BASF and Shale Gas

Roland Merger, GRD/B
Global Shale Gas Resources
There is plenty of shale gas

Technically recoverable resources (TRR) of shale gas
Status May 2013
(‘000 bcm)

Global TRR of Shale Gas 206.7

- Estimates of shale gas resources are often uncertain and changing
- TRR of shale gas does not mean that the resources are also economically feasible to recover

* Middle East only includes assessment of Turkey and Jordan; other Middle East & Caspian countries are excluded, but could hold significant resources.

Source: EIA, June 2013
BASF segments

**Chemicals**
- Petrochemicals
- Monomers
- Intermediates

**Performance Products**
- Dispersions & Pigments
- Care Chemicals
- Nutrition & Health
- Paper Chemicals
- Performance Chemicals

**Functional Materials & Solutions**
- Catalysts
- Construction Chemicals
- Coatings
- Performance Materials

**Agricultural Solutions**
- Crop Protection

**Oil & Gas**
- Oil & Gas
BASF segments and shale gas

BASF is a consumer of natural gas

BASF products are used in shale gas production

BASF is a supplier of natural gas

Chemicals
- Petrochemicals
- Monomers
- Intermediates

Performance Products
- Dispersions & Pigments
- Care Chemicals
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Agricultural Solutions
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Oil & Gas
- Monomers
- Intermediates

BASF
The Chemical Company
BASF as a seller of chemicals

BASF supplies chemicals into oil field service companies engaging in fracking

BASF supplies single components:

- Friction modifiers
- Thickeners
- Surfactants
- Scale inhibitors
- Biocides

These are used for the manufacture of fracking fluids.

Components of fracking-fluids

- 21% Proppant
- 1% Additives
- 78% Water
BASF as supplier of Natural Gas

- E.g. Germany: 12% of natural gas from domestic production (declining)

- Assumed shale gas resources worth exploring

- Research whether shale gas production in Germany is feasible should be supported

- Hydraulic fracturing is well-established in conventional production 1/3 of conventional gas production requires fracking. No approvals in Germany since 2011, gas production is declining.

- **Wintershall** has 30 years of experience in hydraulic fracturing in Europe, Russia and Argentina
Wintershall
Set for further growth upstream
Share of Oil & Gas in BASF portfolio

Overview

Share of Oil & Gas in BASF portfolio

Average EBITDA* 2009-2013
(€ billion)

- Oil & Gas 2.3 (24%)
- BASF Group w/o Oil & Gas 7.4 (76%)

Cumulative capex** (plant, property, equipment)
(€ billion)

- Oil & Gas 6.4** (31%)
- BASF Group w/o Oil & Gas 14.5 (69%)

Key facts
- 2009-2013:
  - Oil & Gas: Solid profit contributor to BASF Group
  - Oil & Gas accounted for 31% of BASF Group capex
- EBITDA share of Oil & Gas in BASF’s portfolio expected to remain in the same order of magnitude in the upcoming years
- Capex share of Oil & Gas business in BASF portfolio will slightly decline

* Excluding non-deductible oil taxes  **Fixed assets, tangible assets from acquisitions, activated exploration expenditures

A subsidiary of BASF – The Chemical Company
Focus on Core regions

Exploration & Production: Clear regional focus

Focus on Core regions

A subsidiary of BASF – The Chemical Company
Increased security of supply for Europe

Nord Stream

Increased security of supply for Europe

Nord Stream offshore pipeline
- Pipeline capacity: 55 billion m³ per year via two 1,220 km subsea pipelines
- Successful gas deliveries since November 2011
- JV between Gazprom 51%, BASF/Wintershall and E.ON* 15.5% each, Gasunie* and GDF SUEZ* 9% each
- Total BASF investment: €1.15 billion

Nord Stream onshore
- System expansion: OPAL (October 2011), NEL (October 2012)
- Increased transportation capacity to NL, B, F, CZ through system upgrade including storage Jemgum
- Germany as distribution hub for Europe
- Total BASF investment: €1.15 billion

* Indirect through subsidiary companies
Securing the supply of South Europe

South Stream

Key facts
- Wintershall acquired 15% stake in South Stream
- South Stream consortium to develop, construct and operate the offshore section of South Stream
- First direct connection of Southern Europe to the world’s largest natural gas reserves in Russia
- Total investment (offshore): ~ €10 billion
- Planned capacity: 63 billion m³ p.a. via 4 parallel pipelines each ~ 930 km
- Start-up: End of 2015 earliest
BASF as supplier of Natural Gas

Shale Gas in Germany

- Resource estimates: 700-2300 bcm
- Equivalent to 13 years of German demand or:
- Keep current domestic production level for another 100 years
Shale gas production techniques and possible environmental hazards

- Combination of two established technologies: horizontal drilling and hydraulic fracturing.

- Shale reservoirs are generally deep below surface and groundwater layers.

- Water, sand and additives are pumped at pressure into the shale, opening up hairline fractures that allow gas to flow.

- Thousands of meters of impermeable rock separate fractures from drinking water aquifers.

- Fractures cannot propagate to the surface.

Quelle: US Energy Information Administration and US Geological Survey
Wintershall is acting responsibly

- Information on all projects on „www.heimische-foerderung.de“
- Self-Commitment to Maximum of Transparency and Safety
Düste Z10
The model project

- **Geological target:** carboniferous tight gas sands

- **Realization:**
  - 4380 m of vertical drilling
  - Extensive data collection
  - Fracking required

- **Potential Z10:**
  - up to 870 mil m³ of natural gas production,
  - investment approx. 30 mil €

- **Total potential „Düste Karbon“:**
  - 20-40 bcm natural gas
  - thereof 25% recoverable (best case)
BASF as a Natural Gas Consumer

- natural gas is the basis for a multitude of chemical value chains
- investment decisions in the chemical industry largely depend on raw material situation
- low natural gas cost in US support C1-based and energy-intensive value chains
BASF as a Natural Gas Consumer

Natural Gas

Fuel
- Power
- Steam

Feed
- Methanol
- Ammonia
- Acetylene
- Natural Gas

Natural Gas Liquids

Olefins

Chlorine
Oxygen
Multitude of value chains
Formaldehyde
Urea
Nitric Acid
BDO
What is BASF doing in the US?

Source: EIA AEO 2013

US Dry Natural Gas Production

- Non-associated onshore other
- Associated with oil
- Non-associated offshore
- Alaska
- Coalbed methane
- Tight gas
- Shale gas

Source: EIA AEO 2013
Geismar, LA

2012: **New Methylamine Plant** Geismar, LA

2014: World scale **Formic Acid plant** Geismar, LA
2013: **Revamp of steam cracker** Port Arthur, TX
(ethane processing and addition of 10th furnace, now > 1 mil t/a ethylene)
Freeport, TX

Announced: Ammonia JV with Yara
US Gulf Coast

Methane to Propylene plant,

US gulf coast;

largest BASF single-plant investment to date
Effects on US Economic Growth

Until 2020 cheap natural gas in the US will result in huge growth:

- 46,000 new jobs in the chemical industry
- 72.7 bn USD investments in the chemical industry

Source: IHS-Global Insights, ACC
BASF and Shale Gas - Summary

BASF views shale gas as an opportunity

We therefore

- support research on shale gas also in Europe
- use the fracking application as a new market for chemicals
- take advantage of the low energy prices in the US for new investments
Freiwillige Prüfungen auf Verträglichkeit für Umwelt und Wasser

KEIN Hydraulic Fracturing in Trinkwasserschutzgebieten

Regelmäßige Prüfung der Bohrung auf Unversehrtheit

Fachgerechte Entsorgung der anfallenden Wässer

Offene und transparente Kommunikation