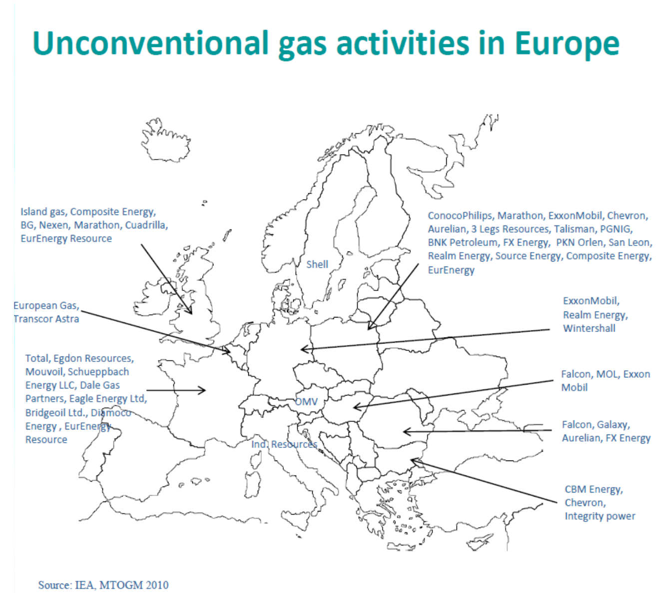
Slickwater Frac underway – Montney Shale - source:Talisman Energy Polska Sp. z o.o.



Developing a Competitive Service Industry in Europe

Instytut Studiów Energetycznych

Andrzej Sikora

Cracow, September 8th., 2011

Disclaimer

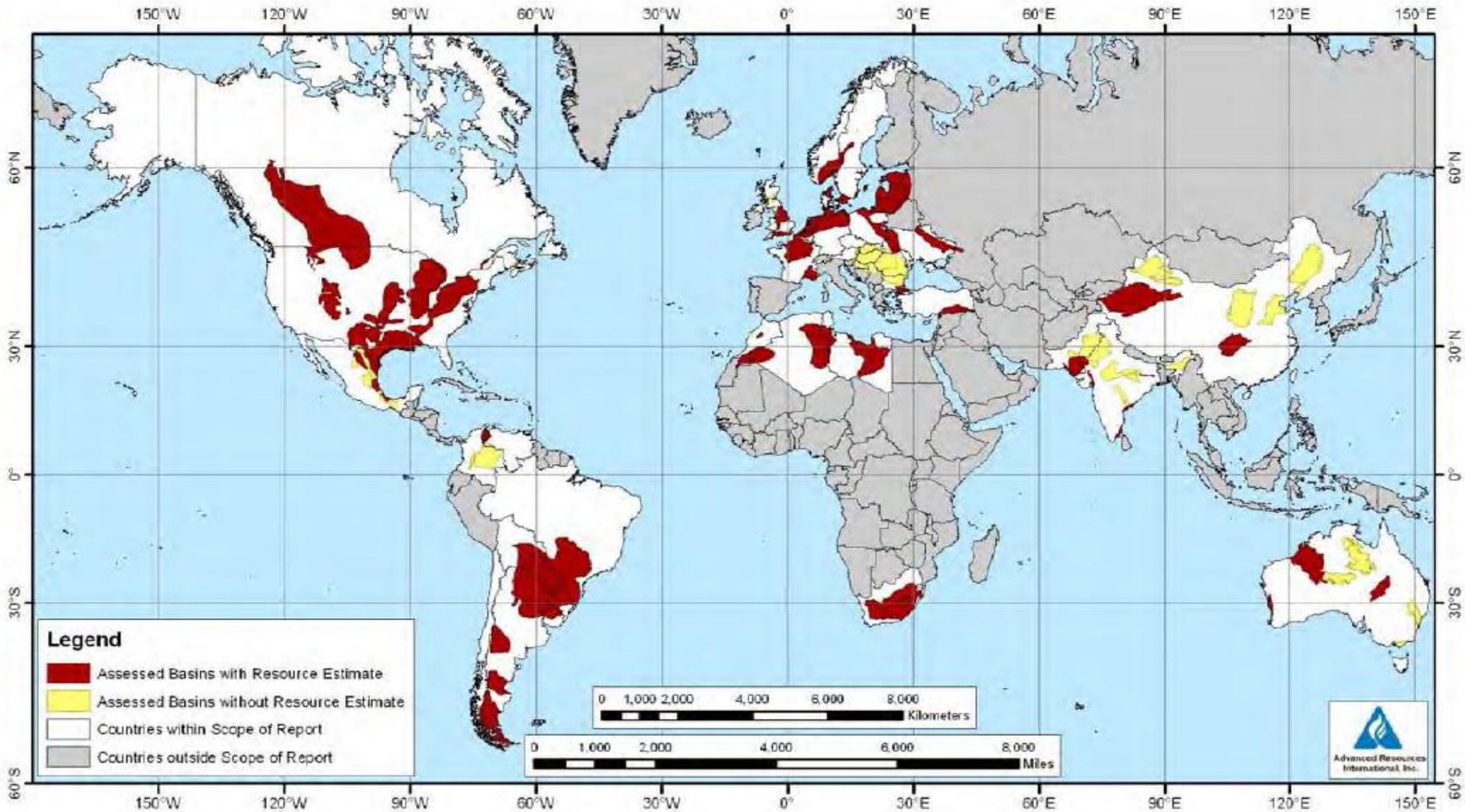
The information on which this presentation is based derives from our own experience, knowledge, data and research. The opinions expressed and interpretations offered are those of Energy Studies Institute and have been reached following careful consideration. However, the Oil&Gas business is characterized by much uncertainty and all of our comments and conclusions should be taken in that light. Accordingly, we do not accept any liability for any reliance which our clients may place on them.

The plan of the lecture

- ✓ Short quiz - for better understanding…
- ✓ Service industry what does it means?
- ✓ Current Status quo in Europe
- ✓ The importance of competition to make Shale economical
- ✓ Routes into Eastern Europe
- ✓ What is to be done to reduce drilling and completion costs?

Source: Talisman Energy Polska Sp. z o.o.

Map of 48 Major Shale Basins in 32 Countries



Source: World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States US EIA April 201

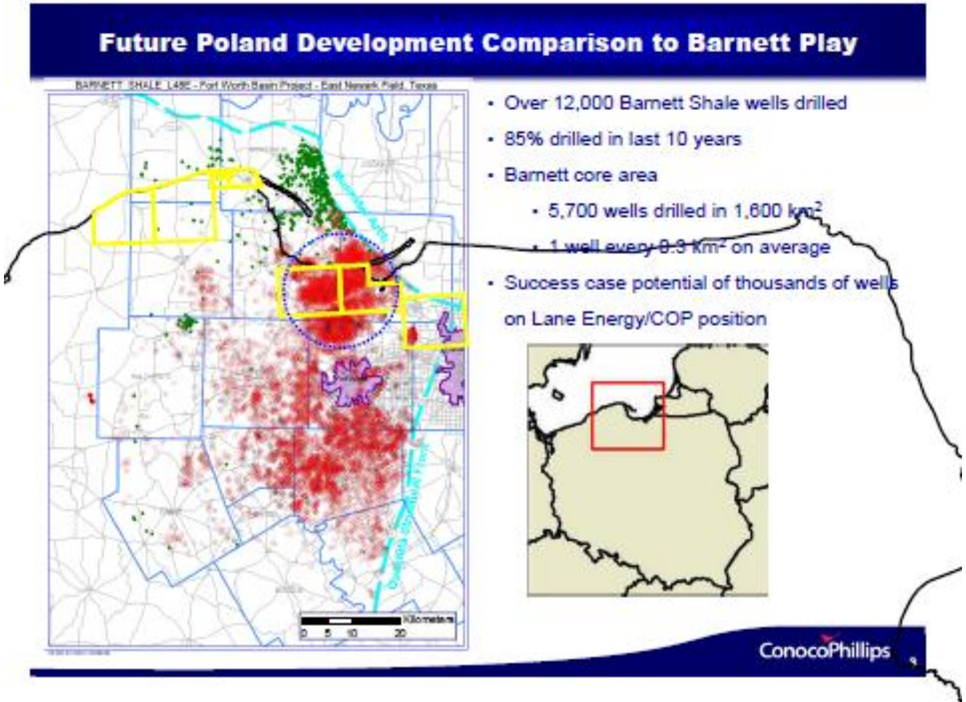
Service industry what does it means?
Can we estimate the worth of the market?

Among others services like:

- ✓ Drilling services
- ✓ Geoscience
- ✓ Wireline
- ✓ Water (!)
- ✓ Sand (!)
- ✓ Pumping
- ✓ Pipelines
- ✓ Mud logging
- ✓ Cementing
- ✓ Coiled tubing
- ✓ Slickline services
- ✓ Well testing
- ✓ Completion
- ✓ Hydraulic fracturing
- ✓ and many, many more…

„The plan calls for Halliburton to provide services including drilling services, mud logging, cementing, coiled tubing, slickline services, well testing, completion and hydraulic fracturing. Halliburton will support the project with project management services.[…] Present in Poland for more than 15 years, Halliburton performed the first-ever shale hydraulic fracturing operation in Poland for PGNiG in August 2010"

Source: www.halliburton.com/public/news/pubsdata/press_release/2011/corpnws_071311.html

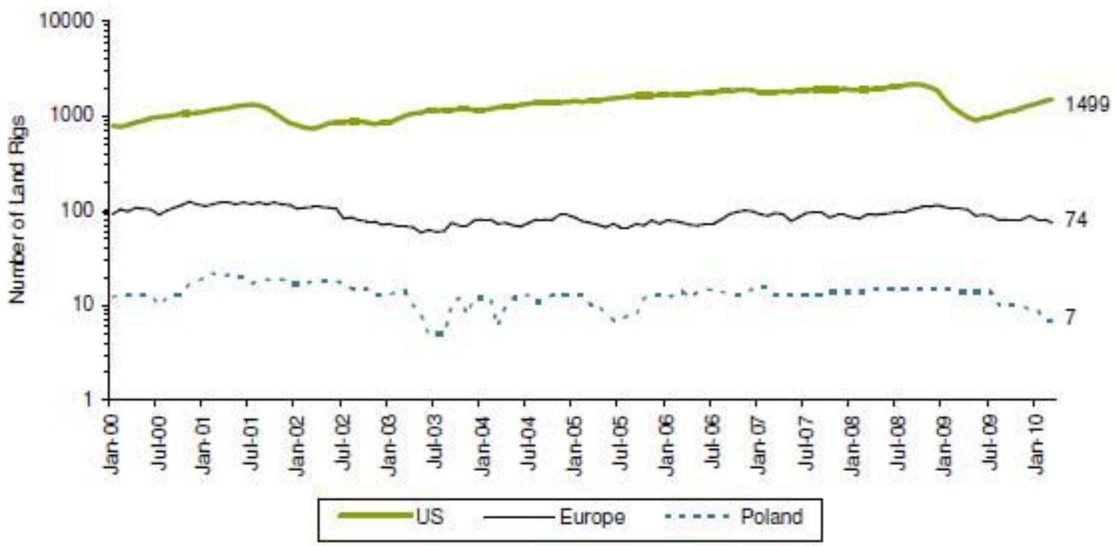


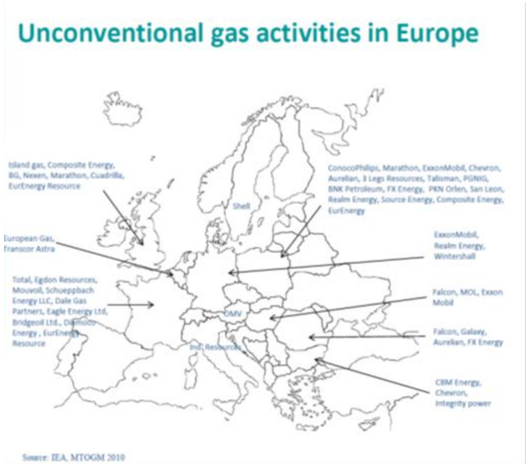
✓ Project management services…

Source: Bill Babcook „CoP US-Poland Energy Roundtable 2010"

Comparison of numbers of land drilling rigs

Rig capacity in Europe will need to increase dramatically





„Average costs for a typical well are between $7.5 million and $10 million, with additional operating costs of around $2.25 per thousand cubic feet of gas extracted, or mcf, meaning in order for projects to remain profitable, U.S. Henry Hub gas prices would need to stay above $7.50 per mcf. They are trading around $4 per mcf.[…]"

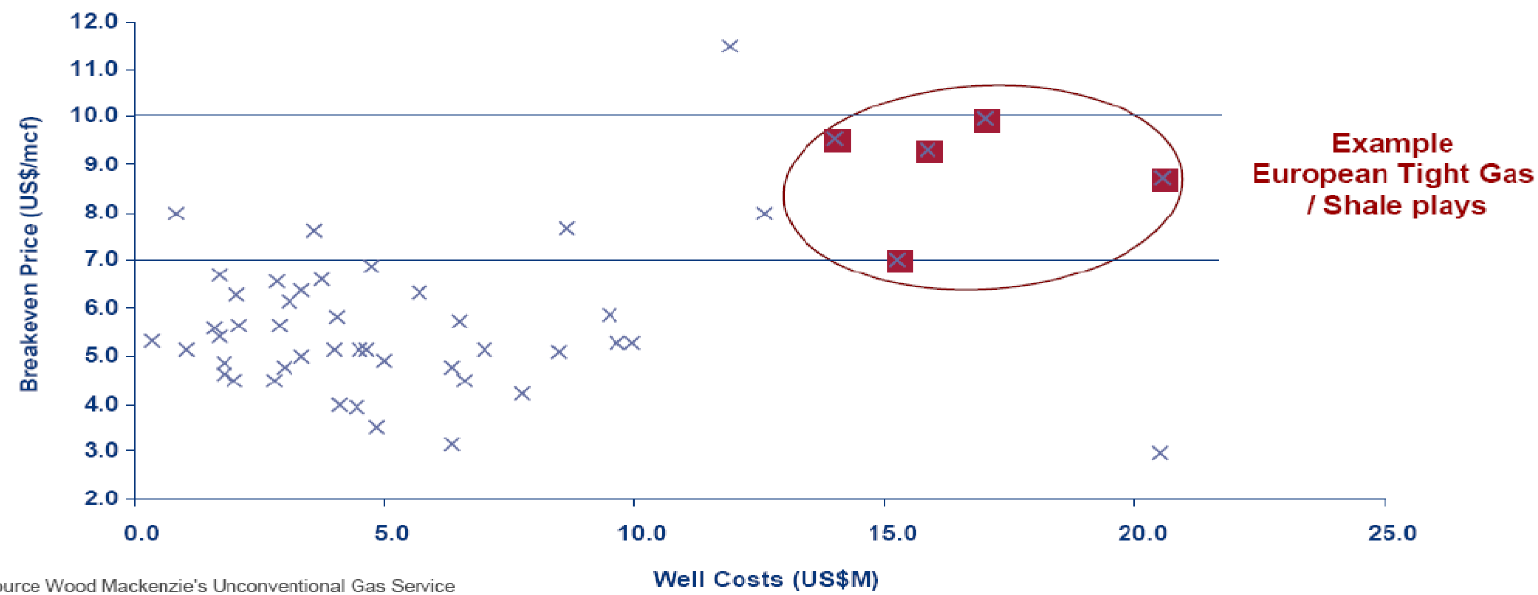
Source: Oswald Clint analyst at Sanford C, Bernstain http://naturalgasforeurope.com/analysts-see-challenges-in-accessing-european-shale-gas-potential.htm

Current „status quo" in Europe

2

Current forecasts of breakeven costs for European shale gas and tight gas are significantly higher than those for the US and Australia

Well Costs vs. Breakeven Prices for Shale Gas and Tight Gas Plays Around the World



Source Wood Mackenzie's Unconventional Gas Service

13

The importance of competition to make shale economical.

Cost reductions is a key…

- ✓ **The EU law - bureaucratic burden -**
  local regulations; language differences
- ✓ **Local rig market is dominated by state-controlled companies -**
  reducing the effect „competition on cost"
- ✓ **Extremely limited supply of key services -**
  just few frac, geoseismic crews (travel needs)
- ✓ **Times of drilling = experience -**
  fast and efficient operations - proper equipment

Completion Example

- **Typical Marcellus Frac:**
- 10 Stages, 2 000 T of sand, and 12 000 m^3 of water pumped at >16 m^3/min

TLM Montney Shale Frac – Altares HZ c-A085-I/094-B-01 **(Total pumping HP on site: 24,000)**

Routes into Eastern Europe

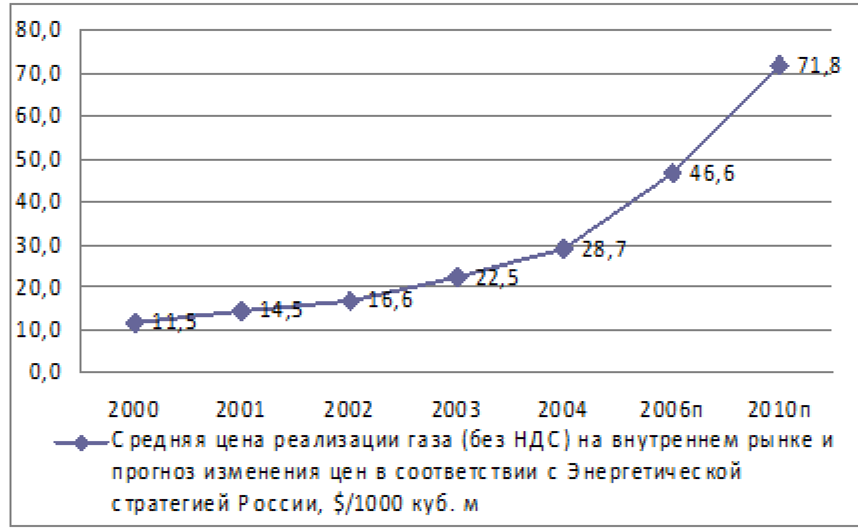
Source: East European Gas Analysis

EU-Russia WTO „gas formula" deal

„The representative of the Russian Federation confirms that producers/distributors operating on gas supplies to industrial users would operate to recover their costs (including cost of production, overheads, financial charges, maintenance and upgrade of extraction and distribution infrastructure, investment in the exploration and development costs of new fields) […] and would be able to make a profit, in the ordinary course of business."

(This is a commitment)

Source: Draft Working Party report, WTO ACCESSION OF RUSSIA, Q3 2004



- ✓ **2008 - 63,3 USD/1000m^3**
- ✓ **2011 - 126,0 USD/1000 m^3**

(no tariffs and transportation costs)

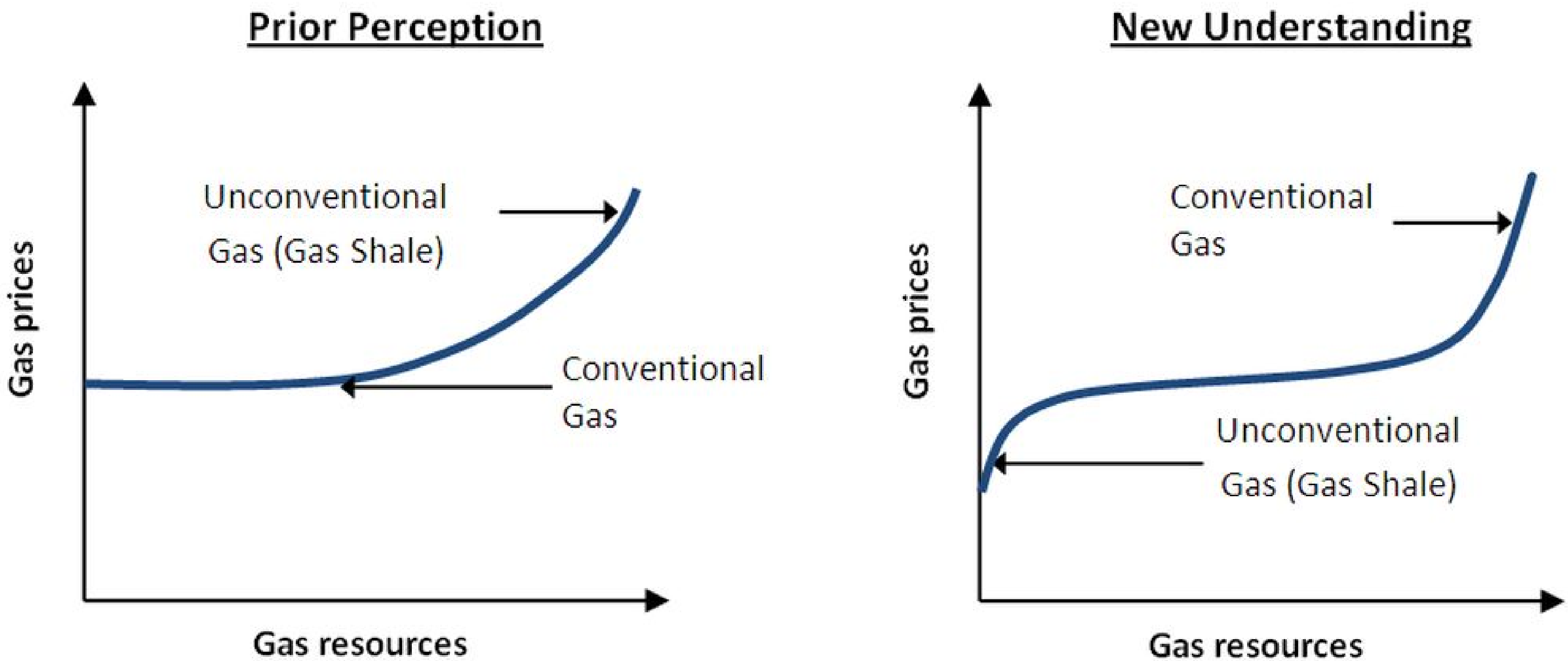
*„Some analysts have questioned whether it is in Moscow's economic interest to join the WTO, since there are **no tariffs** on its biggest export to the EU **- oil and gas**. But the EU policymakers believe the Kremlin has concluded that it needs membership in order to attract the foreign investment necessary to modernize its economy."*

Source: Financial Times (www.ft.com/cms/s/0/785eb542-f802-11df-8d91-00144feab49a.html)

Russia ?

✓Shale gas has moved to the bottom of the US gas supply curve.

✓Until recently, conventional gas was viewed as low-cost, while shale gas was an abundant but high-cost US resource – that perception has now reversed.



Source: Vello A. Kuuskraa, „Gas Shales Drive the Unconventional Gas Revolution", Advanced Resources International, Inc., Washington Energy Policy Conference: The Unconventional Gas Revolution, March 9, 2010, Washington, D.C.

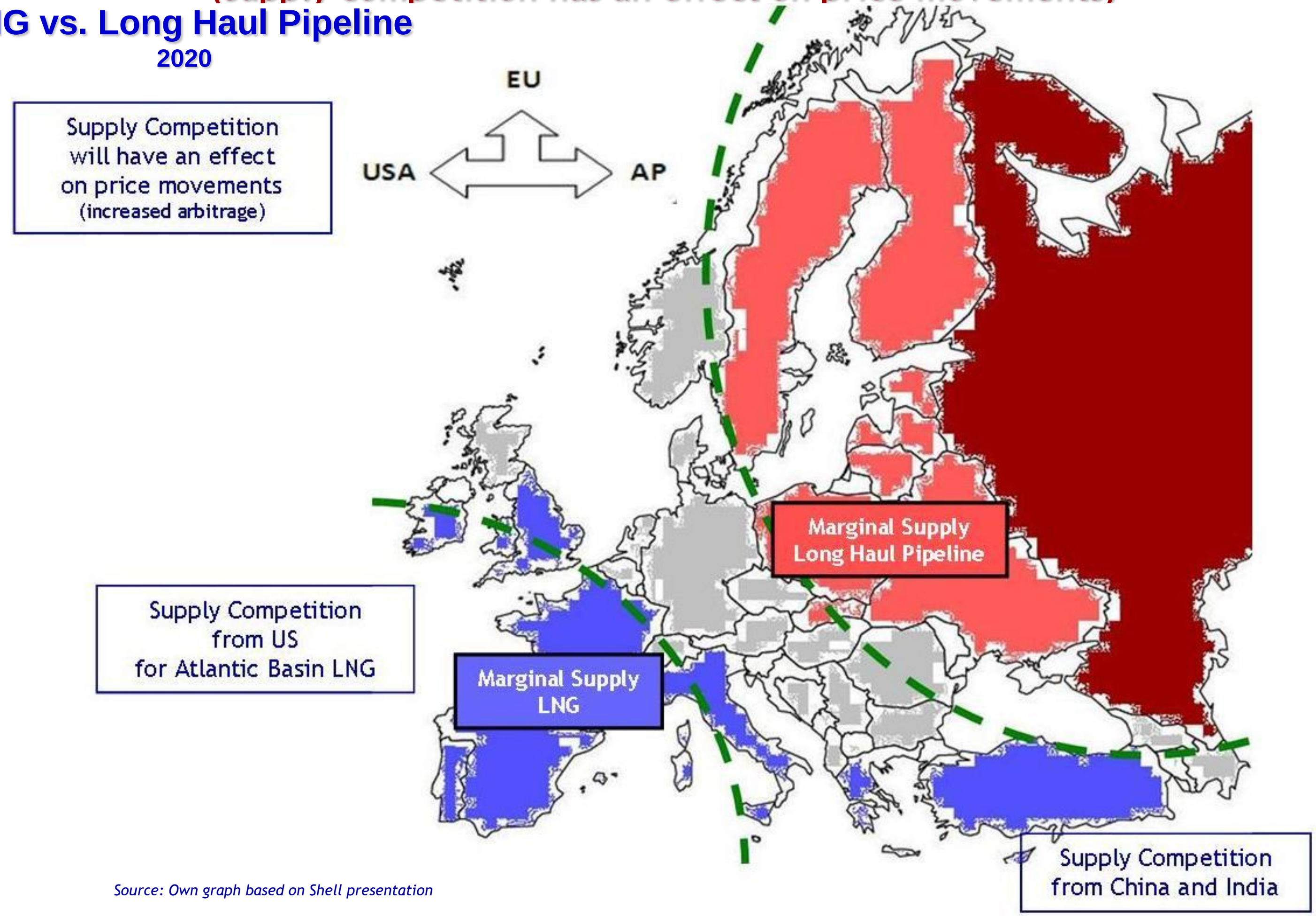
Routes into Eastern Europe

Price arbitrage LNG vs. Pipelines

(supply competition has an effect on price movements)

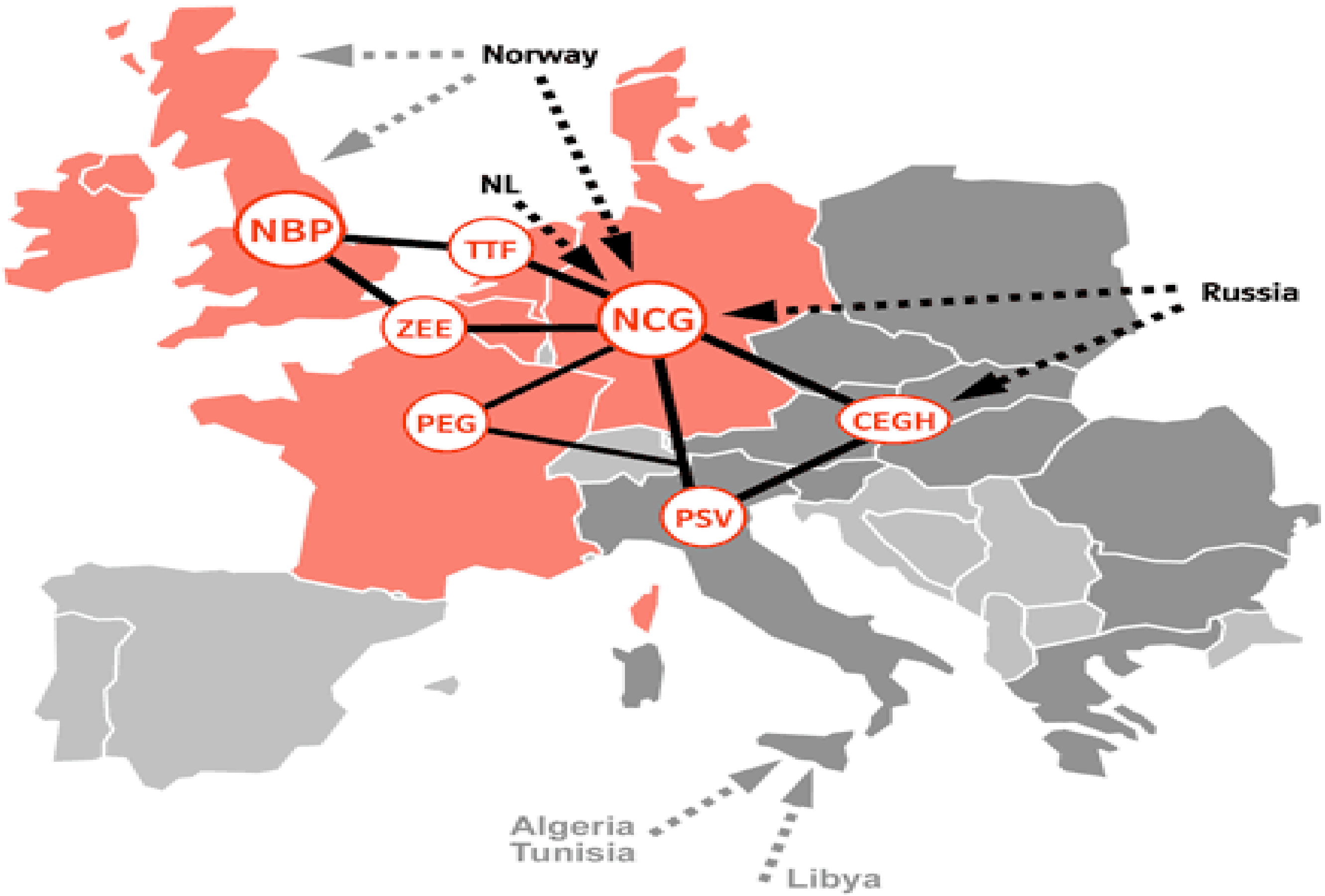
LNG vs. Long Haul Pipeline

2020



Source: Own graph based on Shell presentation

Why EU-27 is not still ready for common European Gas Strategy ?



Source: www.eon-energy-trading.com

Solution or revolution?

Alexey Zaytsev: Budapest Hungary 17-18 June 2011:

„Shale gas is a game-changing reality in the USA, but it is still too early to simply copy its effect to the all world markets.

***Technical limitations**: the permanent drilling is necessary to ensure stable gas volumes, despite of chance to sell them.*
Once you begin to drill for shale, you just can't stop. Does every your neighbor agree?

***Environmental concerns**: quite high in densely populated Europe, given the expand of needed drillings and the volume of water needed for hydrofracking*

***Economic constraints**: spot prices in the USA in the last two years did not allow to cover even the wellhead prices. And it's not cheaper in Europe. Will there be enough chance to secure the investment by forward deals?*

***Legal differences**: the Anglo-Saxon property right system allows the landowner to benefit ; the continental law, on the contrary, does not makes shale gas development attractive for land owners."*

BUT - Shale gas IS a solution:

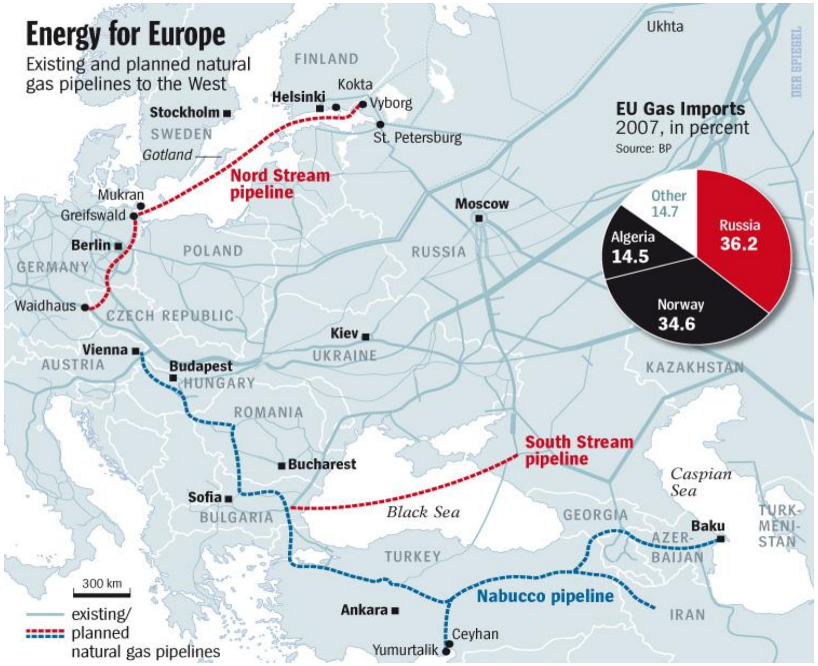
•Countries who are partly able to cover their need for gas by themselves are more likely to expand gas' share in their energy mix.
•Shale gas is a good option for Europeans to contribute to falling domestic conventional production.

Can Poland duplicate the unconventional gas revolution ?

„With a little help from my friends…"

- ✓ *Spatial constraints make land access a major obstacle. This is linked to population density. In promising regions such as Europe (116 people/ sq km) and China (140 people/ sq km), population density is a lot higher than in the US (31 people/sq km). Higher population densities also limit water resources, which are critical for hydraulic fracturing.*
- ✓ *European service industry much less mature than in North America*
- ✓ *European well costs – drilling & stimulation – up to four times NA levels*
- ✓ *Fiscal regime not yet in place*
- ✓ *Framework for unconventional gas less attractive than in NA (the USA)*

Existing and planned natural gas pipelines to the West



Source: Der Spiegel, January 2009


Questions ?

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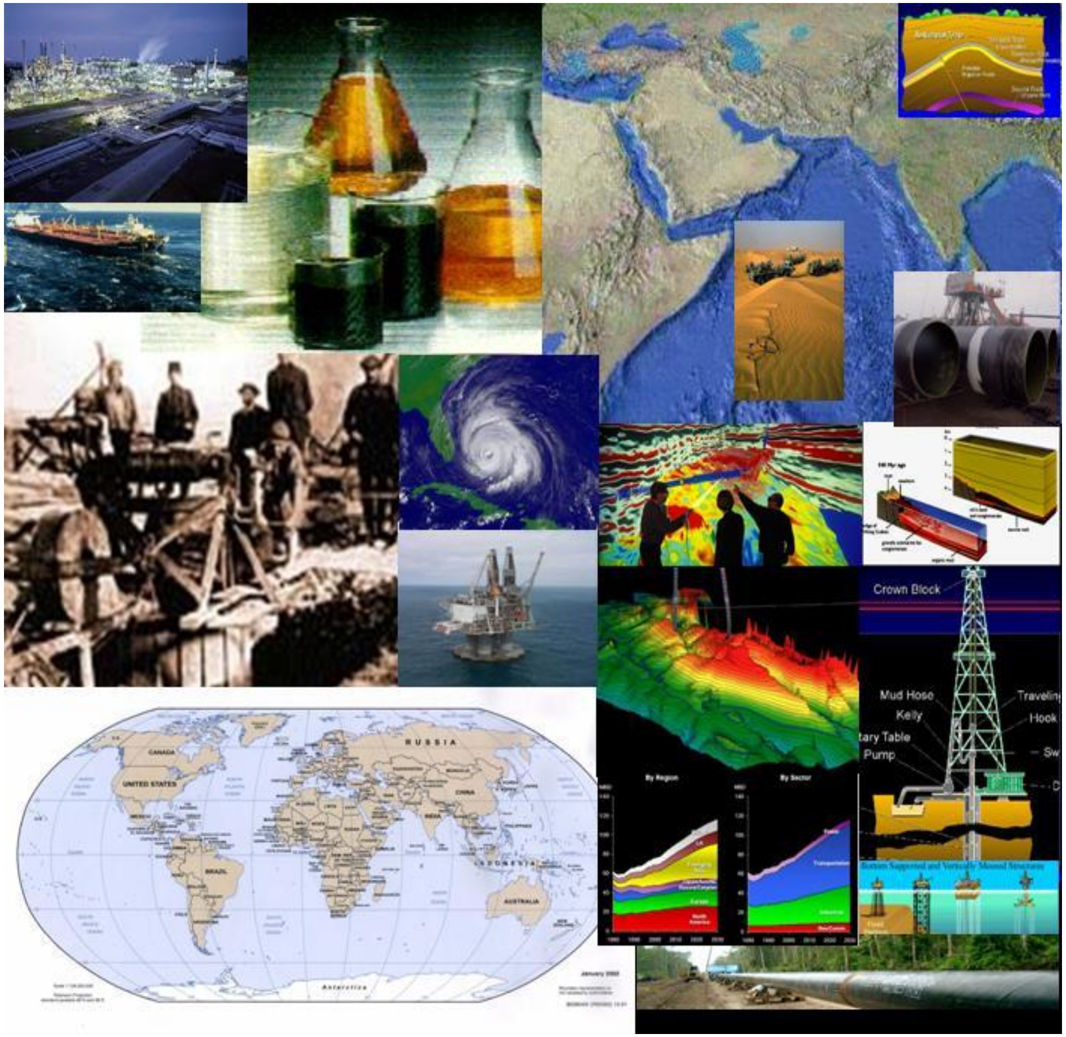
www.ise.com.pl

17 Śniadeckich Street
00-654 Warsaw, POLAND
tel.: +48 22 629.97.46
fax: +48 22 621.74.88



Thank you very much !

☺

andrzej.sikora@ise.com.pl

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