



Ministry of Foreign Affairs
Republic of Poland

Geostrategic Impact of Shale Gas Development: Polish Perspective

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Shale gas – evolution...

1821 - First U.S. commercial natural gas well in Fredonia, New York, produces gas from shale



Late 1940s – Hydraulic fracturing first used to stimulate oil and gas wells. The first hydraulic fracturing treatment (not shown here) was pumped in 1947 on a gas well operated by Pan American Petroleum Corporation in Grant County, Kansas.

Early 1970s – Development of downhole motors, a key component of directional drilling technology, accelerates. Directional drilling capabilities continue to advance for the next three decades.

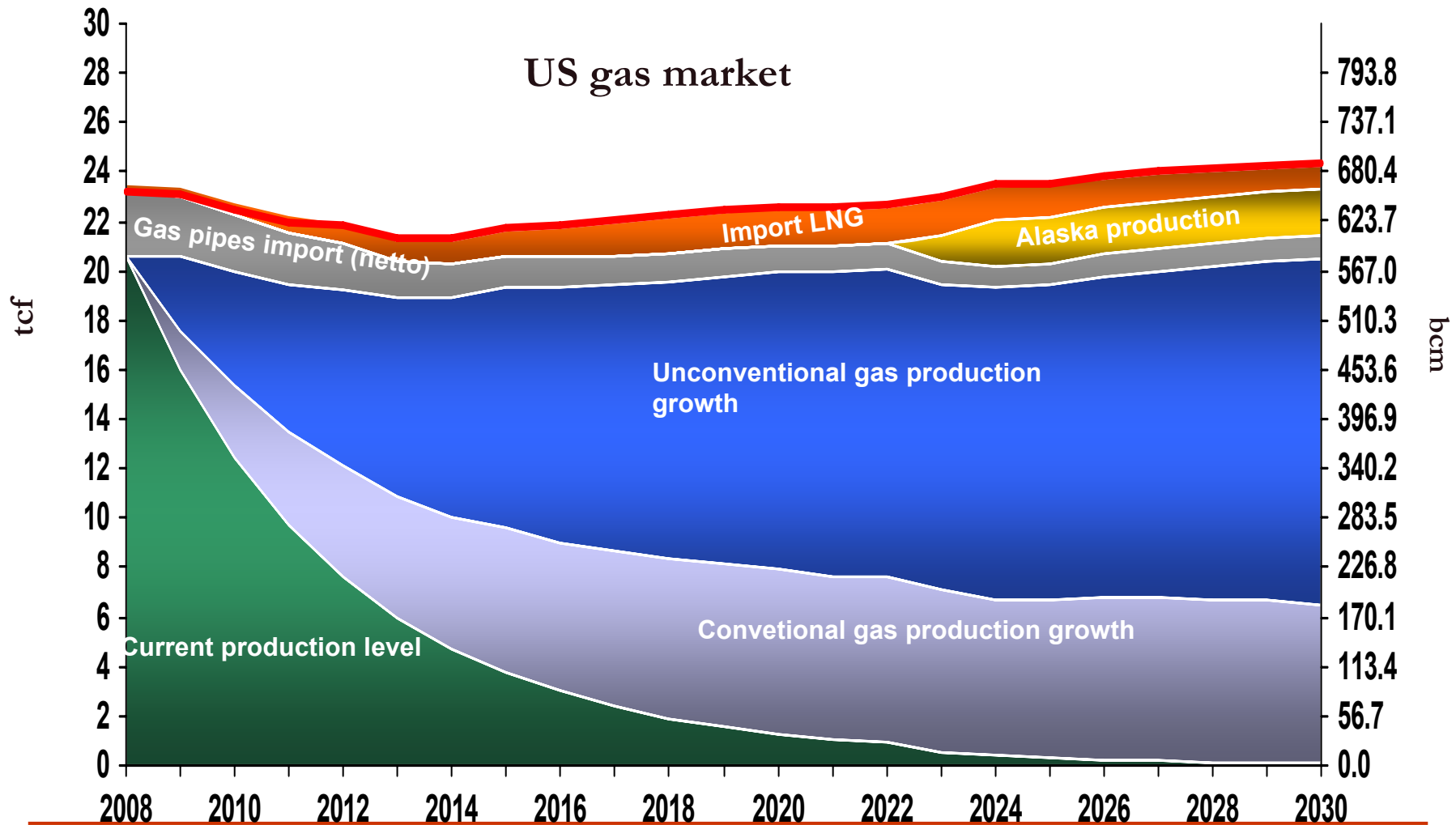
1980s to early 1990s – Mitchell Energy combines larger fracture designs, rigorous reservoir characterization, horizontal drilling, and lower cost approaches to hydraulic fracturing to make the Barnett Shale economic.

2003 to 2004 – Gas production from the Barnett Shale play overtakes the level of shallow shale gas production from historic shale plays like the Appalachian Ohio Shale and Michigan Basin Antrim plays. About 2 billion cubic feet (Bcf) of gas per day are produced from U.S. shales

2010 – Shale gas production amounted to more than 8 Bcf per day - 12% of the natural gas consumed in the United States.



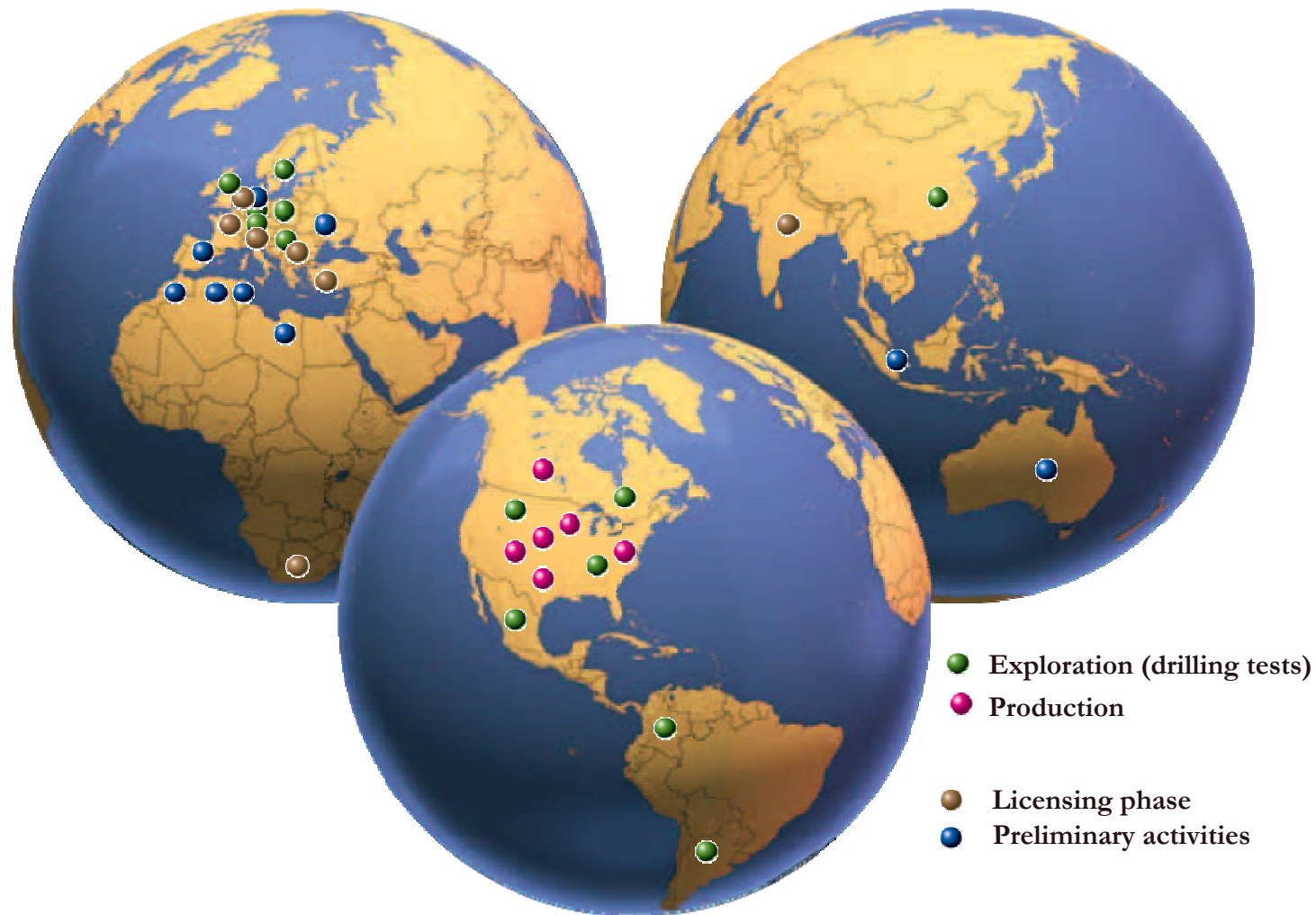
... or revolution?



Source: ConocoPhillips (U.S. DOE, EIA Annual Energy Outlook, 2010)

According to the estimates, by 2030 U.S. production from unconventional gas would reach 50% of total gas production

Globalization of shale gas activities



United States, Canada, China, India, Poland, United Kingdom, Germany, France, Austria, Sweden, Holland, Denmark, Hungary, Romania, Bulgaria, Ireland, Ukraine, Turkey, Tunisia, Morocco, Algeria, Mexico, Argentina, Indonesia, South Africa ...

Globalization of shale gas activities



Globalization of Shale Gas Technologies



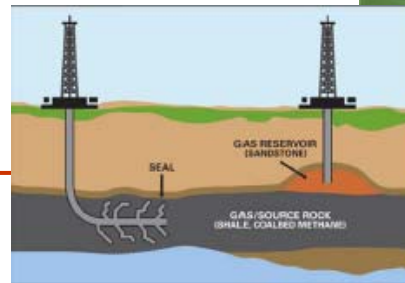
Shale Gas Technologies: Worldwide Technologies?

- **horizontal drilling expertise:** the easiest to make available.
- **fracturing:** limited availability
(high capital costs of fracturing equipment and materials)

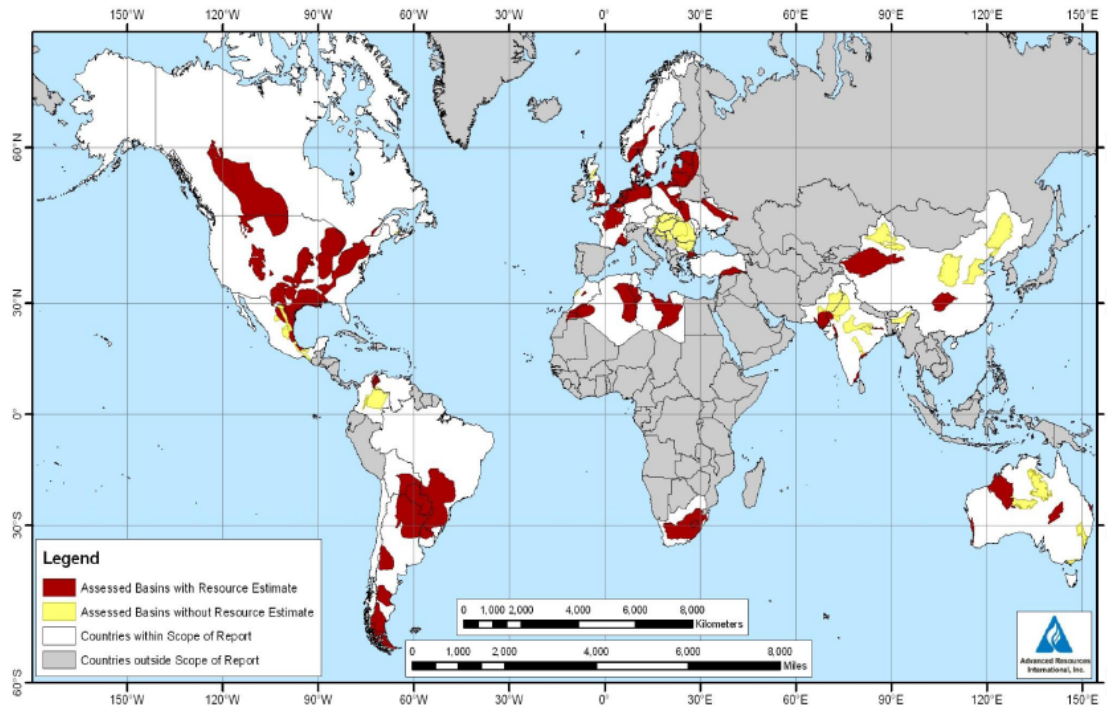


Determinants of shale gas technology's globalization:

- Asset purchase: (*Shell/East Resources: Marcellus ; BG Group/Southwestern Energy: Haynesville*)
- Joint-ventures (*Statoil/Talisman: Eagle Ford; BG Group/Exco: Marcellus, Haynesville; BP/Lewis Energy: Eagle Ford; Total/Chesapeake : Barnett; ENI/Quicksilver: Barnett; Statoil/Chesapeake:Marcellus; BP/Chesapeake :Fayetteville*)
- Shale gas swaps: (PGNiG, Orlen);
- Acquisitions (Exxon/XTO)
- Expansion of US-based operators abroad;
- Domestic R&D



Globalization of shale gas resources



Europe (in bcm):

France	5 097
Germany	226
Nederland	481
Norway	2 350
UK	566
Denmark	651
Sweden	1 160
Poland	5 295
Turkey	424
Ukraine	1 189
Lithuania	113
Others	538

North America (in bcm):

USA	2 441
Canada	1 784
Mexico	1 444

South America (in bcm)

Venezuela	311
Columbia	538
Argentina	2 191
Brazil	6 399
Chile	1 812
Uruguay	594
Paraguay	1 755
Bolivia	1 359

Africa (in bcm)

South Africa	13 733
Libya	8 211
Tunisia	509
Algeria	6 541
Morocco	311

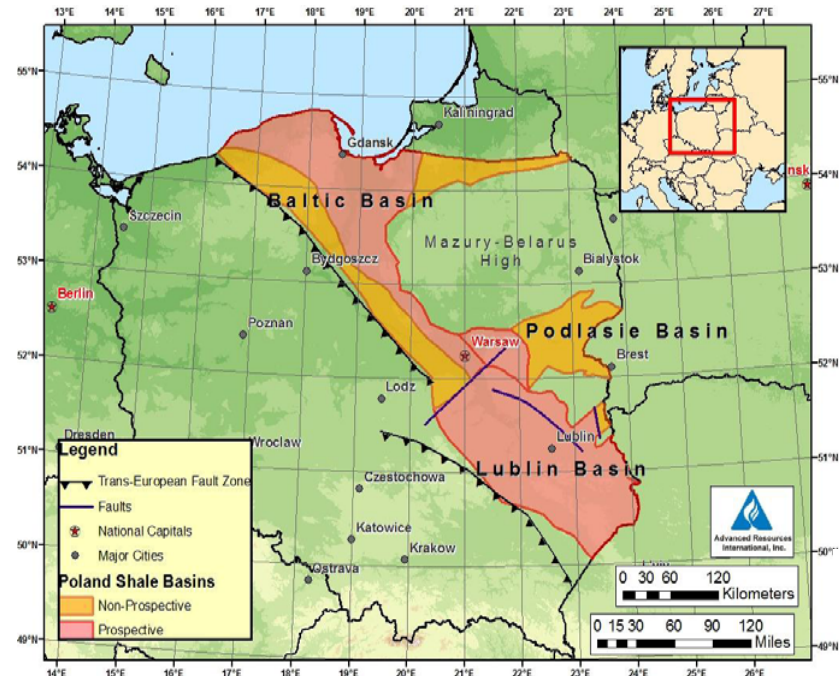
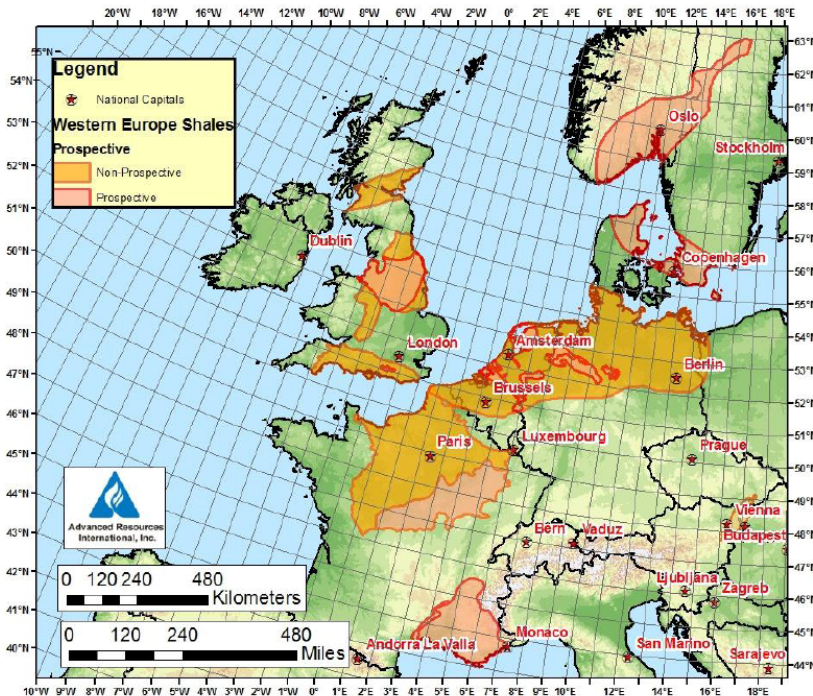
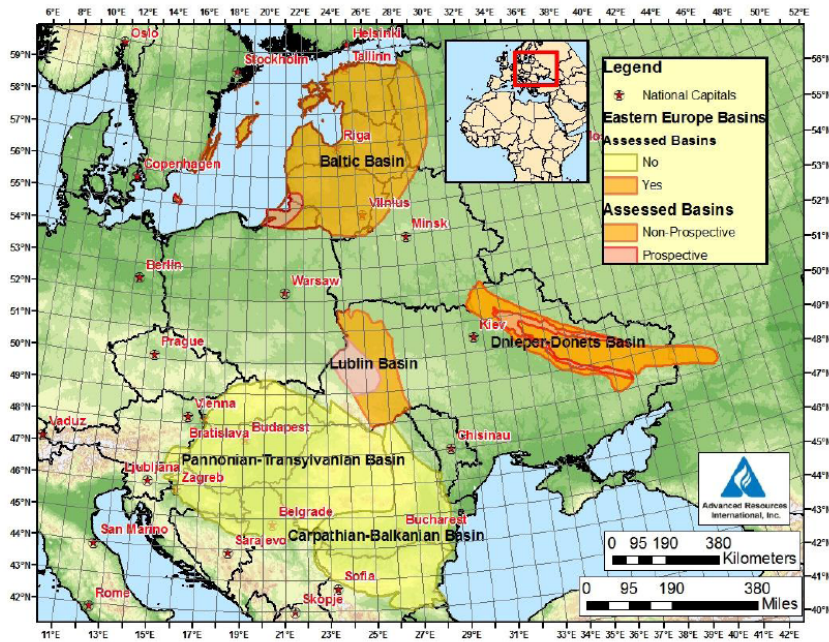
Asia (in bcm)

China	
Indie	1 783
Indonesia	1 444

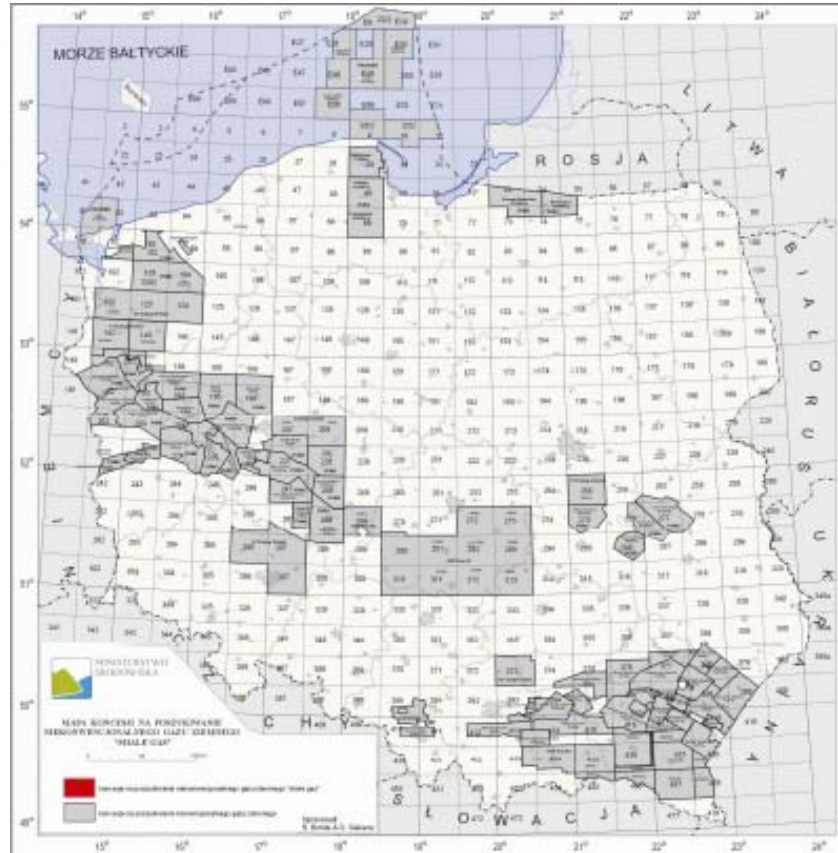
Europe's Potential Shale Gas Resources

Assessment for:

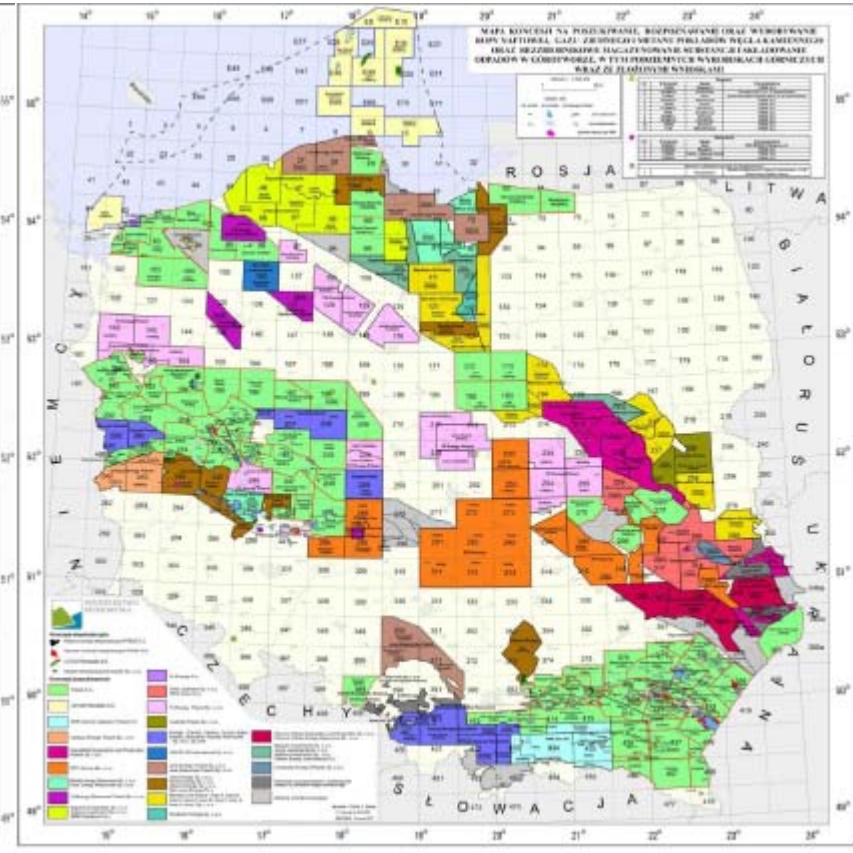
- **Eastern Europe (excluded Poland):**
 - 65 Tcf (1,84 Tcm) of technically recoverable resource
- **Western Europe**
 - 372 Tcf (10,5 Tcm) of risked technically recoverable
- **Poland:**
 - 187 Tcf (5,29 Tcm) of risked technically recoverable resource



Dynamics of shale gas development



2007

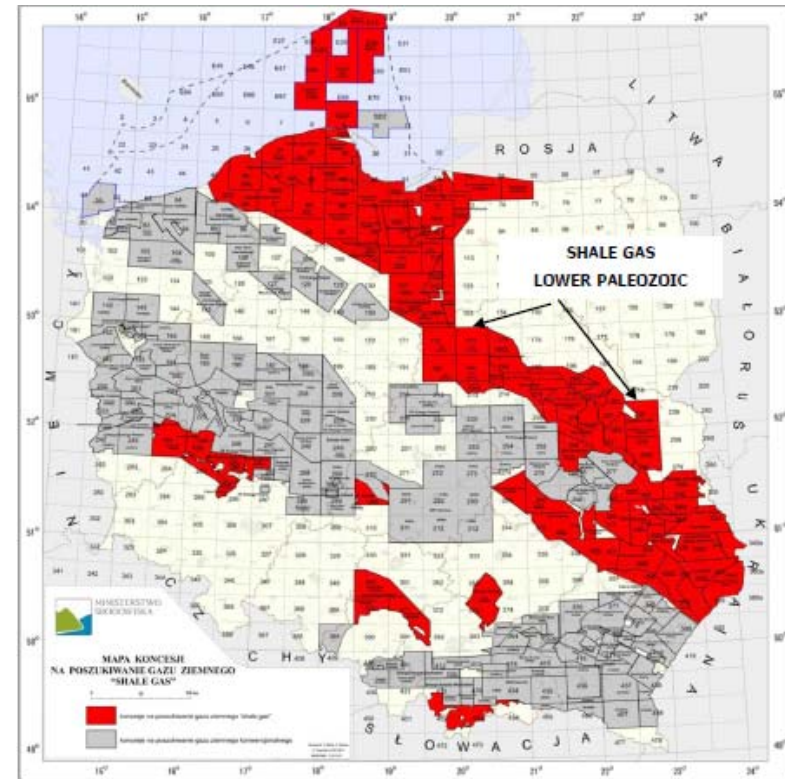


2010

Shale gas in Poland

From 2007 to March 2011 the Minister of the Environment granted **80 concessions for prospecting** and exploration of shale gas fields

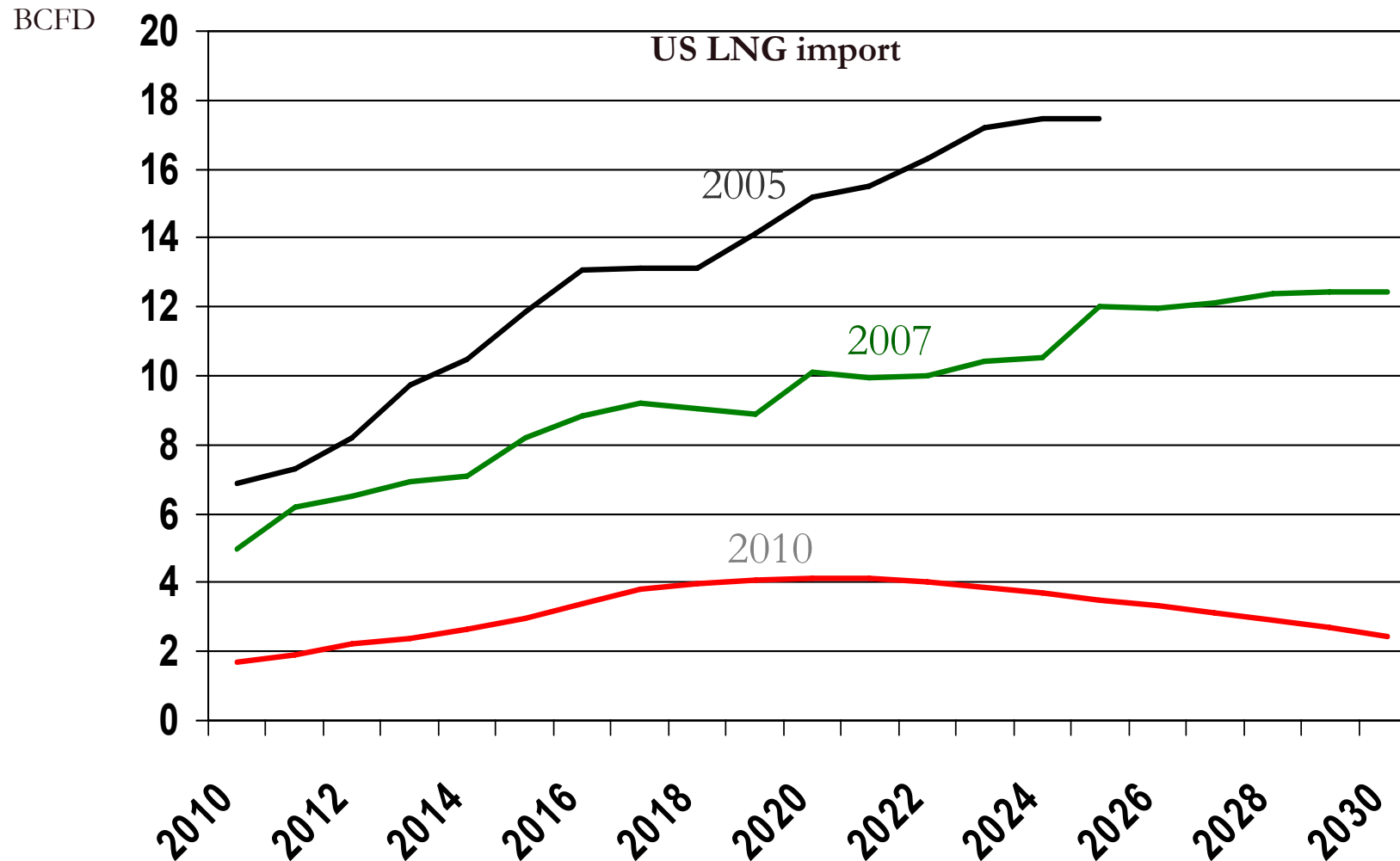
- 5 exploration wells completed by March 2011
- 15 exploration wells planned in 2011
- First reserves estimation and first potential production in 2-3 years



Strategic implications:

- **Impact on LNG countries and markets**
 - **Suppressed need to import LNG – emergence of potential new LNG exporting countries**
 - **Lower demand for LNG (short-term)**
 - **LNG „wins” over long-term**
 - Downward price pressure on natural gas
 - Gas „oversupply”
 - Larger volumes of LNG sold on spot-market
 - Prices competition from shale gas
 - Reducing seasonal volatility of gas prices
 - Altering global energy mix (shale gas vs. renewables, nuclear energy, CCS)
 - Growing role of gas compared to other fuels (coal switching to gas, replacing oil in transport)
 - Redefining geostrategic position of countries and regions
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Impact on LNG markets

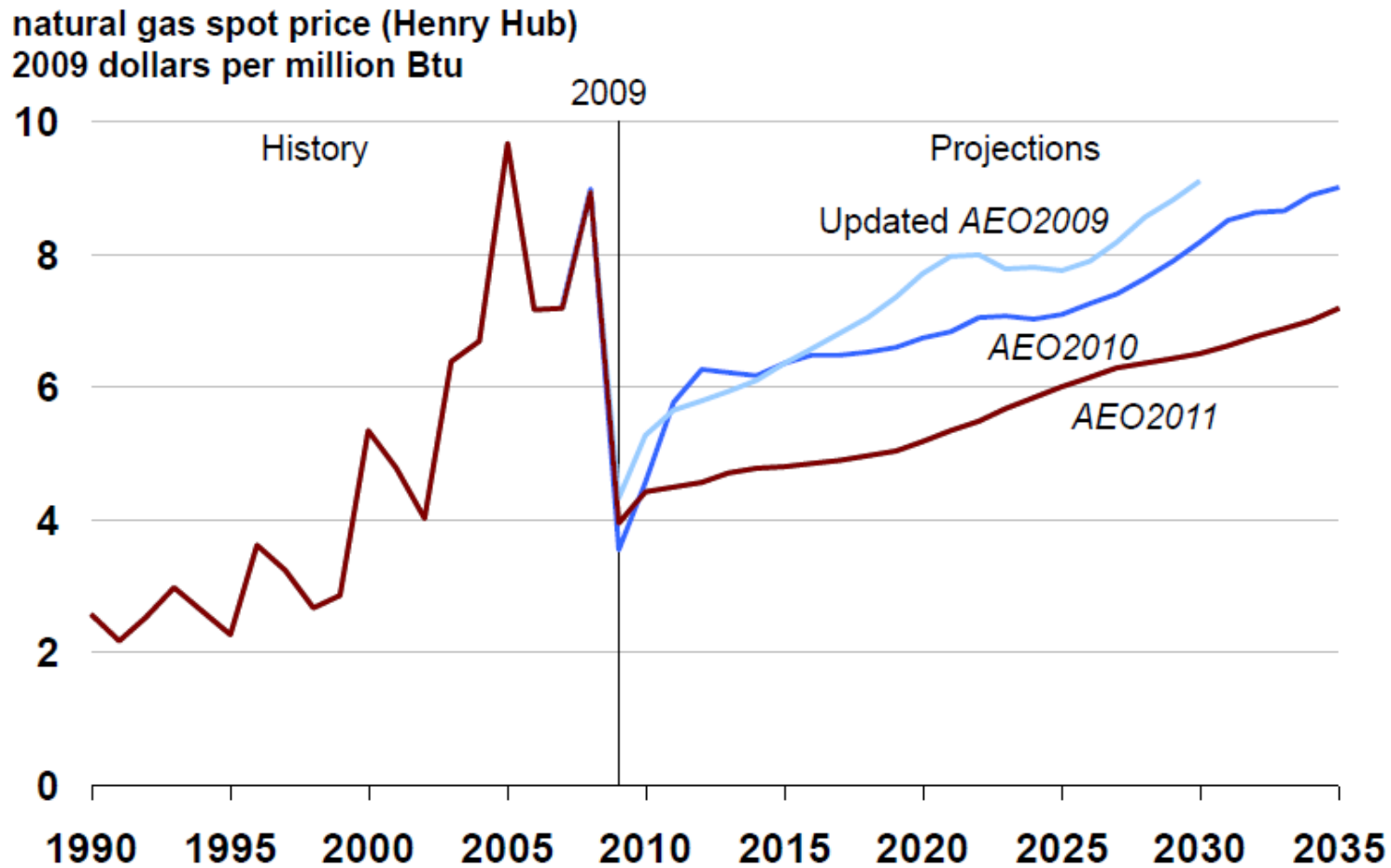


The dynamic development of shale gas production made the U.S. Department of Energy decrease estimates significantly regarding imports of LNG to the U.S.

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Implications for natural gas prices



Source: EIA, Annual Energy Outlook 2011

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European implications

➤ Short term:

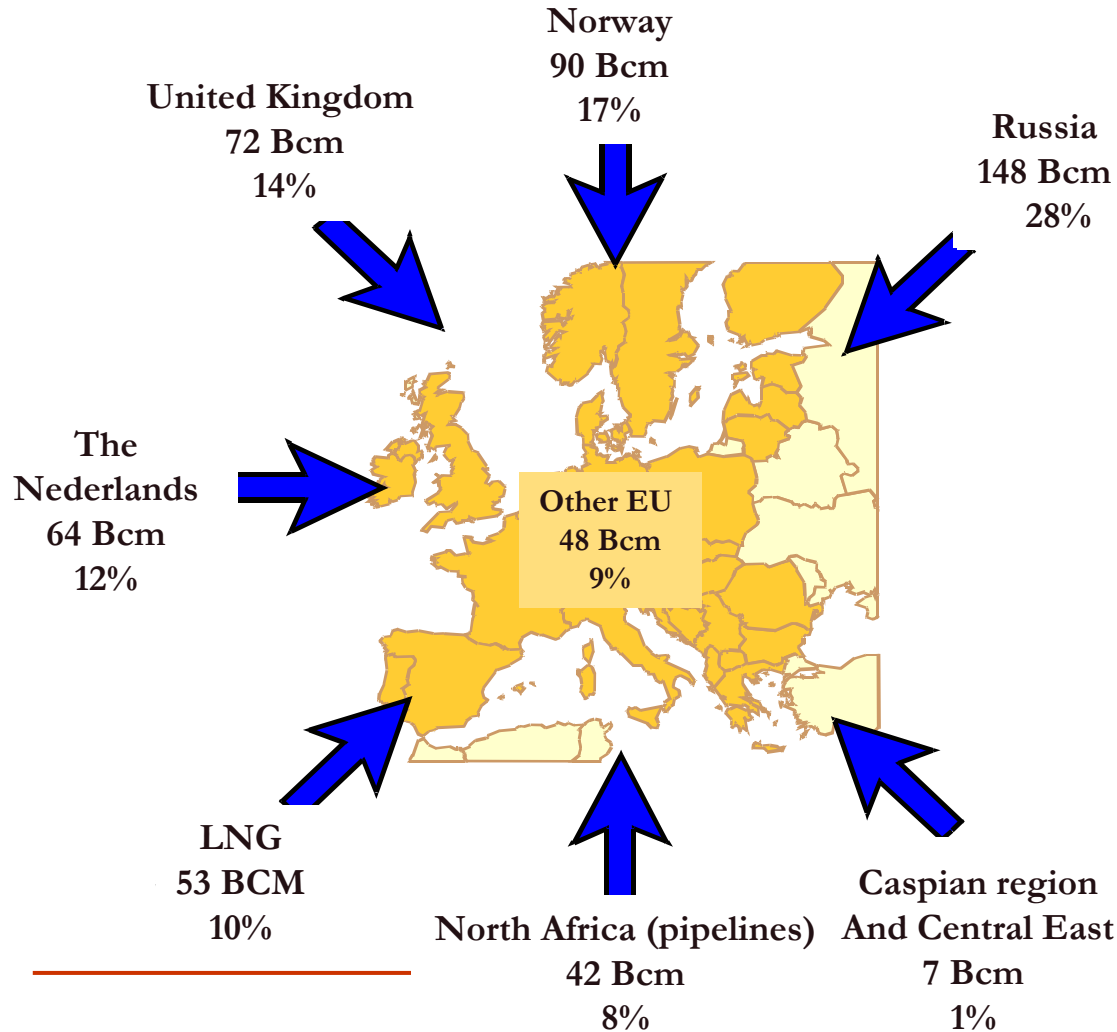
- Increase in supplies of LNG - decrease of spot prices
- Pressure on contract prices

➤ Medium and long term strategic questions:

- Reducing dependence on natural gas supplies from out of Europe
 - Increased pressure on long -term contracts and pricing formula
 - Re-evaluation of energy security and European energy and climate policy (Energy Roadmap 2050)
 - Shale gas after Fukushima I and Libya
-

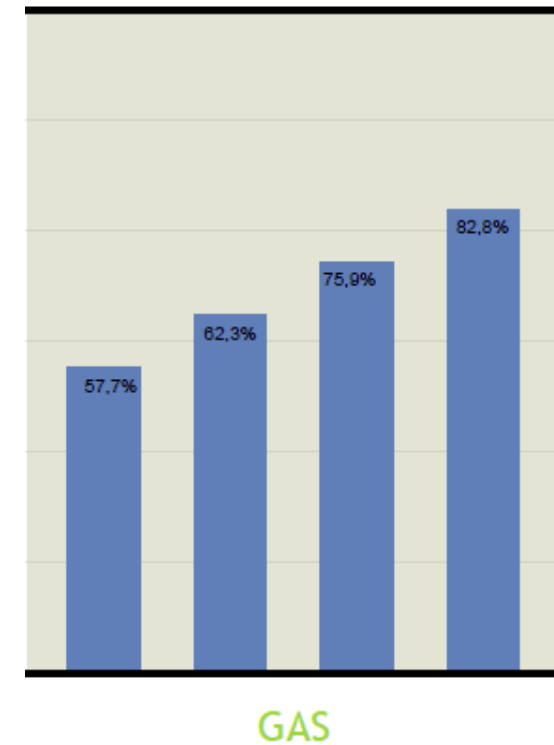
Strategic question: gas imports dependency

Potential shale gas resources in Europe: 15,7 TCM



EU-27 Import Dependency

2005 2008 2020 2030



Source: EU Commission

Strategic question: Pipeline projects

New Lifelines

Final capacity of selected planned pipelines, in cubic meters per year

Nord Stream pipeline (Baltic Sea)

55 bln m³

Value based on current European market price for Russian gas (around €320 per 1,000 cubic meters) **€17.6 bln**

Nabucco pipeline

31 bln m³ **€9.9 bln**

South Stream pipeline (Black Sea)

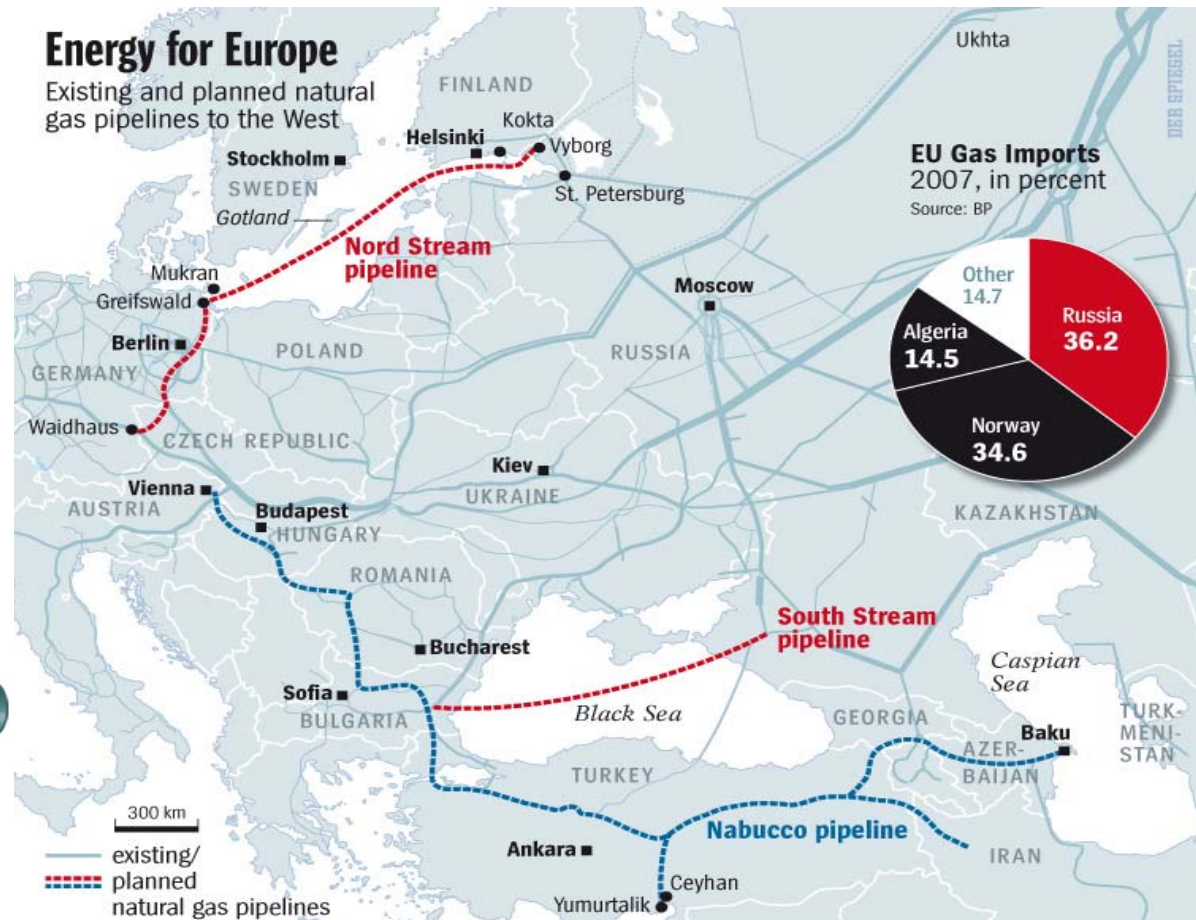
30 bln m³ **€9.6 bln**

For comparison: existing pipelines ...

... through Ukraine **120 bln m³**

... through Poland

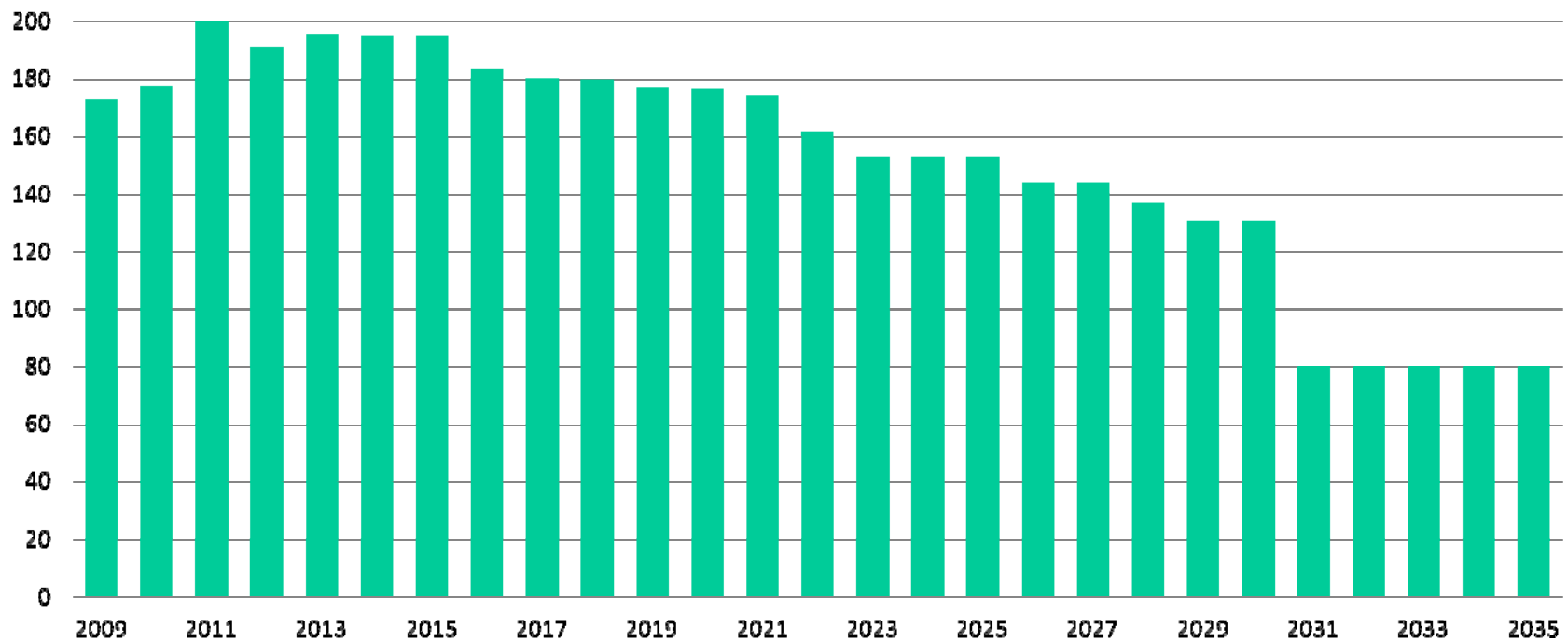
30 bln m³ **67 bln m³** after expansion DER SPIEGEL



Reducing importance of existing and planned gas pipeline projects

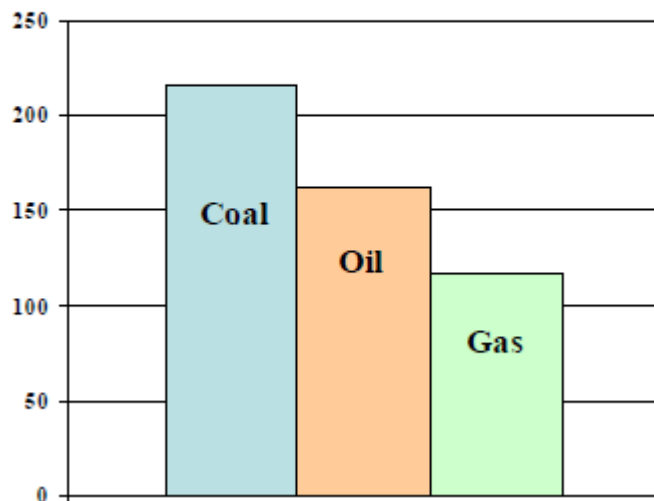
Strategic question: long term contracts

Gazprom: European long-term contracts.



Strategic question: EU climate policies

Pounds of CO2 emissions per million Btu (averages)



- Lower SO_x, NO_x, and Mercury Emissions
 - GHG Emission Mitigation
 - Lower Carbon fuel
 - Allows the Use of Renewable Energy
-

EU Energy Roadmap 2050

Support transition to low-carbon energy system in 2050

- Focus on energy security, competitiveness as well as **decarbonisation**, throughout transition
- Identify European-wide perspective

How to achieve these goals

Renewable Energy Sources (RES)

Nuclear Energy

Carbon Capture and Storage (CCS)

Shale gas

EU Energy Roadmap 2050

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Financing in the time of fiscal consolidation

Renewable Energy sources (RES)

Have these go

Nuclear Energy

Nuclear energy after Fukushima ???

to ac

Cost effectiveness, early stage of technology development

and Storage (CCS)

I

Shale gas – a transition fuel to low-emission economy?

Shale gas

Poland's chances...

- Strengthening Poland's energy and climate security
 - Strengthening bilateral relations (political and economic) with countries involved in the shale gas development
 - Deepening relations with neighboring countries, potential Polish gas customers (especially V4 countries); Development of interconnectors;
 - Facilitating completion of internal energy market;
 - Redefining energy relationship with countries – major gas suppliers to the Polish market, including transit countries (mainly Russia, Ukraine and Belarus)
 - Development of scientific and technical cooperation related to exploration and production of hydrocarbons and other related areas (e.g. geology)
 - Strengthening economic position of Poland in region (additional revenues to the budget, competitiveness of industry, service sector development, etc.)
-

... and challenges

- Lack of social acceptance for development of shale gas sector in EU countries
- Environmental challenges:
„Natura 2000”
- Lack of service companies and skilled personnel
- Competition from other energy sectors
- Competition from companies supplying gas to Europe and stakeholders in major infrastructure projects



Existing forms of shale gas cooperation

- **Global Shale Gas Initiative (ca. 20 countries)**

- Strengthening regulations and standards
- Exchange of best practices
- Training support

- **GASH: assessment of shale gas resources in Europe**

- European interdisciplinary shale gas research (sponsored by *Statoil, ExxonMobil, Gas de France SUEZ, Wintershall, Vermillion, Marathon Oil, Total, Repsol and Schlumberger*);
- started in 2009; first phase: 3 years
- development of a GIS-based European black shale database

- **Cooperation within the European Union**

Conclusions on Energy, European Council, 4 February 2011: *”In order to further enhance its security of supply, Europe’s potential for sustainable extraction and use of conventional and unconventional (shale gas and oil shale) fossil fuel resources should be assessed”.*

- **Bilateral cooperation**

To reach full potential of shale gas, cooperation of stakeholders is necessary!



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Thank you for your attention !

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