Fram Field Development Plan
UK Central North Sea

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Reserves: Our use of the term “reserves” in this presentation means SEC proved oil and gas reserves and SEC proven mining reserves.

Resources: Our use of the term “resources” in this presentation includes quantities of oil and gas not yet classified as SEC proved oil and gas reserves or SEC proven mining reserves. Resources are consistent with the Society of Petroleum Engineers 2P and 2C definitions and includes Oil Sands.

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To facilitate a better understanding of underlying business performance, the financial results are also presented on an estimated current cost of supplies (CCS) basis as applied for the Oil Products and Chemicals segment earnings. Earnings on an estimated current cost of supplies basis provides useful information concerning the effect of changes in the cost of supplies on Royal Dutch Shell’s results of operations and is a measure to manage the performance of the Oil Products and Chemicals segments but is not a measure of financial performance under IFRS.

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Overview

- Fram location and overview
- Exploration and appraisal history
- Key subsurface uncertainties
- Subsurface development concept
- Well and completion design
- Surface development concept
- Project schedule
Fram Field Location - UK Central North Sea
Regional Geology - Structural and Depositional Setting

- Palaeocene Forties Sandstone Member
- Basin-floor distal turbidite deposits
- 'Sheet-like' sands deposited in lobe sequences
- SW margin of main NW-SE Forties fan
- Distal and marginal location
- Further down depositional dip than analogues

UK Central North Sea - Quad 29
Southwest part of Central Graben
Northeast of Curlew Horst and west of Puffin Horst
Penetrative salt diapir structure (Zechstein salt)
Salt diapir above Late Jurassic footwall high
Deep structure controlled by Mesozoic rifting
Fram Discovery Overview

Field Summary

- UK Central North Sea
- Oil rim with primary gas cap
- HClIP 390 MMboe (approx.)
- P.012 Licence (Shell 28% Esso 72%)
- P.1664 Licence (Shell 50% Esso 50%)
- Palaeocene Forties Sandstone reservoir
- Porosity 18-28%, Perm 0.1-100mD
- Discovered in 1969 by 29/3-1 well
- Appraised in 1999 with 29/3a-6 well
- Appraised in 2009 with 29/3c-8, 8z wells
- 300 ft TVD thick oil rim (approx.)
- >1500 ft TVD gas column (approx.)
Fram Salt Diapir - 2007 PSDM Near-Stack Reflectivity Data

West

1700

29/8a-4

Salt diapir

Salt diapir

Top Forties time horizon

East

29/3-1

29/9c-7

TWT (ms)

2664

Approx 1km
Forties Reservoir Geology - Facies Scheme Summary

Well 29/3c-8

Thick amalgamated sands 3 – 15 ft thick

Amalgamated Sands (A)

Heterolithic Medium (HM)

Heterolithic Thin (HT)

Facies A

Fan A Grootkloof, Karoo, South Africa

Facies HM

Thin Bedded sheet sands and siltstones (heterolithics) (HM)

Facies HT

<1ft thick sands interbedded with shales

Ross Formation, County Clare, Ireland

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Forties Reservoir Thinning - Forties Isochore Thickness Map

- Thick and high N/G Forties to NW
- Thin and low N/G Forties to SW of salt diapir
- Forties fan margin
- Lista high
- Thinning of Forties and N/G reduction to SE
- 29/8a-4 side lobe
Oil Rim Characterisation - 29/3c-8,8z Appraisal Wells 2009

Planned horizontal oil production well elevation - mid oil rim position

Gas-Oil-Contact (GOC)

DST1A 1,670bopd, 1,000 scf/bbl GOR, 40° API oil, 2% BS&W on a 40/64” choke

Free-water-level (FWL)

100% water saturation

100% water (aquifer)
Key Subsurface Field Development Uncertainties

■ Reservoir properties
  ■ Thickness of T75 reservoir zone relative to fluid contacts.
  ■ N/G variation and rate of reduction towards Forties pinch-out.
  ■ Facies distribution and proportions in southern area of field.
  ■ Permeability of reservoir sands (for well kh/PI).

■ Reservoir architecture
  ■ Stratigraphic connectivity (lateral extent of sands and shales).
  ■ Structural connectivity (influence of faults on fluid flow/pressure depletion).
Fram Proposed Development Well Locations

- Block 29/3c
- Block 29/8a
- Block 29/9c
- Block 29/4c
- PWRI
- GOC
- DCE
- DCW
- G2
- G3
- G4
- P1
- P2
- P3
- P4
- P5
- P2z
- P1z
- 29/3A-3
- 29/3-1
- 29/3A-6
- 29/3C-8
- 29/3C-7
- 29/8A-4
- FWL

Legend:
- 0 500 1000 1500 2000 2500m
Fram Proposed Development Well Locations (3D view)
Horizontal oil and gas producers - well design considerations and objectives

- Pilot holes to constrain depth uncertainty and determine depth of OWC for horizontal well placement.
- Cross-cut reservoir layers in T75 reservoir zone to maximise stratigraphic connectivity.
- Wells to target upper and lower Amalgamated Sand (A) packages based on Vsh seismic inversion volumes.
- 4000ft AH well lengths to optimise well spacing/drainage and kh (due to layered reservoir and low perm).
- Optimise stand-off from GOC and OWC to mitigate early gas and/or water breakthrough to wells.
Fram Well Concept Design - 4000 ft AH Horizontal Wells

Well Concept Design Summary

- Conventional CNS ‘5 string’ casing design
- 13 5/8” intermediate casing shoe at 7000ft MD
- Batch drilling of top hole and intermediate sections
- Water based mud system to be used in 17 1/2” hole
- 9 5/8” production casing set in Forties reservoir
- 4,000 ft AH Forties reservoir sections in 8 1/2” hole
- Ocean Guardian semi-sub drilling rig
- Expected drilling start date July 2012
- Wells to be cleaned-up to rig prior to suspension

Ocean Guardian drilling rig
Fram Well Completion Design

Well Completion Concept

- Wire wrapped screens with swellable packers.
- 5 ½” 13Cr sand screens with 316L wrap material and 200 micron slot size.
- Swellable packers for water/gas shut-off capability.
- Resman chemical tracers (oil and water sensitive).
- Dual Permanent downhole pressure gauges (PDHG).
- Gas lift completion for oil wells.
- Through tubing access to reservoir for interventions (e.g. PLTs).
- Gas well completion as per oil well completion (without gas lift or chemical tracers and single PDHG).
Subsea Design Summary

- 8 x subsea production trees – 5 oil and 3 gas.
- 4.4 km integrated flowline bundle.
- 2 x towhead production manifolds.
- Flexible risers from bundle midline structures to FPSO.
- 1 x subsea produced water re-injection (PWRI) tree.
- 2 km umbilical from PWRI tree to DCE towhead manifold.
- 3 km flexible flowline connecting the PWRI tree to the FPSO
- 18 km 14” carbon steel gas export pipeline.
- Tie-in point to 20” export line at Curlew Deep Gas Diverter.
- Pipeline end manifold (PLEM) at the Deep Gas Diverter.

Proposed subsea layout and pipeline routes
Fram Field Development Plan - FPSO and Subsea Facilities

Fram Development Schematic

KEY
- UMBILICAL
- GAS
- OIL
- LIFT GAS
- PRODUCED WATER

Graphics, Media & Publication Service (Aberdeen) ITU/IE : Ref 02/1204 November 2011
Fram Field Production Forecasts (base case)

- **Oil production profile**
  - 5 oil production wells + 3 gas wells
  - Oil rate includes crude + condensate
  - Peak oil rates approx. 18 kbopd (monthly average)
  - Oil rate decline driven by GOR development and water cut (gas cap expansion drive)

- **Gas production profile**
  - 5 oil production wells + 3 gas wells
  - Gas rate includes free + solution gas
  - Peak gas rates approx. 183 MMscf/d (monthly average)
Fram FPSO Development Project Schedule (Level 0)

- **DECC**
  - **2012**: P1664 Commitment – 12/02/13
  - **2014**: P.012 License Expiry – 17/12/14

- **FPSO**
  - **2012**: SELECT
  - **2013**: DESIGN, PROCUREMENT, HULL
  - **2014**: INTEGRATION & COMM.

- **SUBSEA**
  - **2011**: FEED
  - **2012**: PIPELINE - DESIGN, PROCURE & FABRICATE
  - **2013**: PIPELINE INSTALL
  - **2014**: BUNDLE - DESIGN, PROCURE & FABRICATE, BUNDLE INSTALL

- **WELLS**
  - **2011**: P1664
  - **2012**: DCE
  - **2013**: DCW

Key Events:
- **2011**: Development drilling start
- **2012**: Subsea installation
- **2013**: FPSO hook-up
- **2014**: Onstream