Shale Gas studies in Europe and the Need for a Pan-European Coordinated Assessment

Copenhagen
3rd December 2013
Peter Britze
Definitions

• **Resources** are those quantities of a commodity that are **estimated at a given time** to exist within a jurisdiction or a geographic area. Resources are of two types:
  - *Discovered or in-place* (i.e. an existing commodity whose location and characteristics are known, being assessed on the basis of scarce data),
  - *Undiscovered, or inferred* (i.e. not yet found but assumed to exist based on inferences from geological knowledge and/or various analyses).

From Bachu et al., 2007
• What is *Technical Recoverable Resources* (TRR)
  – Technology specific concept
  – The total amount of resource, discovered and undiscovered, that is thought to be recoverable with available technology, regardless of economics.

• *Resources* are estimated:
  – From available geological data
  – From recovery factors (depends on the geological conditions)
Status on shale gas resources of Europe

Major unconventional natural gas resources in Europe

- Shale gas
- Coalbed methane

This document and any map included herein are without prejudice to the status or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.
Shale Gas Exploration Banned

In general there is moratorium until research on environmental impacts has been undertaken.
Thickness of the Bowland-Hodder unit

Base Bowland-Hodder unit not resolved on seismic data.

Thickness
Feet (m)

0

11,730 (3575)

Seismic section

BGS/DECC study area
Very detailed assessment for the North of England

GIP 1329 tcf (37.7 tcm)
Exploration on shale gas
• yellow: granted permits for the exploration on hydrocarbons - aiming at unconventional
• green: basins with candidate shale gas formations

Exploitation of shale gas
• No permits have been granted in Germany for exploitation of gas from shales
German Situation - Shale Gas Potential

- Shale Gas Potential (GIP) $10^{12}$ m$^3$
  - $7$ min
  - $13$ mean
  - $23$ max

- Technical recovery: $10\%$
- Conv. resources: $0.15$
- Conv. reserves: $0.146$

Map of Germany showing potential shale gas regions with technical recovery and resources/reserves indicators.
The Netherlands
Status on Exploration:

2 exploration licenses granted for shale gas, another 2 pending.

Drilling shale gas exploration wells + awarding new licenses are on hold (MEA, September 2013)

End 2012 MEA decided to base its policy on the outcome of the research on ‘Safety of shale gas and CBM Exploration and Production’ (conducted by Witteveen & Bos, 2013)

Although conclusions were positive MEA decided (September 2013) that prior to drilling exploration well Environmental Assessment study shall be executed (will take 1-1.5 years).
Potential:

Mapped distribution of prospective shale layers.

Depth cut-off 5km (technical criteria)

Estimations of Technical Recoverable Resources (TRR) still uncertain and currently under review. Shale gas is unproven play in the Netherlands

Current estimations indicate that some \(200 \text{ – } 500 \text{ bcm of TRR}\) may be present

Surface restrictions and notional field development plans are not accounted for.
EIA GIP 159 Tcf, TRR 32 Tcf

USGS TRR estimate to be announced 3rd December 2013
### Provinces, Total petroleum systems (TPS), and Assessment Units (AU)

<table>
<thead>
<tr>
<th>Provinces, Total petroleum systems (TPS), and Assessment Units (AU)</th>
<th>AU probability</th>
<th>Accumulation type</th>
<th>Total undiscovered Gas (BCFG)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td>F95</td>
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<tr>
<td>Danish Alum Shale Onshore AU</td>
<td>0.9</td>
<td>Gas</td>
<td>0</td>
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<td>Danish Alum Shale Offshore AU</td>
<td>0.9</td>
<td>Gas</td>
<td>0</td>
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<tr>
<td><strong>Total unconventional resources</strong></td>
<td></td>
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**Danish licence area - April 2013**

Total Shale gas licences
Shale gas prospecting wells, till March, 2013

Red - licences for unconventional shale gas prospecting

Grey - licences for conventional gas fields prospecting
**Table of shale gas well drilled to date (02.10.2013)**

(source: Ministry of Environment)

<table>
<thead>
<tr>
<th></th>
<th>Vertical wells</th>
<th>Horizontal wells</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full frac job</td>
<td>13</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Micro frac job / DFIT*</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Without frac job</td>
<td>21</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>37</strong></td>
<td><strong>11</strong></td>
<td><strong>48</strong></td>
</tr>
</tbody>
</table>

*DFIT – Diagnostic Fracture Injection Test*

**Map of shale gas wells drilled from 2009-2013**

Dyrka & Janas, PGI, 2013
How great are unconventional gas resources in Poland?

SHALE GAS

Shale gas recoverable resources of the onshore and offshore Ordovician – Silurian Baltic – Podlasie – Lublin Basin Basin is estimated for maximum: \textbf{1920 Bcm (1.92 Tcm)}. Taking into account constraints on key parameters of the calculations, the higher probability range of recoverable shale gas resources are: \textbf{346 - 768 Bcm}

Need for coordinated Pan-European assessment

Potential in Europe

Estimates of technically recoverable shale gas resources in Europe

- Economically recoverable potential unclear
  - More explorations needed
Pan-European Assessment

- There is no reliable assessment on the European shale gas resources.
- EU is interested in a reliable assessment of Europe's unconventional oil and gas resources.
- Many geological surveys have made their own domestic assessments, but they are not comparable between countries.
- The overall goal with a pan-European assessment study is to get an independent, scientific based, coherent assessment of the shale gas resources.
Pan-European Assessment cont.

- Pan-European assessment on a basin by basin approach
- The European geological surveys has the data and knowledge on the specific shale stratigraphy, sedimentology, petrography etc.
- By combining the knowledge from each survey into a basin wide synthesis, knowledge is shared and the end product improved.
Many surveys have build up methodologies to estimate the shale gas resources.
  – USGS – TRR
  – BGR – GIP
  – PGI – GIP, TRR

Pilot study of gas potential of the Lower Paleozoic Shales in the Baltic Basin

It is hoped that the pilot will develop into a study, that covers the entire Europe, financed by the Horizon 2020.
Pan-European assessment Basin by Basin

Major unconventional natural gas resources in Europe

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- Coalbed methane

Baltic Basin
EGS GeoEnergy Expert Group (EGS GEEG)

Thank you for your attention

Chair: Peter Britze
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Last remarks

• Specific questions?
• General questions?

• Invitation to a small reception at GEUS

• Interviews with the press is coordinated by Flemming G. Christiansen and Peter Britze

• Presentations available on GEUS website