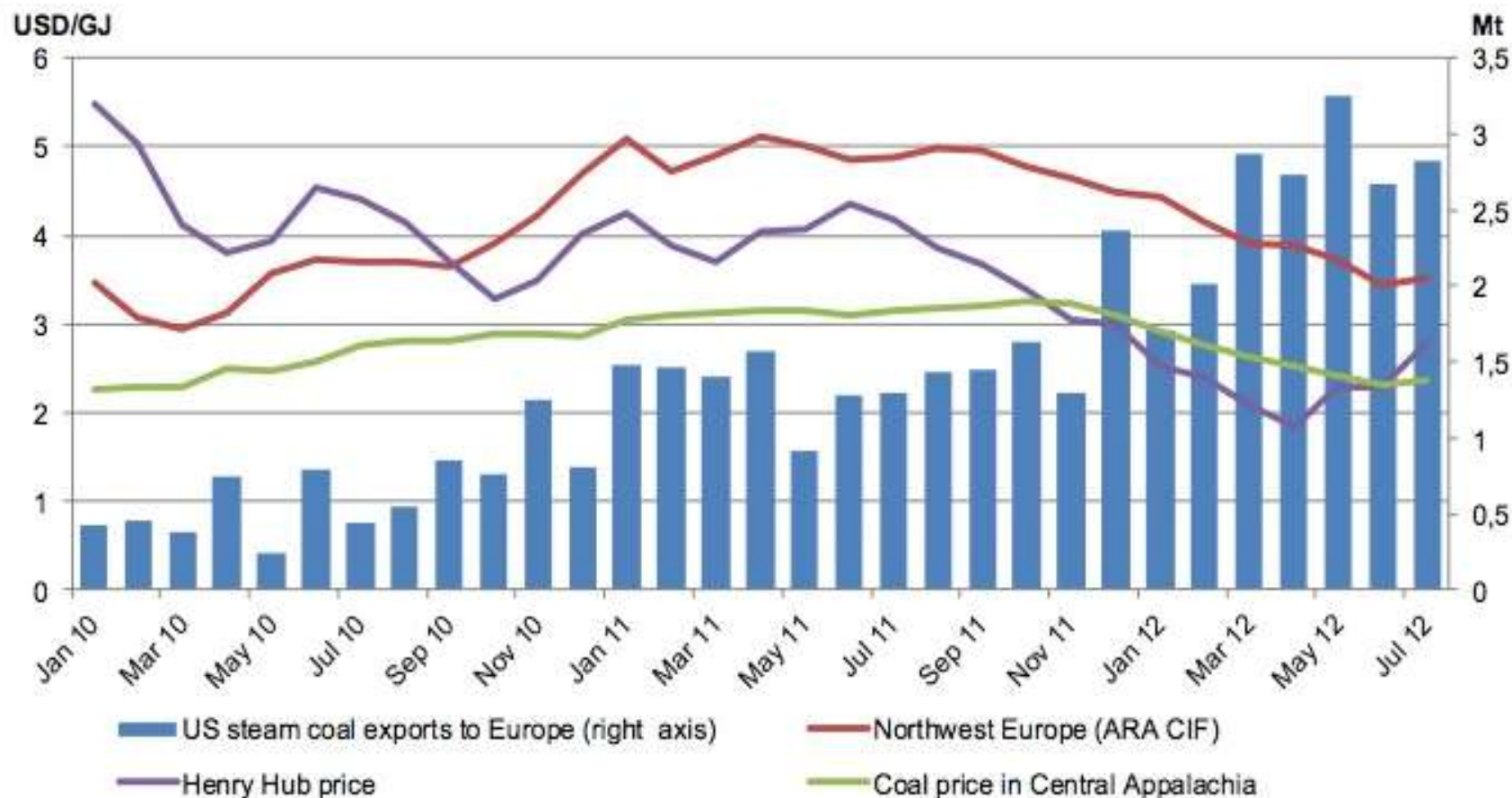
No positive business case for US LNG exports exists
under 2011 IEA scenarios

US coal is displacing Russian gas in Europe



Source: SG Cross Asset Research (data IEA)

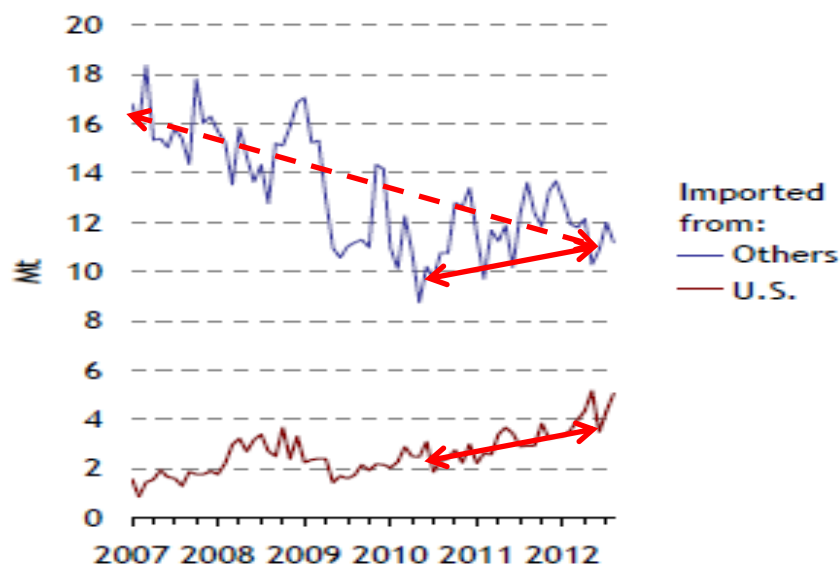
US shale gas switches on coal in Europe.



Source: IEA

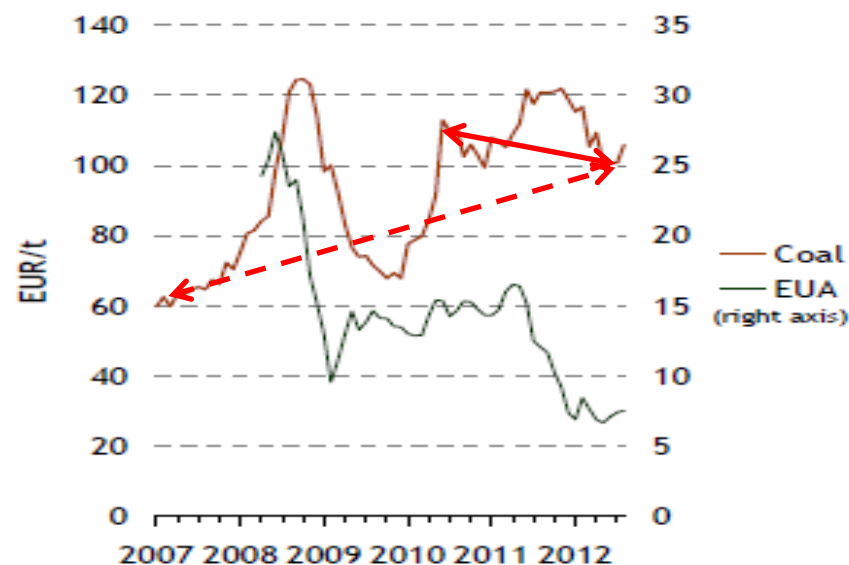
Impact on Electricity Fuel-Shift in the EU

Figure 8: Coal imports by the European Union



Source: Eurostat

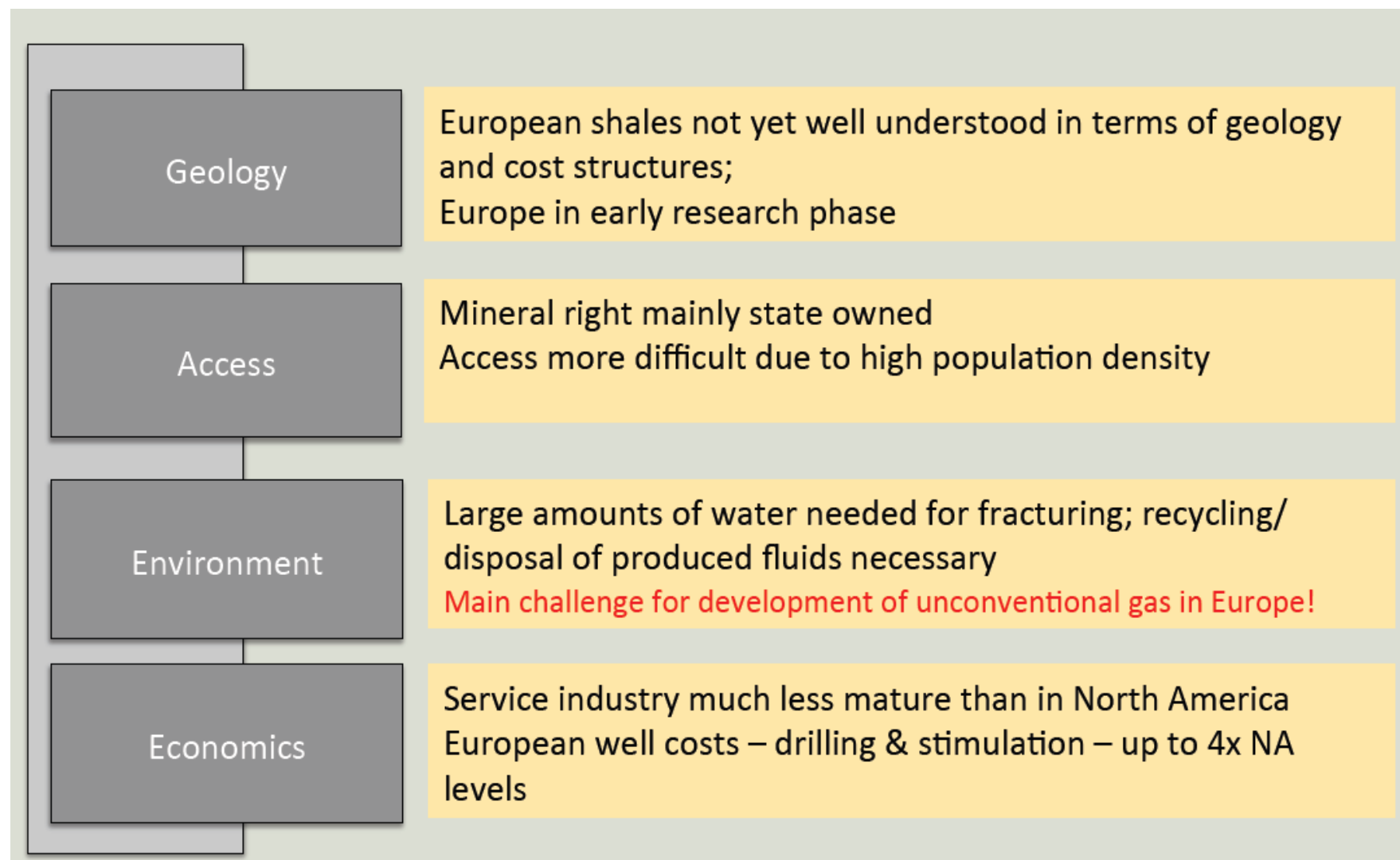
Figure 9: Coal import price of the European Union and EU emission allowance price



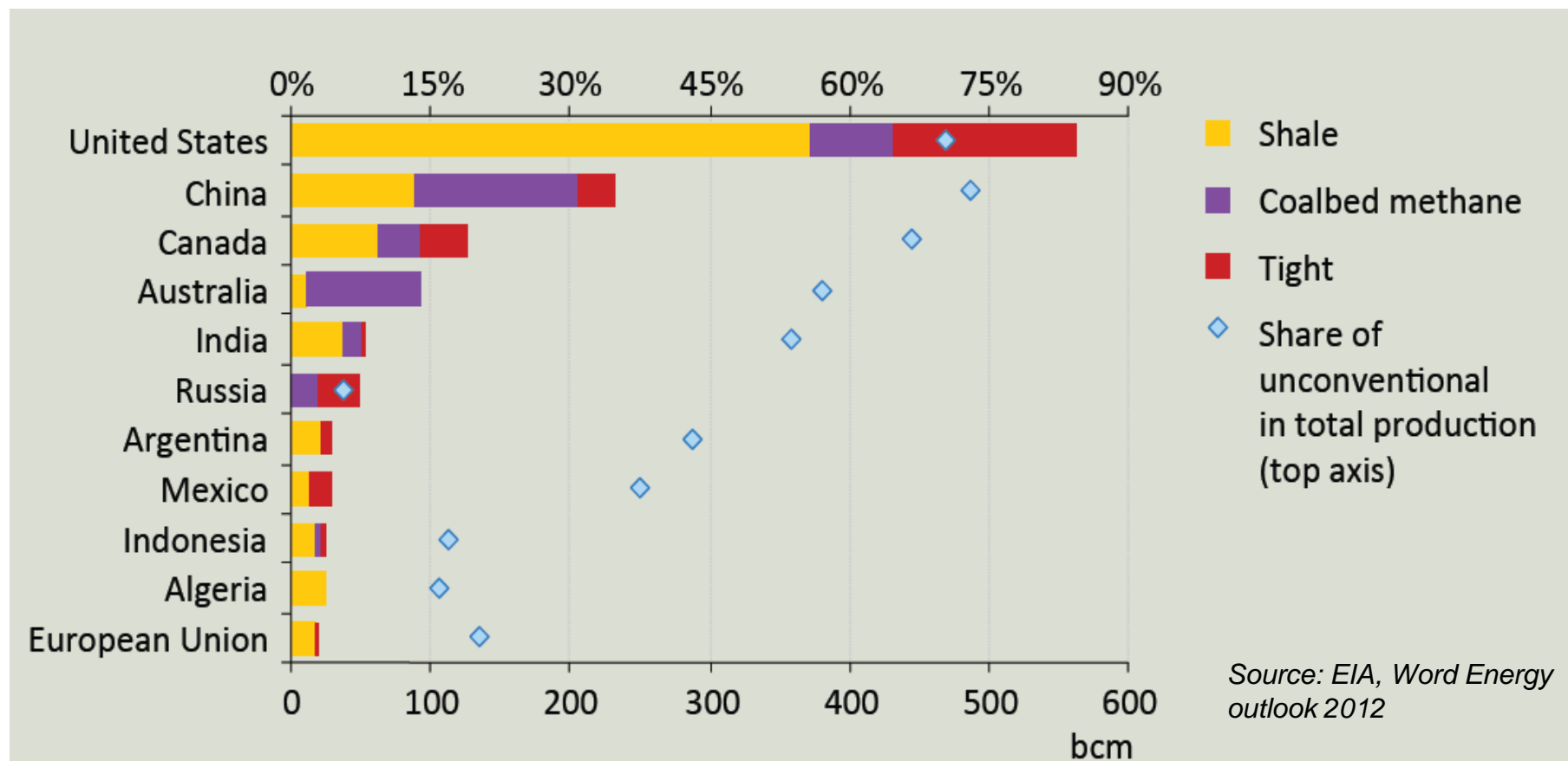
Source: Eurostat,
IntercontinentalExchange

The Current Shift from Gas to Coal in the EU Power Sector
Might Not be Sustained over the Longer Term

Challenges to unconventional gas in Europe.



Unconventional gas production in leading countries 2035



Europe is expected to produce only a limited quantity of shale gas

Conclusions

- › There is still much uncertainty about the economics of shale gas in Europe
- › (Nevertheless) Shale Gas does not seem likely to be a similar game changer in the EU as in the United States
- › Europe remains vulnerable for energy policy by gas exporting countries
- › The development of shale gas will only be successful in Europe if the environmental and economic boundary conditions can be fulfilled