Plaats in dit vak een foto uit de corporate beeldenbank

(11 cm x 25,4 cm, 150 dpi)

Shallow Gas Play in The Netherlands Takes Off

Mijke van den Boogaard & Guido Hoetz
1. EBN B.V.

2. Shallow Gas in the Dutch Offshore
   • Definition
   • Geological setting

3. Why Explore for Shallow Gas?

4. Shallow Gas Inventory EBN

5. Case Study (Open Acreage)

6. Summary

13/12/2012
State participant in exploration & production in The Netherlands

<table>
<thead>
<tr>
<th>Category</th>
<th>2011</th>
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</thead>
<tbody>
<tr>
<td>Productive fields (EBN participation)</td>
<td>258</td>
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<tr>
<td>Exploration participations</td>
<td>47</td>
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<tr>
<td>Production participation</td>
<td>125</td>
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<tr>
<td>Gas sales volume EBN share (bcm*)</td>
<td>30</td>
</tr>
<tr>
<td>Reserves EBN share (bcm)</td>
<td>431</td>
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<tr>
<td>Exploration wells drilled</td>
<td>19</td>
</tr>
<tr>
<td>Production wells drilled</td>
<td>38</td>
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<td>New fields in development</td>
<td>12</td>
</tr>
<tr>
<td>Payments to state (billion €)</td>
<td>5.8</td>
</tr>
</tbody>
</table>

*1 bcm (Nm) ≈ 37.3 bcf
2. Shallow Gas in the Dutch Offshore

Definition

Shallow Gas (SG) = gas in unconsolidated sands, Miocene-Pleistocene

Shallow fields
Shallow leads
Eridanos delta:
- Late-Cenozoic river delta system
- In NL: Late Miocene – Early Pleistocene

Reference: Kuhlmann et al., 2004
2. Shallow Gas in the Dutch Offshore

Geological Setting

- Top Chalk (Mid-Paleocene)
- MMU
- Salt domes
- Amplitude anomalies

Reference: Kuhlmann et al., 2004

~1000 m

~70 km
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6. Summary
3. Why Explore for Shallow Gas?

**History**

- Occurrence shallow leads known since early 70s
- Presence producible shallow gas proven by wells in 80s
- Early water breakthrough & sand production expected → fields not developed
3. Why Explore for Shallow Gas?

History

• Currently 3 successfully producing fields:
  - A12-FA (2007)
  - F02a-B-Pliocene (2009)
  - B13-FA (2011)

• Technical breakthrough (e.g. sand control in horizontal wells)

Reference: Chevron, Oil&Gas Journal, 2009
3. Why Explore for Shallow Gas?

Shallow Gas Offshore NL

Today:
3 fields producing
5 fields under development/development pending
3. Why Explore for Shallow Gas?

1. New technology proven successful for SG developments

2. New 3D seismic points to more opportunities

3. Significant volumes identified:
   36-118 bcm GIIP, 18-62 bcm UR
   Relatively high POS

4. Marginal field tax incentive applicable (2010, www.nlog.nl) & Guaranteed gas off take
1. EBN B.V.

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Identify Shallow Gas (SG) leads:

- High amplitude seismic reflection indicative for gas
- Mapping of *bright spots* (BS) defines SG leads
Select most attractive leads based on:

1. Well data:
   gas shows, log data

2. Bright spot classification

4. Shallow Gas Inventory EBN
   Identify Leads

13/12/2012
4. Shallow Gas Inventory EBN
Bright Spot Classification

Lead x

Trapping geometry

Stacked reservoirs

Vertical relief

Depth

Area

0

1

2

3

1 = L
2 = M
3 = H
4. Shallow Gas Inventory EBN
Bright Spot Classification

BS type:

4WDC (e.g. A12-FA)
FDC (e.g. F02a-B-Pliocene)
Strat. trap
Very shallow
Small size

Prospectivity?

4WDC type
• Area: M/H
• Depth: M/H
• Vertical relief: L/M
• Number of Stacked Reservoirs: L/M/H
• 4WDC

FDC type
• Area: M/H
• Depth: M/H
• Vertical relief: M/H
• Number of Stacked Reservoirs: L/M/H
• FDC

13/12/2012
4. Shallow Gas Inventory EBN
Size of the Prize

15 leads analysed in detail:

- Total GIIP P50-P10: 12 – 22 bcm*
- Several large leads to be analysed

*1 bcm (Nm) ≈ 37.3 bcf
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   • Definition
   • Geological setting

3. Why Explore for Shallow Gas?

4. Shallow Gas Inventory EBN

5. Case Study (Open Acreage)

6. Summary

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5. Case Study 1: F04/F05-P1 (Open Acreage)

Detailed factsheets on www.ebn.nl
5. Case Study 1: F04/F05-P1 (Open Acreage)

Detailed factsheets on www.ebn.nl

<table>
<thead>
<tr>
<th>Zone</th>
<th>P90</th>
<th>P50</th>
<th>P10</th>
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<tbody>
<tr>
<td>Sand 1</td>
<td>0.4</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Sand 2</td>
<td>0.4</td>
<td>0.8</td>
<td>1.6</td>
</tr>
<tr>
<td>Sand 3</td>
<td>0.4</td>
<td>0.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Total</td>
<td>1.2</td>
<td>2.7</td>
<td>5.6</td>
</tr>
</tbody>
</table>

1 bcm (Nm) ≈ 37.3 bcf

Detailed factsheets on www.ebn.nl
6. Summary (1/2)

Shallow Gas Play in The Netherlands Takes Off

- Northern offshore NL: SG in Cenozoic unconsolidated sediments (Eridanos Delta)

- Extensive occurrences of SG known from seismic & wells

- Why explore for SG now?
  1. 3 Successfully producing fields (sand measures in horizontal wells)
  2. Area largely covered by 3D seismic
  3. Significant shallow gas potential (18 – 62 bcm UR)
  4. Marginal field tax incentive applicable & guaranteed gas take

13/12/2012
Shallow Gas Inventory EBN
- Bright Spot Classification
- 152 leads in northern offshore NL
- 48 attractive leads (14 open acreage)

Case study (open acreage)
- F04/F05-P1: 2.7 – 5.6 bcm GIIP (P50-P10)

• Remaining challenge: find cost efficient solutions due to
  - Relatively small leads
  - Distance to infrastructure
Acknowledgements

- TNO, Chevron, Dana, ONE, Total
- EBN B.V., in particular:
  - Berend Scheffers
  - Eveline Rosendaal

See you in booth 10!