shale gas –
do economics and regulation change
at the German-Polish border

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North America gas shale basins
increase of shale gas supply to the market
decrease of gas price in USA due to increase of shale gas supply to the market

U.S. Spot Natural Gas Price
(after: Natural Gas Intelligence & Baker Hughes)
since 2009 split of prices of oil and gas

[Graph showing the price of crude oil and natural gas from 2005 to 2011. The graph compares the price of crude oil and natural gas in USD per barrel and USD per million British thermal units (BTU).]
Shale gas impact on US economy

- Recently shale gas stands for ~ 25% US gas production
- Cumulative shale gas investments in US ~ 80 bln USD/year
- US limited gas import – export of LNG gas; **US become the biggest gas producer** in the World
- **Decrease of gas price in USA** in 2008-2009 – bigger nominal profit than all federal support to US economy
- **Cheap gas in USA** – attracts gas consuming industry; US chemical industry turning back to US from China
- Investment of **1 mln USD/year** creates 14 jobs (direct – 4, indirect – 4,5, induced – 5,5)
- **Example**: Investment of Encana in British Columbia (W Canada) created 80,000 jobs
shale gas resources – N & S America (EIA report)
shale gas resources – Europe (EIA report)
shale gas resources – Asia & Africa (EIA report)
potential shale gas basins in Europe
shale gas in Europe – pro vs contra

- breaks the historical division into less developed, unreliable exporters vs developed consumers – different geographic distribution of resources

- challenges existing structure of gas supplies (e.g. Gasprom, Northstream, North Africa)

- competition with other energy producers – nuclear power plants (France), renewable energy (Germany/EU), coal (Poland)

- local communities & green activist, in some countries also politicians, concerns about environment impact

- for countries with high coal & lignite position in energy mix – a realistic alternative allowing for reduction of CO₂ emission

- countries dependent on monopolistic gas supplier desire alternative (Central & Eastern Europe)
economic cost of dependence on monopoly

<table>
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<tr>
<th>Country</th>
<th>USD / 1000 m³</th>
<th>Dependence on Gazprom (%)</th>
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<tbody>
<tr>
<td>Great Britain</td>
<td>150</td>
<td>0</td>
</tr>
<tr>
<td>Germany</td>
<td>250</td>
<td>40</td>
</tr>
<tr>
<td>Poland</td>
<td>350</td>
<td>60</td>
</tr>
<tr>
<td>Slovakia</td>
<td>400</td>
<td>100</td>
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challenges for shale gas exploration in Europe

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  production cost (Poland ~300 $/1000m3 vs US – 120-150)
breakeven cost vs resources (globally)
shale gas production costs

- estimated breakeven cost of shale gas production in Poland:
  ~300 $/1000m³; 9 $/MMBtu

- drilling costs in Poland 10-15 MM $; drilling costs in w USA – 3-10 MM $
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- environmental concerns
environmental concerns – which one really matters?

- methane emissions?
- water consumption for hydraulic fracturing?
- aquifer pollution by frack fluid or methane?
- uncontrolled composition of chemical additives?
- flow back fraction of frack fluid utilization?
- radiogenic trace of solid waste?
- landscape footprint of drilling and other infrastructure?
- earth tremors?
- disturbance of local societies with transport & drilling?
- density of population?
Poland – an European natural lab for environment impact analysis of gas and oil production from shale and tight reservoirs

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first shale gas drilling pad in Poland (Łebień LE-1 well)