Energy system analysis of shale gas perspectives. Key factors and potential impacts

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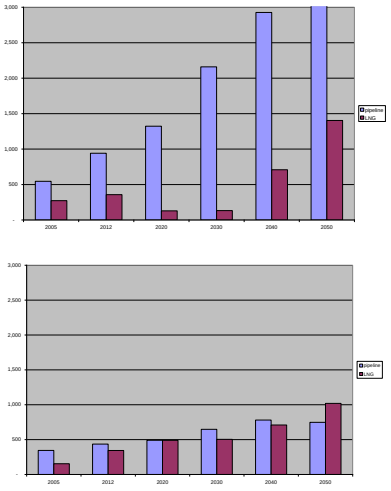
Objectives

- exploration of the uncertainty around the potential effects of shale gas development on natural gas markets and the wider energy system
- energy system analysis to identify the main mechanisms through which different shale gas can affect the global energy system

  ➔ a simplified "theoretical" model explaining the behaviour of the system in response to different shale gas economics

Revision of TIAM common version 2011

1. Calibration trade TIAM common version 2011
2. Revision of key factors
   - Trade channels: representation of all current and projected trade links (pipelines and LNG)
   - Infrastructures: revised and documented figures for existing pipelines and LNG
   - Infrastructures: revised and documented figures for projected pipelines and LNG
   - Pipeline cost: revised and documented figures for new pipelines
   - LNG cost: revised and documented figures for new liquefaction terminals
3. Further improvements
   - Natural gas reserves/resources (incl. shale gas)
   - Natural gas projected production capacity
   - Oil production capacity
   - Oil transportation costs
   - Oil/gas prices
   - GDP growth
   - Competition in electricity generation



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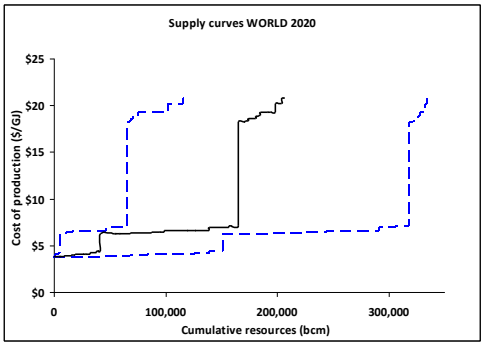
Shale gas supply curves

- Meta-analytical study on shale gas resources, systematically scrutinized the methods, assumptions and results of over 50 original country- or regional-level estimates;
- State of the art and future drilling, hydraulic fracturing and production technologies for shale gas wells, summarized through a simple model showing how some key cost components yields pessimistic, most likely and optimistic scenarios of the current and projected shale gas production costs



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Scenario analysis

	Reserve Size		
Production Cost	***Low***	***Most likely***	***High***
Low	Low Resources Low Cost		Optimistic
Most likely		Most likely	
High	Conservative		High Resources High Cost

Sensitivities:

- A stronger oil/gas price link
- A carbon constrained energy system
- Wider acceptance of nuclear
- Less costly natural gas transportation

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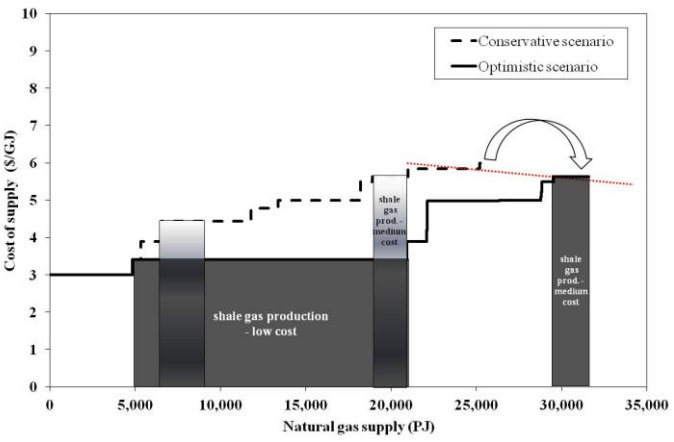
Shale gas development: new equilibrium on regional gas markets

Natural gas supply curve at equilibrium – USA, 2030: change between optimistic and conservative shale gas scenarios



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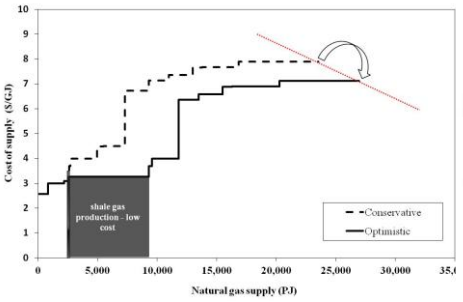
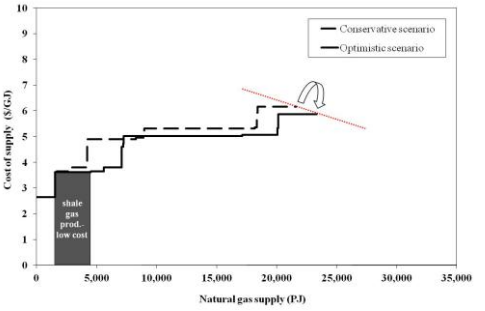
Shale gas development: new equilibrium on regional gas markets

European Commission

Natural gas supply curve at equilibrium
China 2030



Natural gas supply curve at equilibrium
WEU, 2030



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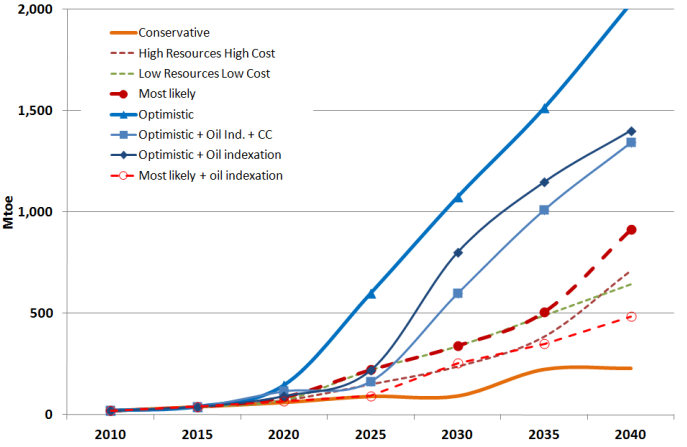
Shale gas development: 4 main scenarios + sensitivities

European Commission



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Impact of shale gas on the global energy system (b)

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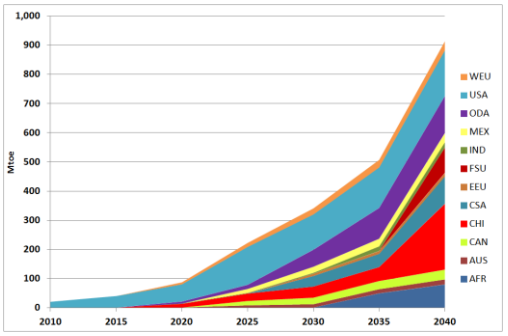
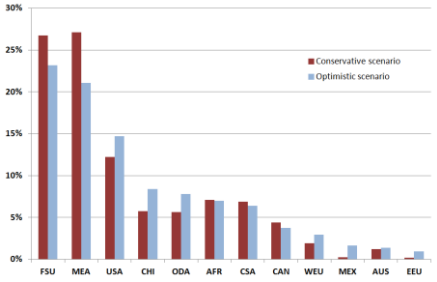
Shale gas production by region – Most Likely scenario





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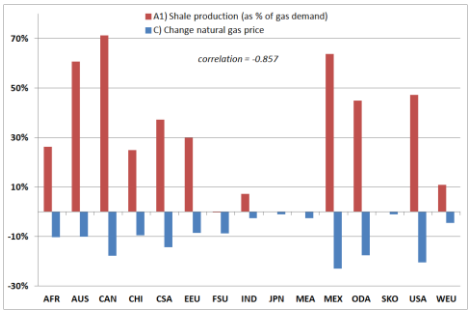
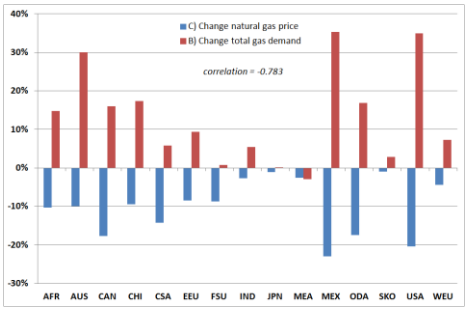
Shale gas production, gas prices and gas demand

European Commission

Shale gas production and gas prices (Opt vs Cons)



Natural gas prices and gas demand (Opt vs Cons)



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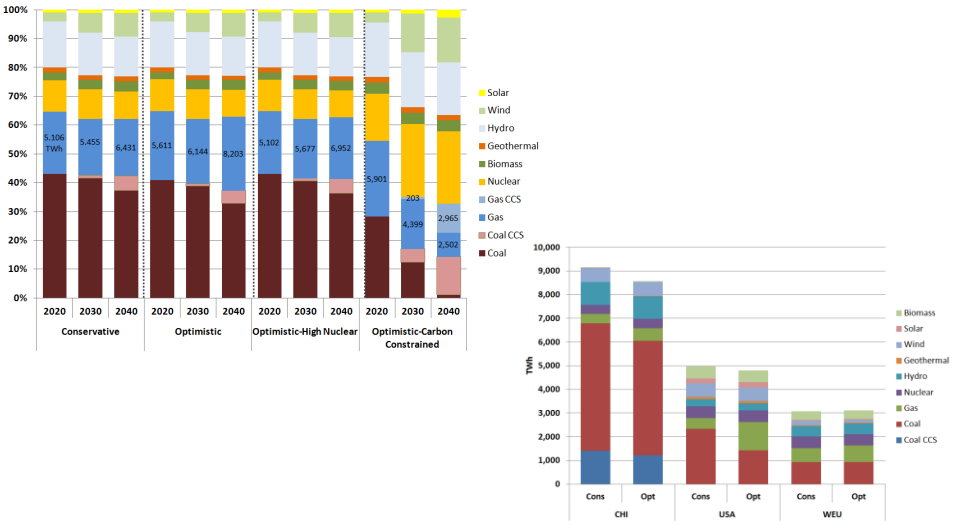
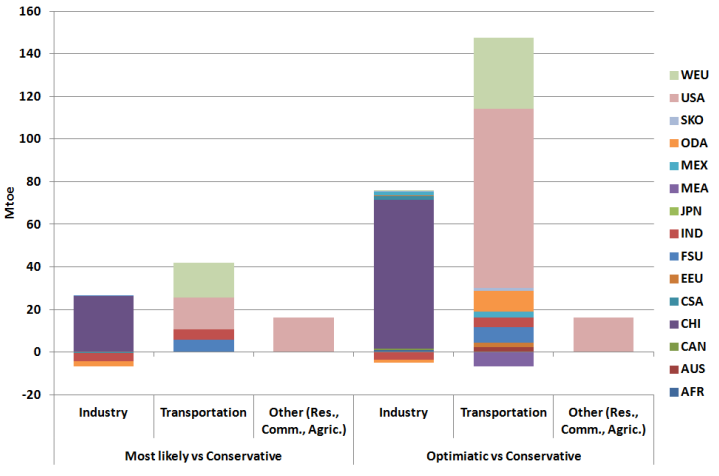
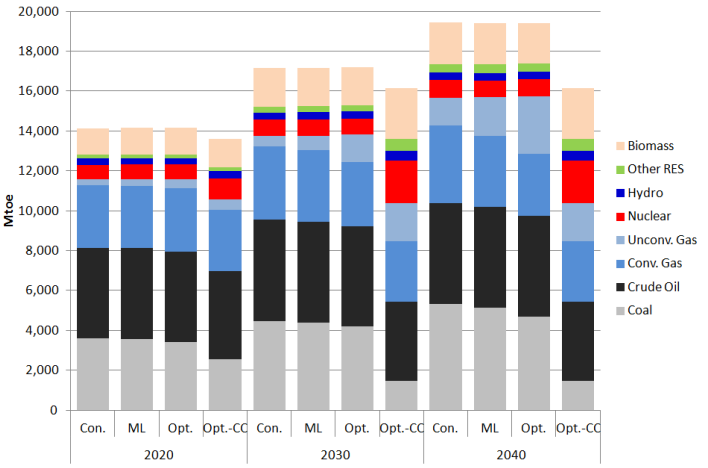
Shale gas development and electricity production



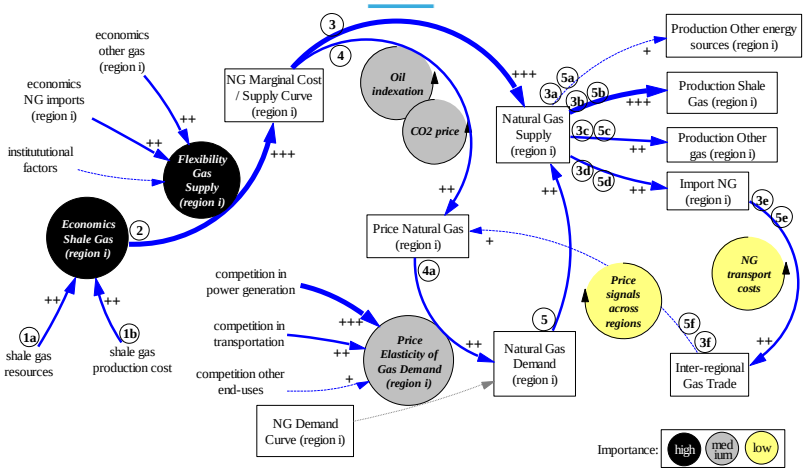
Shale gas scenarios and natural gas in end uses



Shale gas scenarios and global primary energy



A simple model of main actions / feedbacks from shale gas development



The extent to which shale gas penetrate the energy system
➔not only on its future economics, also dynamic interactions of a considerable number of supply- and demand-side drivers and techno-economic developments

Conclusions

- Future scale of shale gas development is dependent foremost on its economics, but only if optimistic assumptions on both resources and costs
- highly diversified across regions, depending on regional specificities, in particular the competitiveness of shale gas versus competing sources of energy (either conventional gas and/or other energy sources)
- Trade: fall in deliveries to new shale gas producing regions as well as a corresponding decline in exports from conventional gas-producing regions
- No regions developing shale gas to begin gas exports
- Key conditions for propagation of effects of opt. shale gas case:
  - substitutions on supply side must lead to a decrease in the marginal cost of gas supply
  - this decrease must be passed on to the demand side
  - leading to a decrease of gas prices for final users
- The weaker the oil/gas price link, the greater shale gas development
- Role for gas as cost-effective bridge towards a low-carbon energy system
- Region specific gas price demand elasticity
- Transmission of price reductions between markets, which can extend lower prices to regions with minor shale gas production ➔ limited importance

Thanks

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