

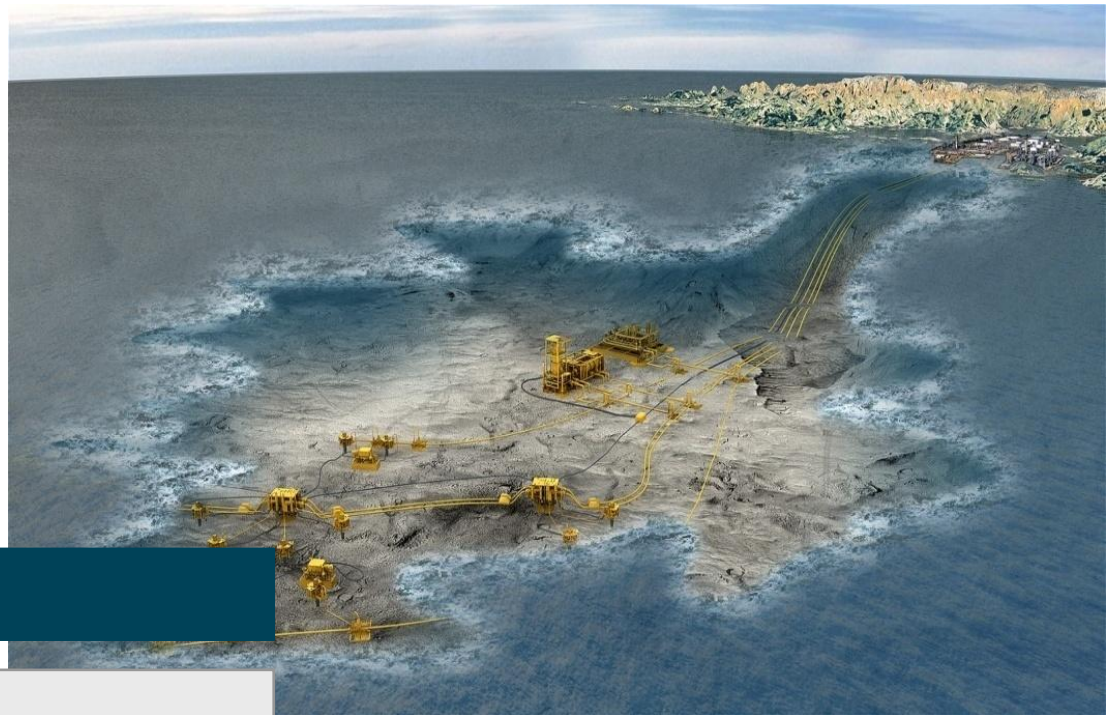


FORCE
Subsea Systems
Stavanger 30.5.2011

Hans Jørgen Lindland
FMC Technologies

We put you first.
And keep you ahead.

Agenda



Subsea Systems

EOR – operational issues

Opportunities

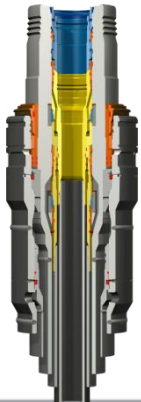
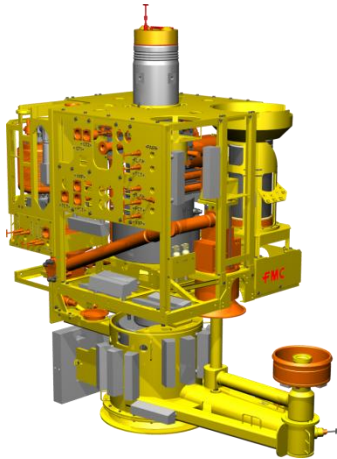
Summary

Subsea Production System



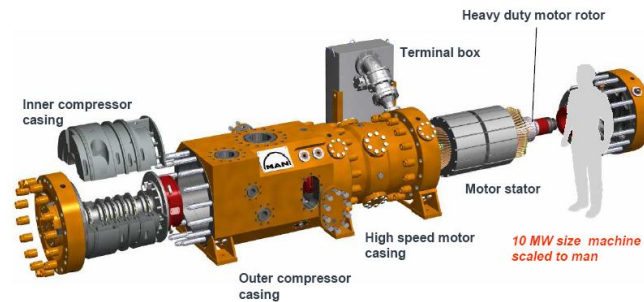
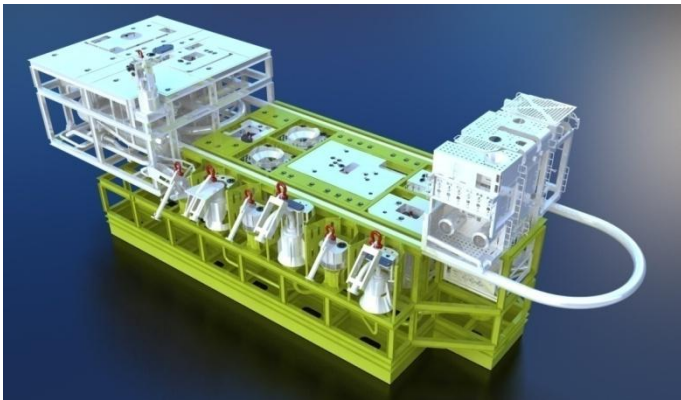
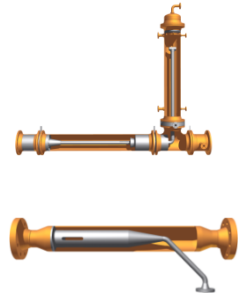
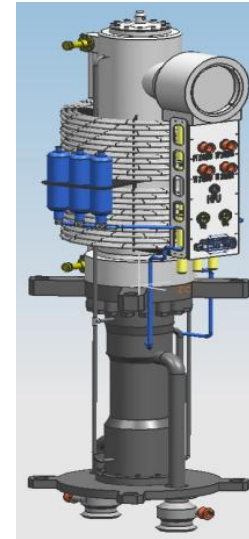
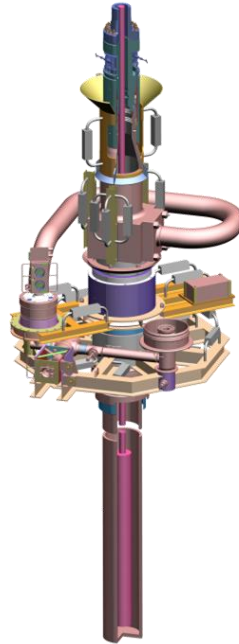
..conventional products...

components packed together making up a system



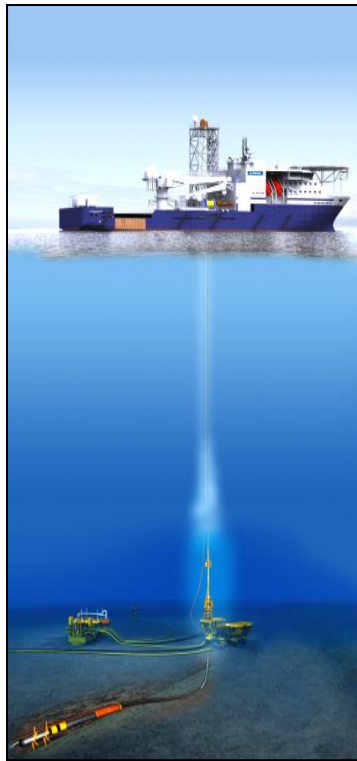
..Subsea IOR Products...

subsea compatible





..Subsea IOR services...



FMC WATCH

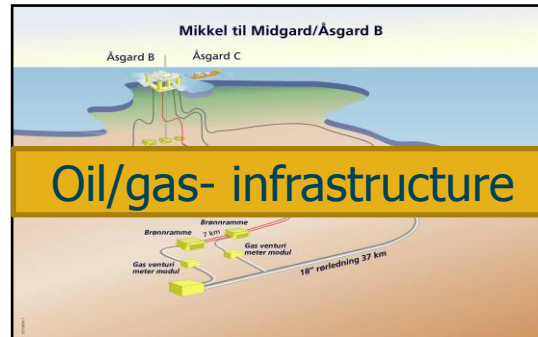
The FMC WATCH section contains four images: a 3D cutaway of a subsea wellhead, a control room with multiple monitors and a chair, a software interface for 'Maintenance Modification Repair' showing a grid and data, and a software interface for 'Flow Manager' showing various charts and data points.

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Maintenance Modification Repair

Flow Manager

Subsea Systems on NCS



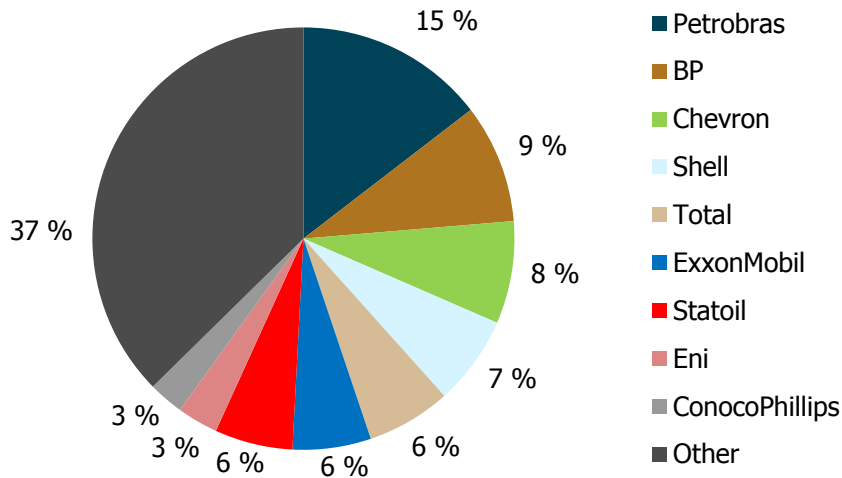
Operating environment

- HSE
- Access - logistic
- Cost

Close to 50% of oil production on NCS from subsea

Global Subsea Market – Strong Growth

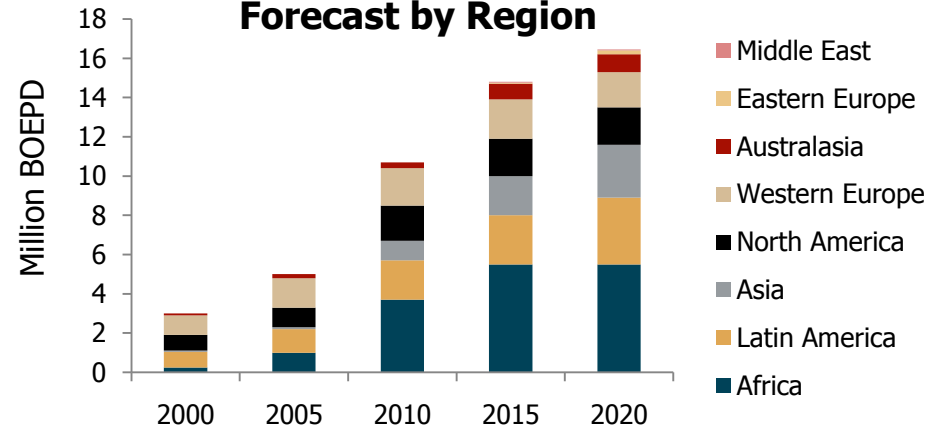
Subsea Tree Deliveries 2010-2014



Annual Average 480 - 720 trees

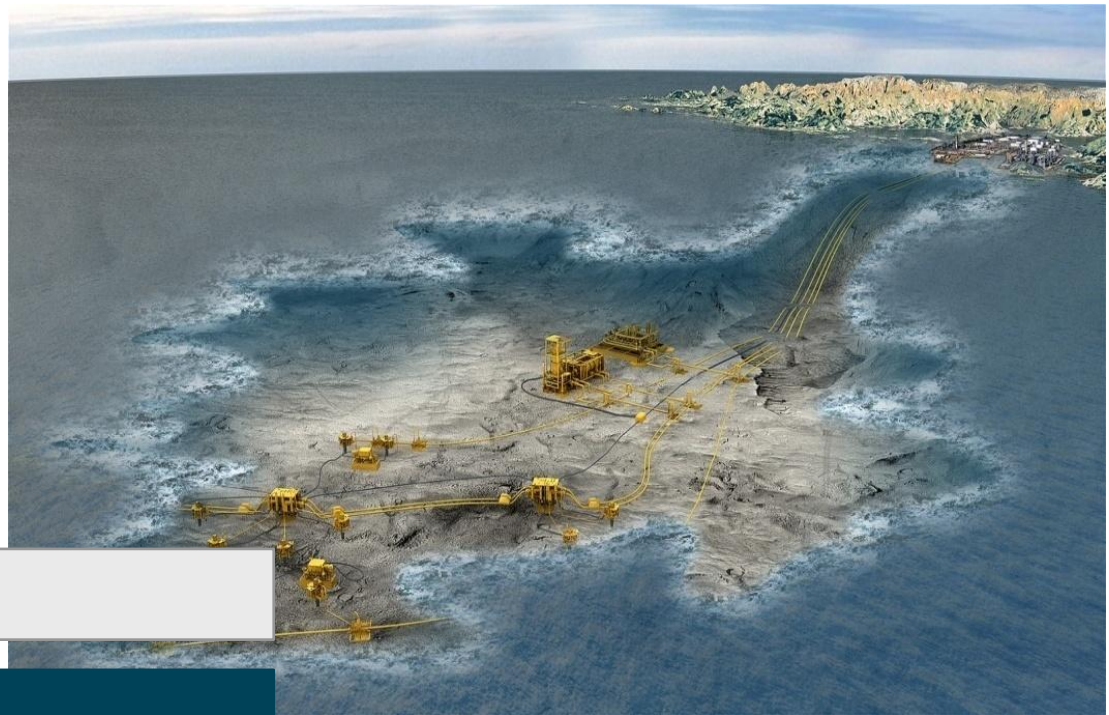
Source: Infield Systems Ltd.

Subsea Production Forecast by Region



Source: Datamonitor

Agenda



Subsea Systems

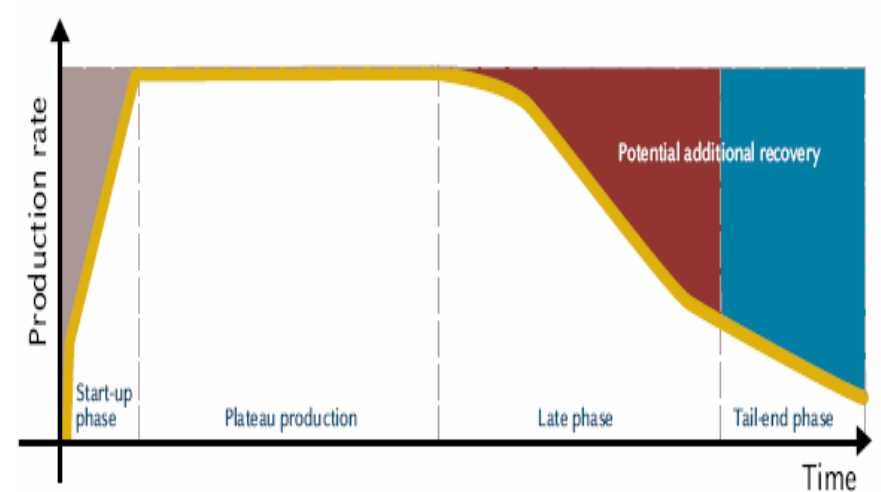
EOR - operational issues

Opportunities

Summary

Subsea EOR

- CO₂ injection
- WAG and SAWAG
- Polymerinjection
- Water with chemicals
- Low salinity water
- Use of tracers



Subsea EOR Operational Issues

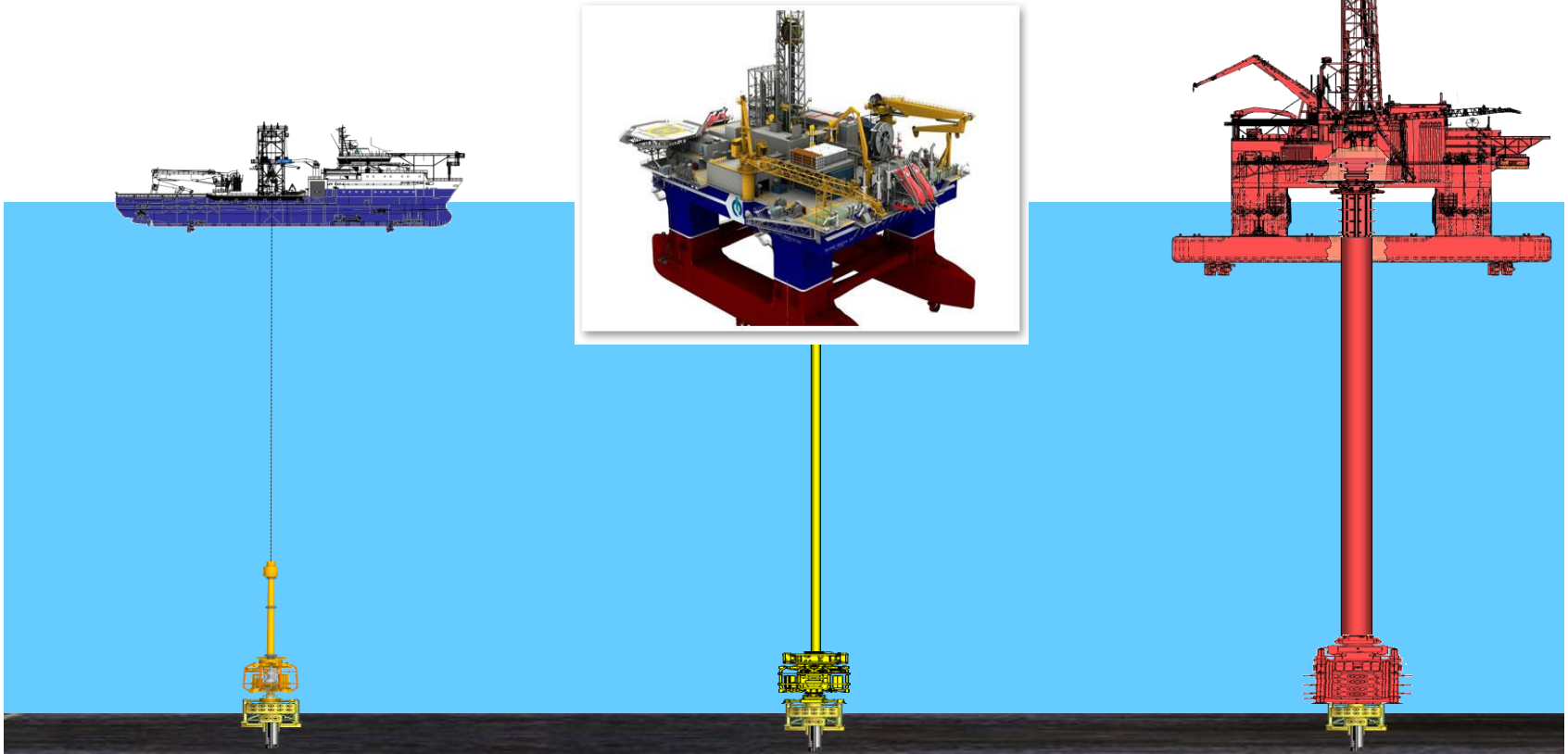
- Difficult and costly access to subsea wells
- Large well spacing
- Manifolding of production and injection lines
- Sea water readily available – fresh water costly
- Logistic and pumping of water and chemicals
- Controlling of flow – sampling?
- Environmental effects?

Cost of well access

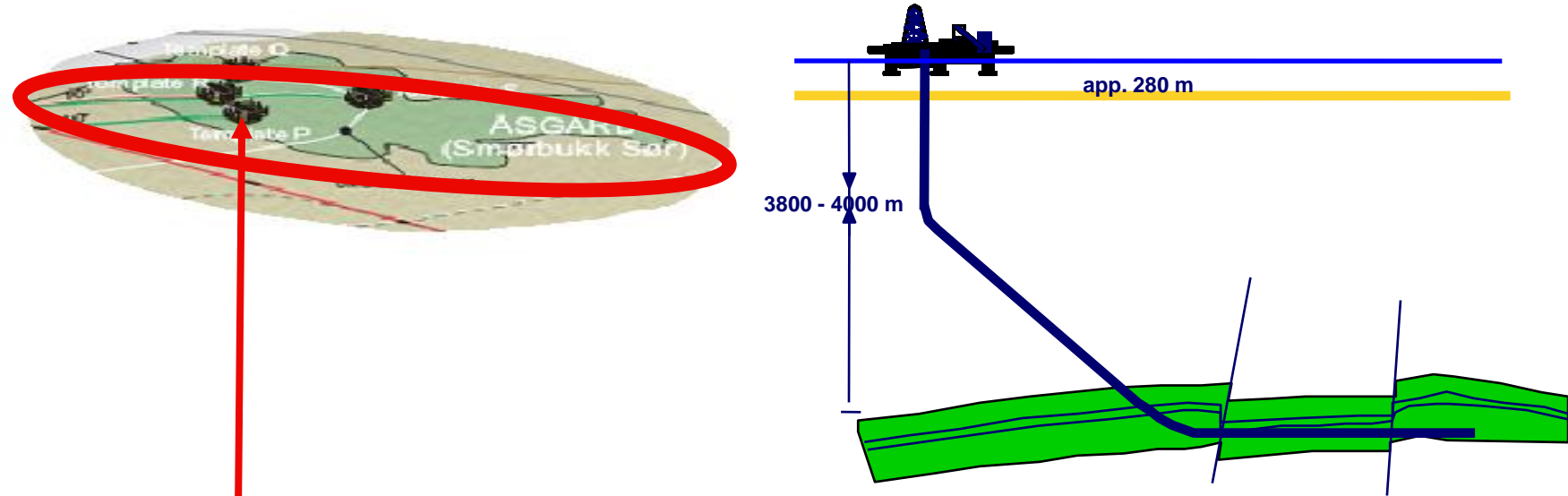
RLWI
=2 Mnok/d

Riser based intervention
=4 Mnok/d

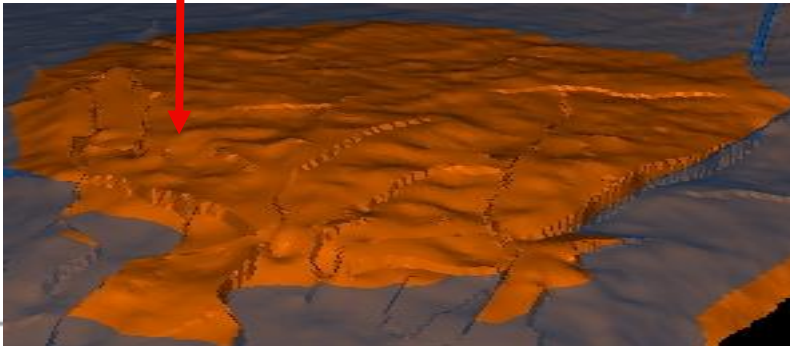
Drilling and completion
=6Mnok/d



Typical well spacing subsea



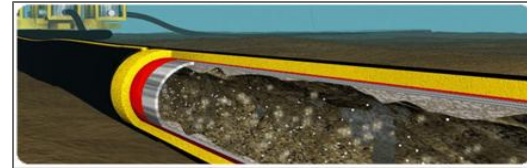
- * Length from 4700 m to 7600 mMD.
- * Horizontal in the reservoir section.



Online Flow Control Needed



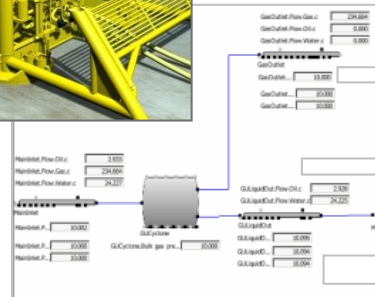
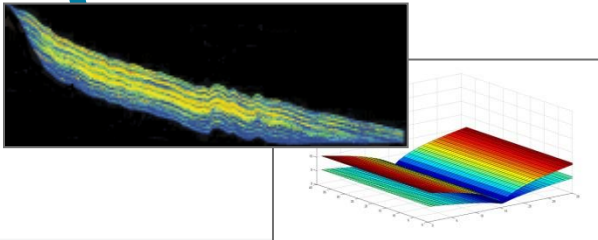
Dynamic Pipeline Simulator



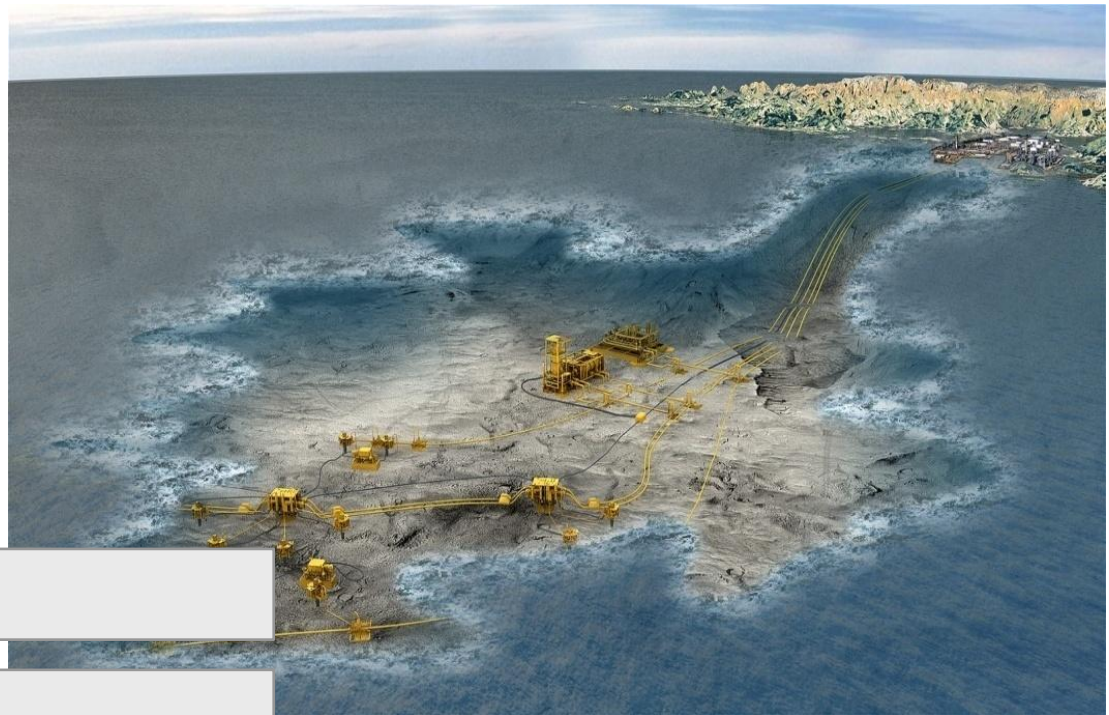
Dynamic Process Simulator



Dynamic near-well reservoir model



Agenda



Subsea System

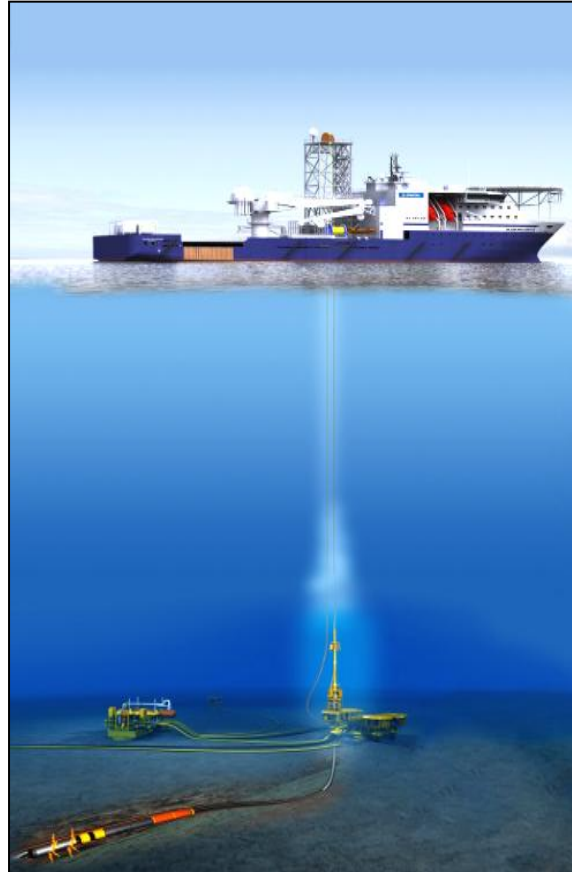
EOR – operational issues

Opportunities

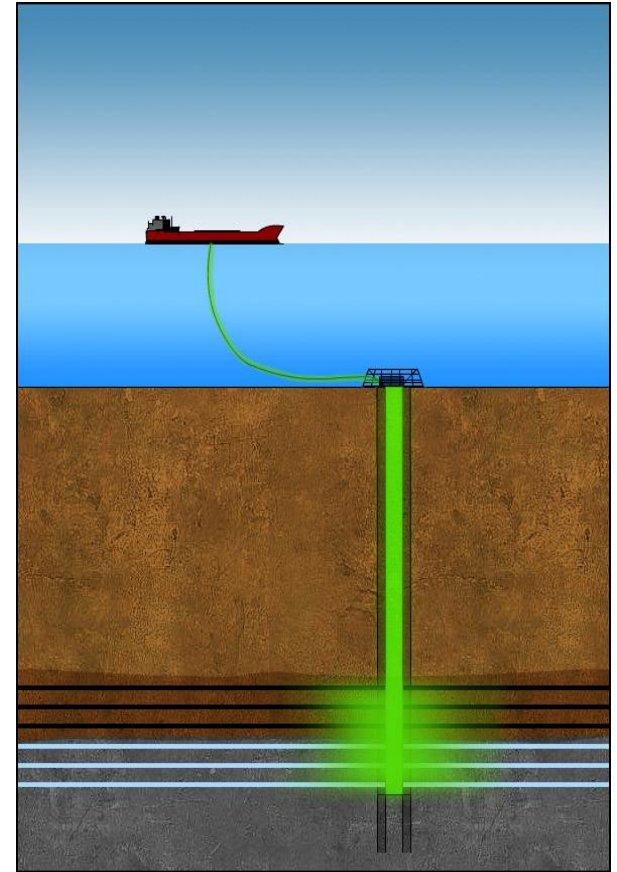
Summary

Combined Operations – Pumping and RLWIInitiate a Pilot?.....

- 3 vessels in operation
- Pumping and storage capacity for 500m³+
- Well access ok



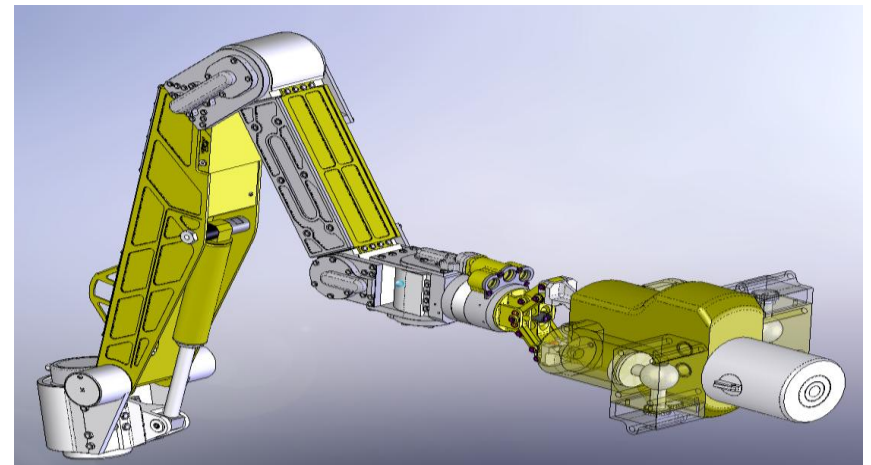
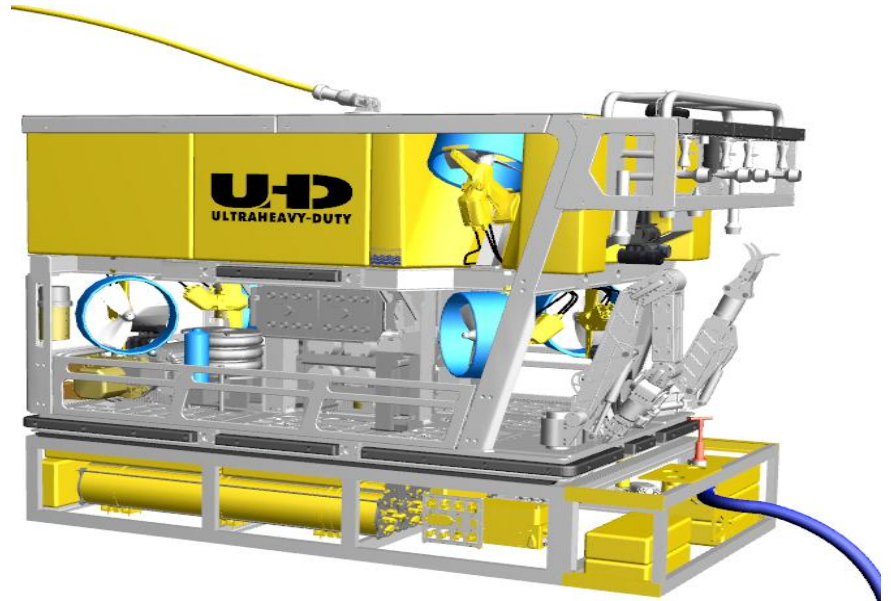
IOR



EOR

Subsea Sampling – New Technology

- Perform PVT sampling by use of an ROV
- IMR vessel can be used
- Provided for prevention of hydrate formation



Logistic Freshwater – Shuttle Tankers

- Capacity 750kbbbl
- In regular transit
- Relative low cost

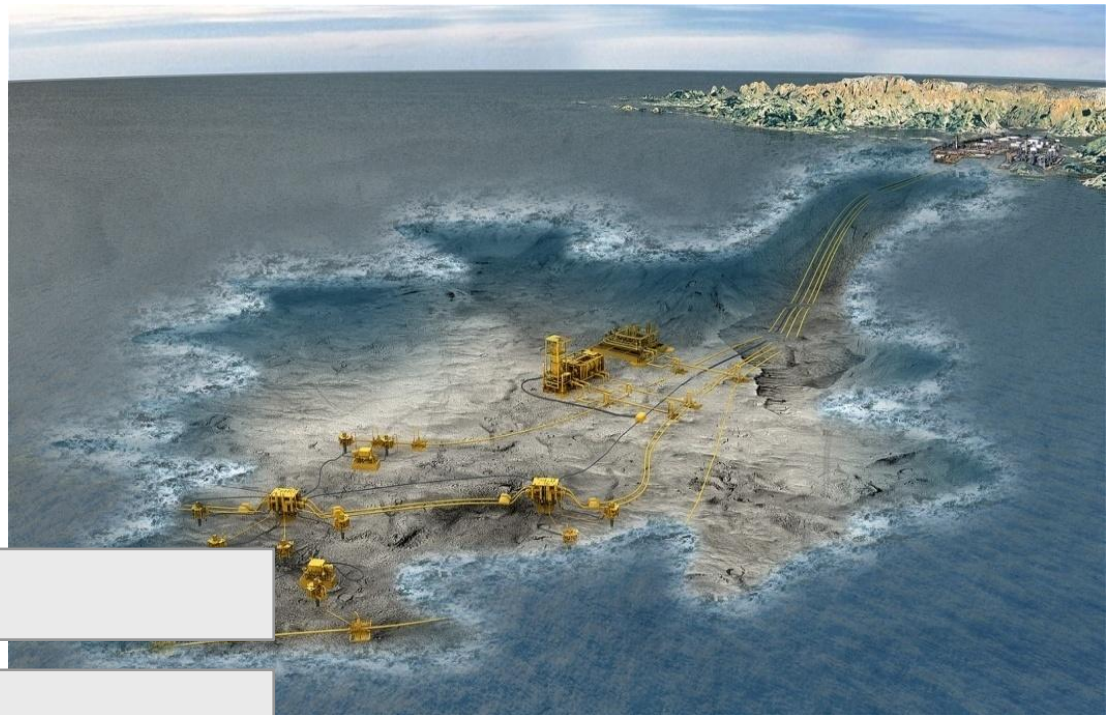


Multiphase meters w/ extended functionality

- Measure water salinity
- Detection of salt water break-through
- Measure injection flow by introducing one more DP cell



Agenda



Subsea System

EOR – operational issues

Opportunities

Summary

Summary

Status

- Subsea fields accounts for close to 50% of oil production on NCS
 - IOR services ongoing
 - EOR?

Subsea EOR

- Access to wells and cost a big issue
- Opportunities exists
 - Technology available
 - Pilots needed

Way forward

- EOR initiative must come from the operators/NPD
- The subsea industry ready to act!

An aerial photograph of an offshore oil and gas platform in the ocean. The platform consists of several interconnected structures, including a central processing unit and various smaller modules, all connected by a network of pipes and walkways. The surrounding water is dark blue with white-capped waves. In the background, a rocky coastline is visible under a clear sky. The text "Thank you!" is overlaid in a large, bold, yellow font in the center of the image.

Thank you!