WHAT TO EXPECT THE NEXT 20 MINUTES

- Status report on Dutch reserve estimates
- Geological & Prospectivity studies
- Some leads
- Concluding remarks
- Booth 10: the Netherlands, EBN, MEA & TNO
HISTORIC TRENDS

Reserves: 94 bcm
Contingent res.: 24 bcm
9 explo. wells

Reserves: 55 bcm
Contingent res.: 20 bcm
8 explo. wells
PAST & FUTURE PRODUCTION TREND

- Historical production 'small fields'
- Historical production Groningen Field
- Expected supply from Reserves (PRMS)
- Expected supply from Contingent Resources (PRMS)
- Expected supply from as yet undiscovered accumulations
- Production allowance Groningen accumulation 2015

Table 8. Domestic production of natural gas from small fields for the next 10 and 25 years, in billion m³ Geq

<table>
<thead>
<tr>
<th>Production</th>
<th>2015 to 2025</th>
<th>2015 to 2039</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small fields</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reserves</td>
<td>144</td>
<td>166</td>
</tr>
<tr>
<td>Contingent resources (dev, pending)</td>
<td>29</td>
<td>48</td>
</tr>
<tr>
<td>As yet undiscovered</td>
<td>48</td>
<td>166</td>
</tr>
<tr>
<td>Total for small fields</td>
<td>221</td>
<td>380</td>
</tr>
</tbody>
</table>
Stranded fields in portfolio @ 2010 => some 40 fields

Some recent successful stranded fields developments:

- **K4-Z**, discovery 1974, developed in 2013 with help of the marginal field incentive
- **K15-FH**, discovery 1992, currently under development
- **L04-D**, discovery 1981, currently in production with help of the marginal field incentive
- **Q07-FA**, discovery 1973, recently successfully appraised.

40 stranded fields in portfolio
PROSPECTS IN DUTCH PROVEN PLAYS

De Jager & Geluk, 2007

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EXPLORATION POTENTIAL IN PROVEN PLAYS

Prospect portfolio Offshore

Prospect portfolio Onshore

Exploration potential @ EMV=0 cut-off: 165 bcm

Exploration potential @ EMV=0 cut-off: 113 bcm
UNDER-EXPLORED DUTCH NORTHERN OFFSHORE

- Generally 0 to 3 exploration wells per block
- Wells are generally invalid tests or the “new” plays under study.
- Outside the main proven play outlines:
  - No reservoir
    - Way north of southern provenance Rotliegend feather edge
    - Very low net reservoir in Carboniferous
  - Lack of sufficient charge
    - Presumed lack of mature source rock: not present not mature or over mature
    - No reservoir ⇔ source connection because of thick sealing packages in between
SUBSURFACE DATA AND E&P INVESTMENT CLIMATE

- Subsurface data free of charge through www.nlog.nl
  - Well data
  - Seismic data
  - Oil & gas field data
  - Etc.
  - Regional subsurface maps & thematic datasets
  - Geological studies
  - Bibliography of Dutch geology

- Stable, reliable & encouraging investment climate:
  - Small fields policy; guaranteed off take of gas from small fields
  - Marginal fields tax allowance
  - State participation in exploration and production
  - Fallow acreage
NORTHERN OFFSHORE G&G STUDIES

- Ambition: unravel and understand all petroleum geological elements:
  - Structural development
  - Assessment of accommodation space
  - Basin fill architecture
  - Burial history

- Define plays
  - Reservoir
  - Seal
  - Source

- See presentation of 2013 for some incipient hypotheses

G&G and “lead” studies performed:
- Shallow gas
- Chalk
- Upper Jurassic – Lower Cretaceous
- Triassic
- Carboniferous
- Structural Development
- Source rock

See poster presentations in booth 10
and the digital booth on www.nlog.nl
Go North, a fresh look at the Palaeozoic structural framework and hydrocarbon charge in the Dutch northern offshore

Marten ter Borgh*, Bastiaan Jaarsma and Eveline Rosendaal EBN, the Netherlands. * Corresponding author, marten.borgh-ter@ebn.nl

Variance 200 ms below Base Permian Unconformity
STRUCTURAL FRAMEWORK & DEVELOPMENT

Devonian–Carboniferous, -normal faults

(Permian) Triassic – Jurassic, -normal faults

Jurassic – Palaeogene -dextral strike-slip faults
TRIASSIC PROSPECTIVITY

Southern provenance

Northern provenance

Basin wide accommodation space
  - Traditional layer cake strat.
  - Local pods
SOURCE ROCKS IN THE DUTCH N-OFFSHORE

Upper Jurassic s.r
Zechstein s.r
Namurian hot shales s.r
Westphalian coal s.r
Posidonia s.r
Scremerston coal s.r

Legend:
- Coal
- Sand
- Clay Sand
- Shale
- Marls
- Carbonate
- REAAP area
- International Border

High contrast seismic facies in Visean

23 m coal
30 m coal
2 m coal

Well Synth_2 Scene 2

Depth
Generation

Upper Jurassic
Lower Jurassic
Zechstein
Upper and Lower Carboniferous
Lower Carboniferous

Pre-Tertiary shows

SOURCE ROCKS IN THE DUTCH N-OFFSHORE

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PLAYS IN THE DUTCH NORTHERN OFFSHORE

- Plays, reservoirs:
  - Tertiary,
  - Chalk,
  - Jurassic,
  - Triassic,
  - Zechstein,
  - Rotliegend,
  - Upper Carboniferous,
  - Lower Carboniferous

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A CARBONIFEROUS LEAD

<table>
<thead>
<tr>
<th>Lead</th>
<th>Kilimanjaro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reservoir</td>
<td>Namurian &amp; Visean clastics</td>
</tr>
<tr>
<td>Seal</td>
<td>Silverpit shales &amp; Zechstein salt</td>
</tr>
<tr>
<td>Source</td>
<td>Scremerston coals</td>
</tr>
</tbody>
</table>
EXPLORATION POTENTIAL OF THE DUTCH N-OFFSHORE

Preliminary inventory:

- Chalk: >55 untested closures, sizes varying between 10 and 300 MMbbls
- Triassic: > 50 closures, 29 leads, 80 bcm unrisked
- Zechstein: 7 leads
- Rotliegend Cygnus equivalents: not evaluated
- Carboniferous: 20 leads/structures, 75 bcm unrisked
CONCLUDING REMARKS

- G & G studies provide a better understanding of the Dutch Northern Offshore.
- There are well defined plays with respect to source, reservoir and seal combinations.
- Wells drilled in this area are often invalid tests for the plays discussed.
- Within this area numerous leads have been identified to mature.
- Posters and presentation available in the digital booth on www.nlog.nl.
- Further information through EBN or TNO.
- Some of the study results may be presented at: Palaeozoic Plays of Northwest Europe.
THANK YOU FOR YOUR ATTENTION

HOPE TO SEE YOU IN BOOTH 10