The Schoonebeek Field: EOR redevelopment of a European onshore giant

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Also in this presentation we have aggregated our equity position in projects for both direct and indirect interest. For example, we have aggregated our indirect interest in the Pluto project via our 34% shareholding in Woodside Energy Ltd.
Presentation outline

- Field history
- Redevelopment decision
- Reservoir and Hydrocarbons
- Development strategy
- Challenges
- WSPE role
Field Overview

- Partners: NAM, EBN
- Cretaceous Bentheim Sandstone reservoir
- Discovery: 1943
- Production: 1944 – 1996 (abandoned)

- Viscous oil
- 599 vertical wells
- STOIIP: 1027 MMbbl
- Peak Production: 25000 bbl/d (1957)
- Cumulative production: 250 MMbbl
Why redevelop?

Schoonebeek Field
Top Bentheim structure

East: Main Water Drive Area
STOIIP: 690 MMbbl
Produced: 200 MMbbl
RF 29%

West: Solution Gas Drive Area
STOIIP: 337 MMbbl
Produced: 52 MMbbl
RF 15%

Expected UR - 51%

4 km
Why redevelop?

Bentheim Sandstone
- Lower Cretaceous
- Shoreface
- Massive sands
- Thickness: 0-40 m
- N/G: 98%
- Porosity: avg. 30%
- Permeability: 500-4000 mD
- Highly faulted anticlinal trap

Excellent Reservoir

SND-1
Problem: Viscous, waxy oil (160-200 cp)  
- Low GOR  
- Highly faulted reservoir

Solution: Horizontal steam injectors and producers  
- Heat oil from 40°C to 200°C  
- 200 cp → 1-3 cp  
- UR: 15% → 51%

GASF = Gravity Assisted Steam Drive

Horizontal section depth between 640 and 920 meter

Vlieland Claystone (top seal)

Bentheim Sandstone reservoir

Oil / water Production

Steam Injection
Compartment Definition

1993 Post-Stack Time

2006 Pre-Stack Depth, High Definition (2005 acquisition)

Typical pre-drill top reservoir uncertainty: +/- 5 m
44 producers
25 steam injectors
4 observation wells

>90,000 km
>25,000 km horizontal
Well Delivery

- Compact land rig/s
  - Custom-made
  - Light
  - Mobile
  - Simple Wells

Drilltec Compact
Drilling Challenges: Collision

Base Bentheim, with existing wells and redevelopment wells
Drilling Challenges: Reservoir

- Offset well
- Structural uncertainty
- Calcite nodule
- "Soft" reservoir

- 2000-0.2 (ohm.m)
- 0-150 (API)

Drilling Challenges: Reservoir

10 – 30m
Example: SCH-1452

- Top reservoir 1m deep
- Base reservoir 1m deep
- Fault as prognosed

Orange-grey: Resistivity log
Yellow-brown: GR-log

Vertical exaggeration 5x
Well Site Petroleum Engineer (WSPE)

- Excellent Shell/NAM graduate training
- Cross-discipline learning
- 44 WSPE graduates

- Cuttings descriptions
- MWD log correlation
- Casing point confirmation
- Monitor horizontal section
- Section TDs
Summary

- Potential recognised in mature field

- Key enablers:
  - Technology advance (seismic, GASF, anti-collision)
  - Increased knowledge

- Campaign: experience aids efficiency
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