Subsea Field Development and Production Enhancement (IOR)

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Poseidon Group

- Specialists in **subsea** systems:
  - Engineering & studies
  - Solutions & equipment packages (EPC)
  - Installation & operational support

- **Key facts:**
  - Founded: 2000
  - Staff: 150 (2009)
  - Turnover: 50 MUSD (2009E)
  - Offices: Aberdeen, Stavanger

- Visit us at: [www.poseidongroup.co.uk](http://www.poseidongroup.co.uk)
A Subsea Field Development?
Components in a Subsea Production System

- Topsides
- Process
- Well Head
- Manifold
- Umbilical
- Flowline
- Reservoir
- Well
Field development architectures:
Manifold, individual wells or daisy chained well; tied back to a production facility
Start with a Study to Establish the Concept
Girrasol(Total) : Well clusters with manifolds

1400 meters depth
Ormen Lange (Shell): Long Step out / Deep Water

- 42” export line
- 2 x 30” flow line
- 2xMEG + 2x Umb
- Shore terminal
- Template A
- Template B
- 120 km from land
- 850 meters depth
What tools can be used for IOR (Increased Oil Recovery) given the typical production profile for gas/oil wells?

We want to lift the curve.
Possible “Tools”

- Inject water to maintain reservoir pressure
- Reduce wellhead pressure by subsea boosting and compression
- Reduce pressure drop and increase flowline capacity by removing water subsea

Production = PI (P_res – P_bh)

- P_top
- Riser (size & depth)
- Flowline (size & step-out)
- P_res
- P_bh
Status for Tools (=Subsea Processing)

- **Now:**
  - Boosting (Multiphase)
  - Raw water injection
  - Electric submersible pumps (ESP)
  - Bulk separation

- **Near future:**
  - Water treatment
  - Gas compression
  - Compact separation
Yme Redevelopment (Talisman) – ESP
Tordis (Statoil): Subsea Separation and Boosting
Pazflor (Total): Subsea Separation and Boosting

**SPS Scope:**
- 49 EHXT Xmas Tree’s
- Production Control System
- 3 Manifold Systems
- 1 SIV Skid (Gas Export Isolation Valve)
- Connection equipment
- ROV, Running & Tie in Tools
- 2 WOCS with Umbilical

**SSS Scope (3 off):**
- Subsea Separation Unit
  - Foundation Base Structure
  - Intermediate Frame
  - Inlet Valve Module
  - Separator Module
  - Manifold Module
  - Pump Modules
  - Subsea Control Module
- Controls & Power Umbilical
- Pump Control Module
- Topside Control System
Ormen Lange (Shell): Subsea Compression

Length: 60m
Width: 38m
Height: 12m
Weight: 3,300 t
GIIP = 528e9 Sm3

wo compression: 10 = 294e9 Sm3

w compression: +97e9 Sm3 = 391e9 Sm3

Longer plateau and increased recovery at Ormen Lange (Courtesy of StatoilHydro)
What about CAPEX and OPEX?
Example based on Subsea Treatment of Injection Water

- Injection of treated seawater from topsides is the most common method for Increased Oil Recovery (IOR):
  - Maintains reservoir pressure
  - Drives the oil to producing wells

- Our new SWIT technology allows a treatment system to be placed on the seabed

- NOTE: Treatment is essential for long-term protection for the reservoir
Base Case - Topside Water Treatment

Seawater intake → Water Treatment Plant → HP pipeline
SWIT Enables Seabed Based Water Treatment

- Save on major cost items
  - Topside treatment
  - HP Pipeline
  - Low OPEX
  - CAPEX when needed
SWIT Application: Fully Integrated System for Water Injection to a Satellite Field

- SWIT at the seabed: 24 mill$
- Flowline from topside: 52 mill$

-> More than 50% cost saving

- 30,000 BPD
- 275 Bar
- 2.5 MWatt
- Power cable only