Resources and future potential in the Netherlands

TNO

ebn
best access to dutch gas

Ministry of Economic Affairs, Agriculture and Innovation

Prospex 2010
Present day E&P map

• Outline of the presentation
  • Quick status report on activities and reserves
  • Futures
  • Mining climate initiatives.
  • (Sub-surface) Spatial planning and synergies
**Conclusions Prospex presentation of 2007**

**Challenges in the Netherlands**

for Government and Industry

- Take advantage of the Window of Business opportunity

- Extend life time offshore infrastructure:
  - Get Non-Producing fields including stranded fields on stream
  - Develop appraised & un-appraised blocks

- Explore:
  - Prospects in proven play: infill relative low risk, low reward
  
  - Expand proven play areas: e.g. Rotliegend feather edge, Carboniferous play higher risk higher reward

  - Evaluate non-proven play: e.g. high risk, high reward Dinantian play or Upper Jurassic Strat. trap
Dinantian play

Kombrink 2008

Herber & de Jager 2010

Fig. 4. Seismic and geological cross-section through the Lithaizermeeden-2 well, which reached TD at 5423m AHRT in Devonian mudstone. Dinantian carbonates were water-bearing.
## Exploration and production activity 2008-2010

<table>
<thead>
<tr>
<th>Category</th>
<th>2008</th>
<th>2009</th>
<th>2010 (to date)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploration wells</td>
<td>9</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Appraisal wells</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Production wells</td>
<td>14</td>
<td>37</td>
<td>15</td>
</tr>
<tr>
<td>Seismic acquisition 2D (km)</td>
<td>838</td>
<td>1849</td>
<td>?</td>
</tr>
<tr>
<td>Seismic acquisition 3D (km²)</td>
<td>1893</td>
<td>-</td>
<td>?</td>
</tr>
<tr>
<td>Fields on stream</td>
<td>8</td>
<td>21</td>
<td>?</td>
</tr>
<tr>
<td>Granted exploration licenses</td>
<td>15</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Returned exploration licenses</td>
<td>1</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Granted production licenses (incl. extensions)</td>
<td>2</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>
Future predictions: riding the wave

Forecasts and actual small fields production (Groningen equivalent gas)

Propex 2010

London, 16 dec 2010
Reserves in the Netherlands

Gas resources in the Netherlands as at 1 January 2010 in billions of Sm³

<table>
<thead>
<tr>
<th>Accumulations</th>
<th>Developed</th>
<th>Undeveloped</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groningen</td>
<td>1036</td>
<td>0</td>
<td>1036</td>
</tr>
<tr>
<td>Others Territory</td>
<td>139</td>
<td>19</td>
<td>170</td>
</tr>
<tr>
<td>Continental Shelf</td>
<td>141</td>
<td>44</td>
<td>184</td>
</tr>
<tr>
<td>Total</td>
<td>1316</td>
<td>55</td>
<td>1390</td>
</tr>
</tbody>
</table>

30-30 ambition Min. E,A&I and EBN

Exploration potential

Stranded fields
The Netherlands - Not in creaming mode yet

Offshore

Onshore

Offshore wells
Offshore Prospect portfolio

Prospex 2010

London, 16 dec 2010
Onshore Prospect portfolio

EXP of onshore prospects per formation

EXP of onshore prospects per license type

Prospex 2010

London, 16 dec 2010
Prospective areas

- Under-explored area
  - New plays
  - Conventional plays

- Mature exploration area
  - New plays
  - Expanding play area
  - Prospect sweep
  - Marginal and stranded assets

- Unconventional play
Shallow gas field and prospectivity
Expanding mature plays

- Opportunities in a mature play
  - Even better imaging through new recording methods and state of the art processing
  - Better innovative dating and integrated correlation techniques
  - Better geological models
Play expansion

• The Rotliegend play

• Other: strat-trap sub-plays in the Carboniferous and the Jurassic
Under-explored area

- New data
- FFF & models

Source rocks inventory

The four study areas defined at the start of the project.

Summary table of the evaluation of the potential source rocks (SR).

Westphalian in the Step Graben and Central Graben
Reservoirs & seal

Top Pre-Permian distribution map (potential reservoirs)

Zechstein thickness map (seal)
Unconventionals, lot of debate and uncertainties
Inventory studies

Shale gas

Coalbed Methane

Top Carboniferous

Depth range

>0m

0m-500m

-500m-1000m

-1000m-1500m

-1500m-2000m

>2000m

Absent

Selected areas

TNO, 2010

Potential areas for Shale Gas

High Potential

Medium Potential

Unknown Potential

No Potential

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TNO, 2010
Unconventionals: Volume, GIIP vs reserves

Volume guesstimates

From In Place to recoverable volumes.
Data in the Netherlands
Availability of data & information through: NLOG.nl
Mining Climate initiatives

• Small fields policy (long standing successful strategy)
  • Guaranteed off-take (GasTerra)
  • Guaranteed transport (Gas-Transport-Services)

• 40% Participation of EBN in exploration and production

• “Fallow declaration” of inactive parts of production licences

• Marginal fields initiative
Marginal fields initiative

Parameter definitions:
1) Volume: Technically recoverable volume according to envisaged development plan (relates to GIIP connected to wells).
2) Initial productivity of a vertical unstimulated well against envisaged pipeline pressure.
3) Distance: Closest point to which can be hooked on with respect to ullage, capacity, gas composition.

Definition of threshold plane:
\[ Q_{\text{threshold}} = 1.2 \times \text{Volume} - 0.66 \times \text{Distance} 0,15 \]

Visualisation of the threshold plane defined by the formulas.
Increasingly more complex playing field

- Interference of sub-surface activities
  - Exploration and production of gas and oil
  - Geothermy
  - Storage of:
    - natural gas, N$_2$, CO$_2$, H$_2$, compressed air
    - waste
- Surface activities:
  - Nature reserve
  - Shipping lanes
  - Windparks
  - Urban areas
- Consequences of activities
  - Induced seismic
  - Subsidence
- Public perception
Synergy between users

- Shared knowledge and experience
  - Geology
  - Techniques
  - Development

- Gas to wire ↔ windparks
  - Alternative evacuation strategy

- Exploration geothermy ↔ exploration oil & gas
  - Improved pre-drill economics through “risk reduction”
  - Relief of abandonment costs
Conclusion

• Still scope in the Netherlands
  • 1) conventional gas
  • 2) unconventional gas

• Data position in the Netherlands is unique

• “Mining Climate” progressively improves to meet standards for a new phase in exploration and production.

• Exploration & Production of gas needs new strategy in a complex 3-to-4D spatial planning

• …