UNFC Resource Classification Conference (for Oil, Gas and Minerals)

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“Applying the UNFC-2009 on the Producing German Oil Field Mittelplate – A Case Study”
“Applying the UNFC-2009 on the Producing German Oil Field Mittelplate – A Case Study”

Martin Hubbig, RWE Dea AG, Hamburg
London, UK, February 7th – 8th, 2011
Overview

> Objective

> Introduction on Mittelplate Oilfield
  – General information
  – Location and environment
  – Infrastructure
  – Geology/Reservoir

> Mittelplate reserves evaluation
  – RWE Dea system/SPE PRMS
  – UNFC-2009
  – Workout variations in categories (no consideration of volumes)

> Conclusion
Objective

> Apply the new UNFC 2009 on an producing reservoir

> Check, if the system

  – Is applicable

  – Is compatible with the RWE Dea/SPE PRMS system

  – “Generates new reserves” or if existing accumulations are excluded

> Not to compare volumes or quantities of the outcome of UNFC-2009 with RWE Dea/PRMS system
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> Conclusion
The importance of the Mittelplate field for Germany's Oil Reserves

<table>
<thead>
<tr>
<th>Reserves 31.12.2009*</th>
<th>Production 2009*</th>
</tr>
</thead>
<tbody>
<tr>
<td>34,0 Mio t</td>
<td>2,8 Mio t</td>
</tr>
<tr>
<td>232 Mbbl</td>
<td>19 Mbbl</td>
</tr>
<tr>
<td>21,4 Mio t</td>
<td>1,6 Mio t</td>
</tr>
<tr>
<td>147 Mbbl</td>
<td>11 Mbbl</td>
</tr>
</tbody>
</table>

63% Germany
56% Mittelplate

*Source: LBEG Landesamt für Bergbau, Energie und Geologie
Mittelplate Joint Venture

RWE Dea AG

100%

RWE

BASF

100%

RWE Dea

50% (Operator)

Field Development Mittelplate/Dieksand Joint Venture

wintershall

50%
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Location and Environment

Located in the middle of the Wadden Sea Nationalpark which was established 1985

Wadden Sea off the coast of Schleswig-Holstein between the Elbe estuary in the south and the Danish border in the north

The Wadden Sea covers the entire coastal region with tidal-flat areas, islands, Halligen, dunes, sandbanks, creeks and saltmarsh. Tidal flats are regularly exposed and flooded in the tidal rhythm

Size: 4410 km²

37% of the area is in Zone 1 (highest protection level)

Declared site as UNESCO World Natural Heritage in 2009
Overview

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> **Conclusion**
Infrastructure: Drilling Rig Capacity and Reach

STOIIP ~ 100 Mio m³ (629 Mbbl)

STOIIP ~ 27 Mio m³ (170 Mbbl)

STOIIP ~ 32 Mio m³ (201 Mbbl)
Infrastructure: Production

> As Production (from 1987) was shipped with barges to the onshore terminal, access for the barges was required for permanent production as storage capacity is limited.

> From 2005, a new pipeline to shore eliminated these restrictions.
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Geological Cross Section W-O

Mittelplate

Dogger Epsilon, Delta, Gamma (ca. 2100 mTVD)

Dogger Beta (ca. 2800 mTVD)

Dieksand
Geological Cross Section W-O - details
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> Conclusion
RWE Dea/SPE PRMS Resource Classification System

PRODUCTION

<table>
<thead>
<tr>
<th>RESERVES</th>
<th>PROJECT STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROVED</td>
<td>On Production</td>
</tr>
<tr>
<td>PROVED plus PROBABLY</td>
<td></td>
</tr>
<tr>
<td>PROVED plus PROBABLY plus POSSIBLE</td>
<td></td>
</tr>
</tbody>
</table>

COMMERCIAL PROVED PROVED plus PROBABLE

PROVED plus PROBABLE plus POSSIBLE

Justified for Development

COMMERCIAL

CONTINGENT RESOURCES

<table>
<thead>
<tr>
<th>SUB-COMMERCIAL</th>
<th>Development Pending S1</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW ESTIMATE</td>
<td></td>
</tr>
<tr>
<td>BEST ESTIMATE</td>
<td></td>
</tr>
<tr>
<td>HIGH ESTIMATE</td>
<td></td>
</tr>
</tbody>
</table>

LOWER RISK

SUB-COMMERCIAL

UNRECOVERABLE

TOTAL PETROLEUM-INITIALLY-IN-PLACE

DISCOVERED PETROLEUM-INITIALLY-IN-PLACE

UNDISCOVERED PETROLEUM-INITIALLY-IN-PLACE

UNRECOVERABLE

PROSPECTIVE RESOURCES

<table>
<thead>
<tr>
<th>PROSPECTIVE RESOURCES</th>
<th>PROJECT STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW ESTIMATE</td>
<td>Prospect E1</td>
</tr>
<tr>
<td>BEST ESTIMATE</td>
<td>Lead E2</td>
</tr>
<tr>
<td>HIGH ESTIMATE</td>
<td></td>
</tr>
</tbody>
</table>

RANGE OF UNCERTAINTY

RWE Dea AG Page 17
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> Conclusion
UNFC Classification

- E axis
  - Economic and social viability

- F axis
  - Field project status and feasibility

- G axis
  - Geological knowledge
## UNFC E-Axis Definitions

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E1</strong></td>
<td>Extraction and sale has been confirmed to be economically viable.</td>
</tr>
<tr>
<td><strong>E1.1</strong></td>
<td>Extraction and sale is economic on the basis of current market conditions and realistic assumptions of future market conditions.</td>
</tr>
<tr>
<td><strong>E1.2</strong></td>
<td>Extraction and sale is not economic on the basis of current market conditions and realistic assumptions of future market conditions, but is made viable through government subsidies and/or other considerations.</td>
</tr>
<tr>
<td><strong>E2</strong></td>
<td>Extraction and sale is expected to become economically viable in the foreseeable future.</td>
</tr>
<tr>
<td><strong>E3</strong></td>
<td>Extraction and sale is not expected to become economically viable in the foreseeable future or evaluation is at too early stage to determine economic viability.</td>
</tr>
<tr>
<td><strong>E3.1</strong></td>
<td>Quantities that are forecast to be extracted, but which will not be available for sale.</td>
</tr>
<tr>
<td><strong>E3.2</strong></td>
<td>Economic viability of extraction cannot yet be determined due to insufficient information (e.g. during the exploration phase).</td>
</tr>
<tr>
<td><strong>E3.3</strong></td>
<td>On the basis of realistic assumptions of future market conditions, it is currently considered that there are not reasonable prospects for economic extraction and sale in the foreseeable future.</td>
</tr>
</tbody>
</table>
## UNFC F-Axis Definitions

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Feasibility of extraction by a defined development project or mining operation has been confirmed.</td>
</tr>
<tr>
<td>F1.1</td>
<td>Extraction is currently taking place.</td>
</tr>
<tr>
<td>F1.2</td>
<td>Capital funds have been committed and implementation of the development project or mining operation is underway.</td>
</tr>
<tr>
<td>F1.3</td>
<td>Sufficiently detailed studies have been completed to demonstrate the feasibility of extraction by implementing a defined development project or mining operation.</td>
</tr>
<tr>
<td>F2</td>
<td>Feasibility of extraction by a defined development project or mining operation is subject to further evaluation.</td>
</tr>
<tr>
<td>F2.1</td>
<td>Project activities are ongoing to justify development in the foreseeable future.</td>
</tr>
<tr>
<td>F2.2</td>
<td>Project activities are on hold and/or where justification as a commercial development may be subject to significant delay.</td>
</tr>
<tr>
<td>F2.3</td>
<td>There are no current plans to develop or to acquire additional data at the time due to limited potential.</td>
</tr>
<tr>
<td>F3</td>
<td>Feasibility of extraction by a defined development project or mining operation cannot be evaluated due to limited technical data.</td>
</tr>
<tr>
<td>F4</td>
<td>No development project or mining operation has been identified.</td>
</tr>
</tbody>
</table>
# UNFC G-Axis Definitions

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Quantities associated with a known deposit that can be estimated with a high level of confidence.</td>
</tr>
<tr>
<td>G2</td>
<td>Quantities associated with a known deposit that can be estimated with a moderate level of confidence.</td>
</tr>
<tr>
<td>G3</td>
<td>Quantities associated with a known deposit that can be estimated with a low level of confidence.</td>
</tr>
<tr>
<td>G4</td>
<td>Estimated quantities associated with a potential deposit, based primarily on indirect evidence.</td>
</tr>
</tbody>
</table>
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> Conclusion
Mittelplate Dogger epsilon

<table>
<thead>
<tr>
<th>#</th>
<th>P90</th>
<th>P50</th>
<th>P10</th>
<th>SPE Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E1.1</td>
<td>F1.1</td>
<td>G1</td>
<td>G2</td>
</tr>
<tr>
<td></td>
<td>G3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E2</td>
<td>F2</td>
<td>G1</td>
<td>G2</td>
</tr>
<tr>
<td></td>
<td>G3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E3</td>
<td>F3</td>
<td>G1</td>
<td>G2</td>
</tr>
<tr>
<td></td>
<td>G3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

112  C1 On Production

222  S1 Dev. Pending

332  S2 Dev. On Hold
Mittelplate Dogger beta

UNFC | PRMS
--- | ---
112 | C1 On Production
112 | C1 On Production
112 | C2 Appr. f. Dev.
112 | C2 Appr. f. Dev.
112 | C3 Just. for Dev.
122 | S1 Dev. Pending
122 | S2 Dev. on Hold
322 | S3 Dev. Not Viable

C1 On Production
C2 Appr. f. Dev.
C3 Just. for Dev.
S1 Dev. Pending
S2 Dev. on Hold
S3 Dev. Not Viable
Conclusions

> Little effort to apply UNFC-2009 if a proper evaluation is available

> SPE PRMS classes can be matched with 3-digit UNFC-2009 code

> Different SPE PRMS sub-classes not discriminated by 3-digit UNFC-2009 code
  - information loss e.g. in beta by using 3-digit UNFC-2009 code, but

> Using subclasses, UNFC-2009 has more breakdowns, and each SPE PRMS sub-class can be matched
  - More sub-classes allow a better discrimination

> Generally spoken, reserves remain reserves and resources remain resources

> Volumes seem not be affected and therefore are equal in both systems
Thank you for your attention!

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