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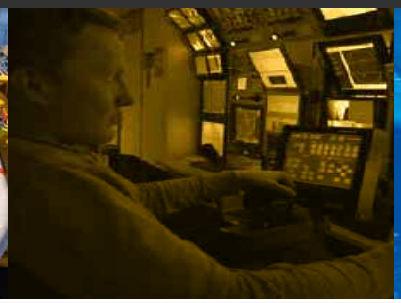
We put you first.
And keep you ahead.

Norwegian Continental Shelf's Role in Shaping the Subsea Industry - and Perspectives for the Future

Sola, 31.01.2013 - Arild Selvig
Sales and Marketing Director

25 years of subsea history on NCS
(1980-2005)





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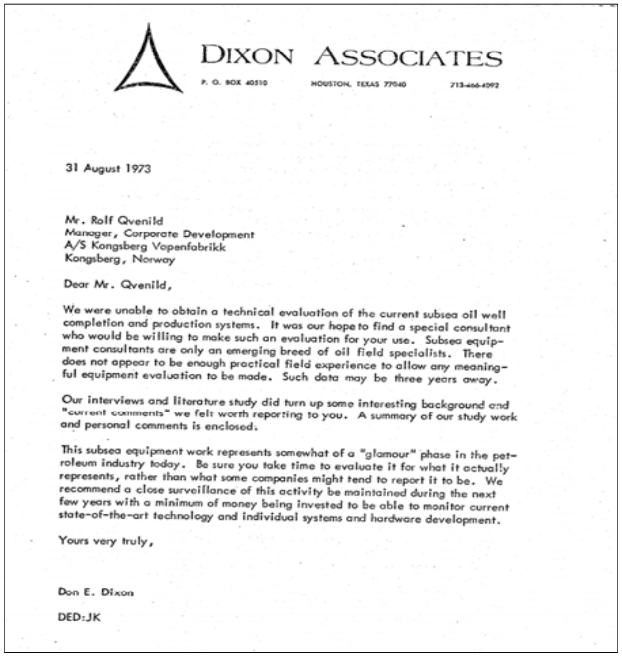
Kongsberg Våpenfabrikk – the early days

Consultancy Advice from 1973 about Subsea



DIXON ASSOCIATES

P. O. BOX 40510 HOUSTON, TEXAS 77040 713-466-4092

31 August 1973

Mr. Rolf Qvenild
Manager, Corporate Development
A/S Kongsberg Vapenfabrikk
Kongsberg, Norway

Dear Mr. Qvenild,

We were unable to obtain a technical evaluation of the current subsea oil well completion and production systems. It was our hope to find a special consultant who would be willing to make such an evaluation for your use. Subsea equipment consultants are only an emerging breed of oil field specialists. There does not appear to be enough practical field experience to allow any meaningful equipment evaluation to be made. Such data may be three years away.

Our interviews and literature study did turn up some interesting background and "current comments" we felt worth reporting to you. A summary of our study work and personal comments is enclosed.

This subsea equipment work represents somewhat of a "glamour" phase in the petroleum industry today. Be sure you take time to evaluate it for what it actually represents, rather than what some companies might tend to report it to be. We recommend a close surveillance of this activity be maintained during the next few years with a minimum of money being invested to be able to monitor current state-of-the-art technology and individual systems and hardware development.

Yours very truly,

Don E. Dixon

DED:JK

... **too little subsea expertise available** to give a meaningful evaluation ...

... Subsea equipment is somewhat **"glamorous"** within the petroleum industry ...

... We recommend **minium money to be invested** over the next years ....

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1979

1970 | 1980 | 1990 | 2000

ELF North-East Frigg

First subsea installation
on NCS

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1983

1970 | 1980 | 1990 | 2000

Testing Gullfaks Satellites

Gullfaks A Subsea

World’s first diverless subsea installation

Shipping Gullfaks Satellites

STATOIL

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1989

1970 | 1980 | 1990 | 2000

Development of
Subsea EH Control System;
Snorre Subsea

Control Modules for Snorre SPS

1991

1970 | 1980 | 1990 | 2000

STATOIL

Statfjord Satellite Project

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1995-1998

1970 | 1980 | 1990 | 2000

STATOIL Mobil elf KOS KONGSBERG OFFSHORE a.s

HOST Technology Development Project

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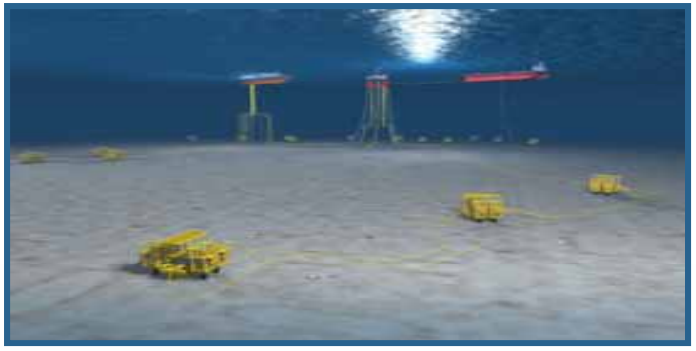
1995

1970 | 1980 | 1990 | 2000

Statoil Frame Contract

XT



Åsgard Field

STATOIL

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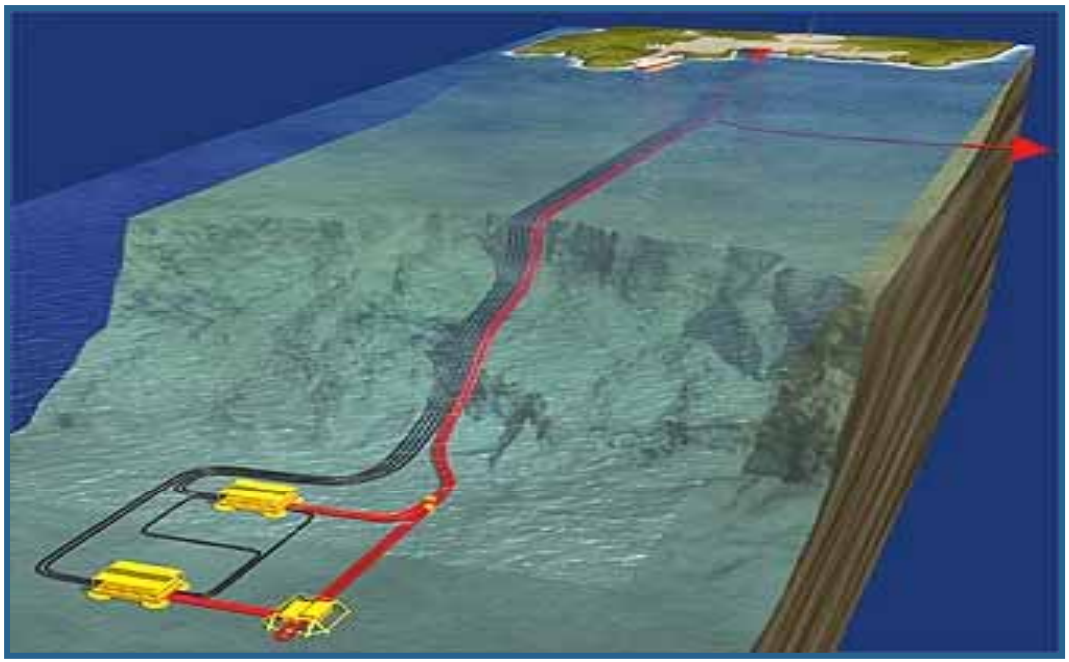
2003

1970 | 1980 | 1990 | 2000



Ormen Lange; Long distance subsea-to-beach

2007

1970 | 1980 | 1990 | 2000

STATOIL

Tordis SSB – World's first commercial application of subsea processing

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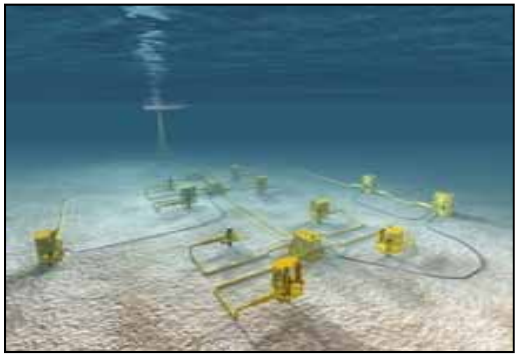
Emerging Subsea IOR Technologies

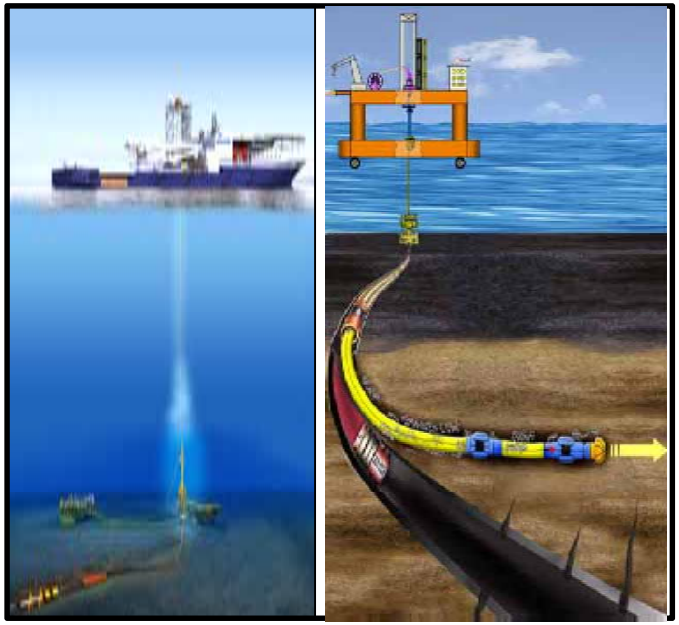
2005 -

1970 | 1980 | 1990 | 2000

Subsea Processing



Condition Performance Monitoring



Low-Cost intervention and side-track drilling

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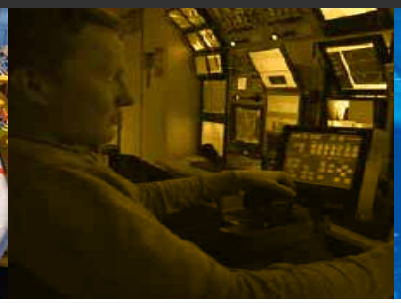
Next 25 years – where are we going?





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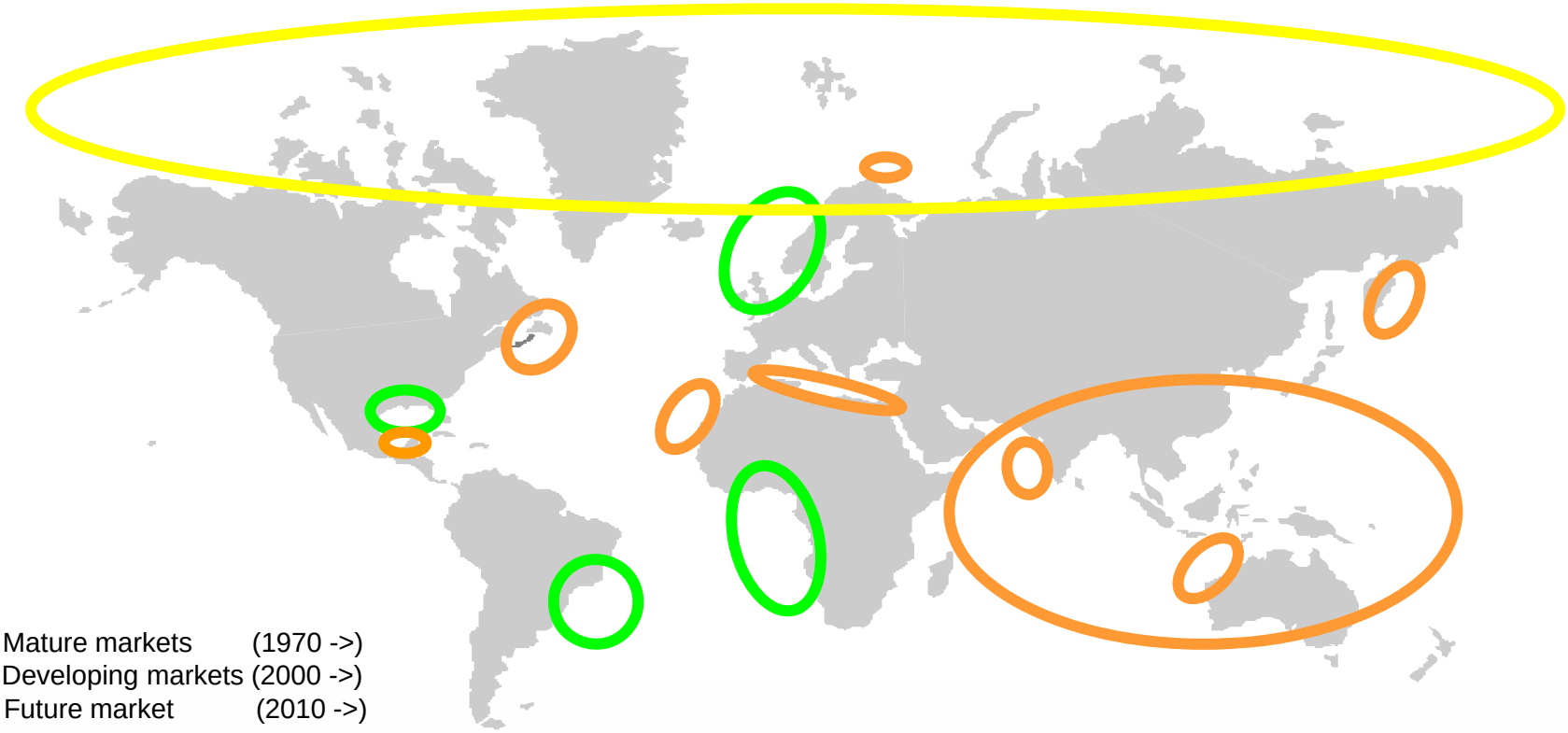
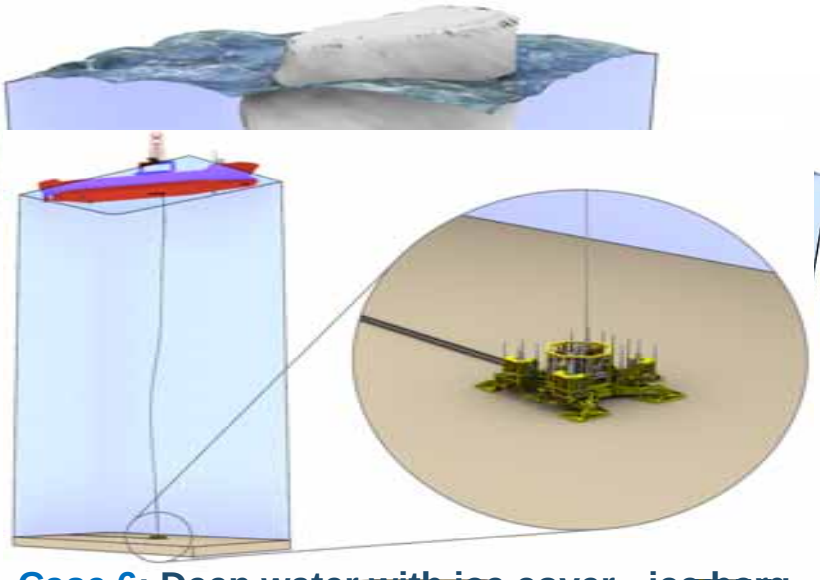
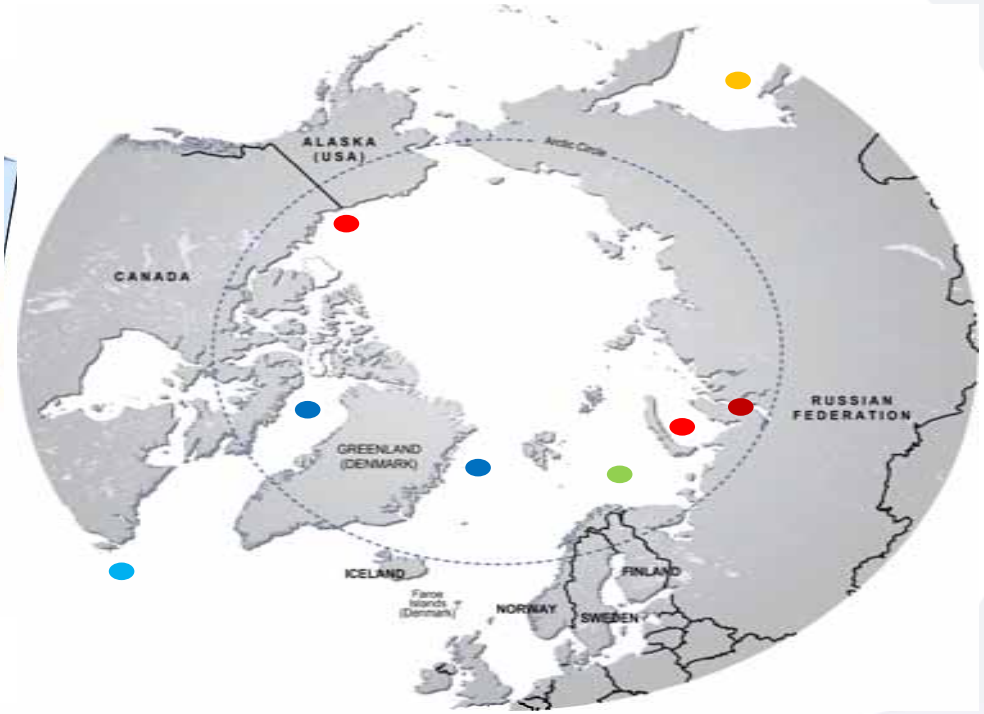
Arctic


Mature markets (1970 ->)
Developing markets (2000 ->)
Future market (2010 ->)

Arctic Field Development Scenarios





Case 6: Deep water with ice cover - ice berg presence (Baffin and Greenland case)

Case 5: Mobile with no ice cover - ice berg presence (Grand Banks case)

Case 4: Deep water with no ice overtrawlability; long step out control and power - All Subsea (Barents Sea case)

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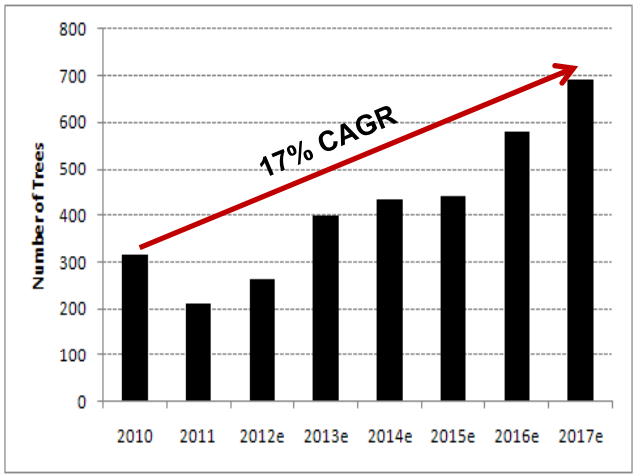
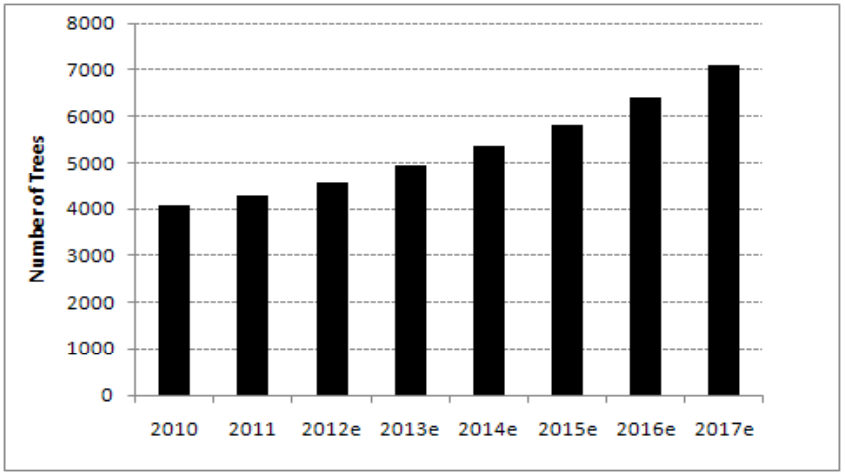
Subsea IOR

New trees installed - X



Accumulated trees installed – X^2



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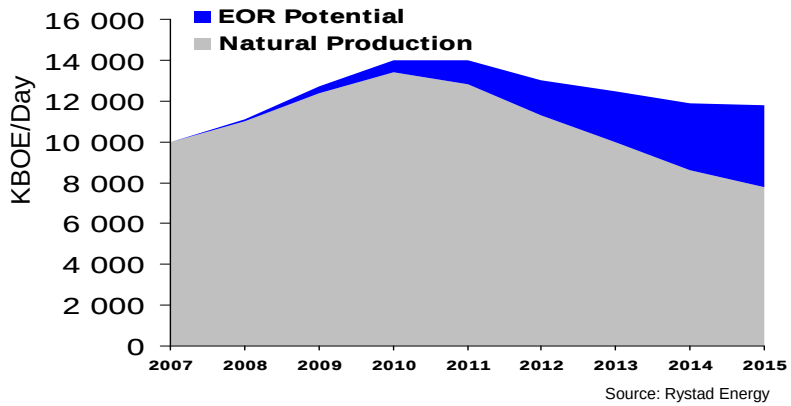
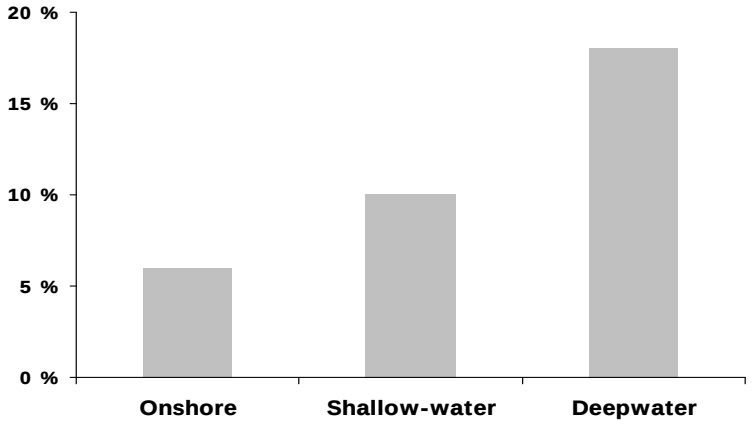
Subsea IOR

Subsea Field Production Profile



Source: Rystad Energy

Annual Field Decline Rates



Source: Cambridge Energy Research Associates (CERA); Jan 2008
Note: Includes natural decline plus EOR efforts
Onshore/Shallow water field declines
lower due to EOR technologies

Implications

- Increased opportunities to low-cost subsea drainage points
- Increased need for seabed pumping and/or processing
- Increased need for well interventions
- Increased need to perform preventive maintenance and refurbishment

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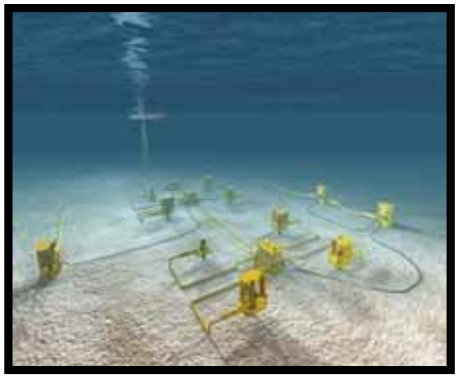
Subsea IOR Building Blocks

IOR

Low cost drainage points



Processing

- Separation
- Pumping/Boosting
- Compression

Subsea Service

- Riserless Light Well Intervention
- Production Management
- Condition monitoring
- Life of field services

Subsea Service - still a Fragmented Business Model …

Subsea Onshore Base

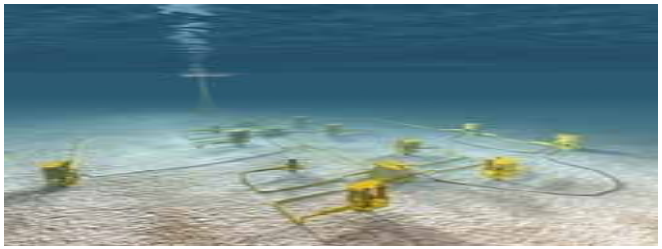
Subsea Interventions

Landing String

TT Sidetrack Drilling

Conventional Well Intervention

Maintenance & Repair



Rental Tool Mgmt

Customer Training

ROV's

Operation Support

Light Well Intervention

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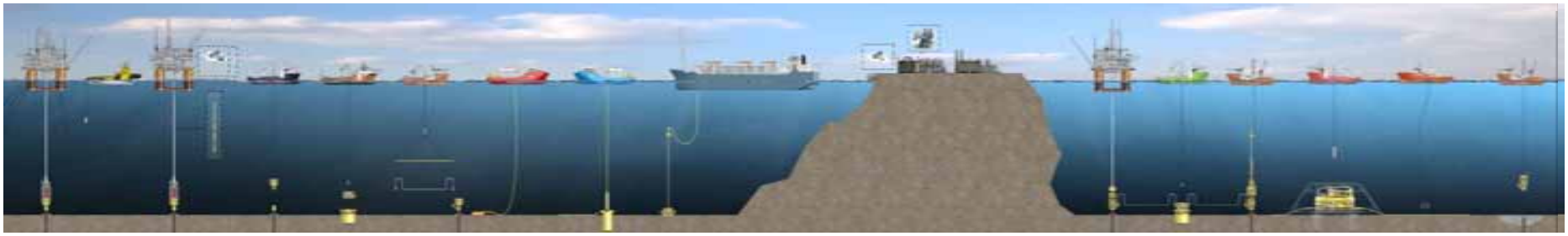
Subsea Service Value Chain

Drilling and Completion Support | Install | Operate and Manage | Maintain Production and Increase Recovery | Plug and Abandon



Subsea Service Platforms

Installation	Asset Management	Production Optimization	Equipment Intervention	Well Access

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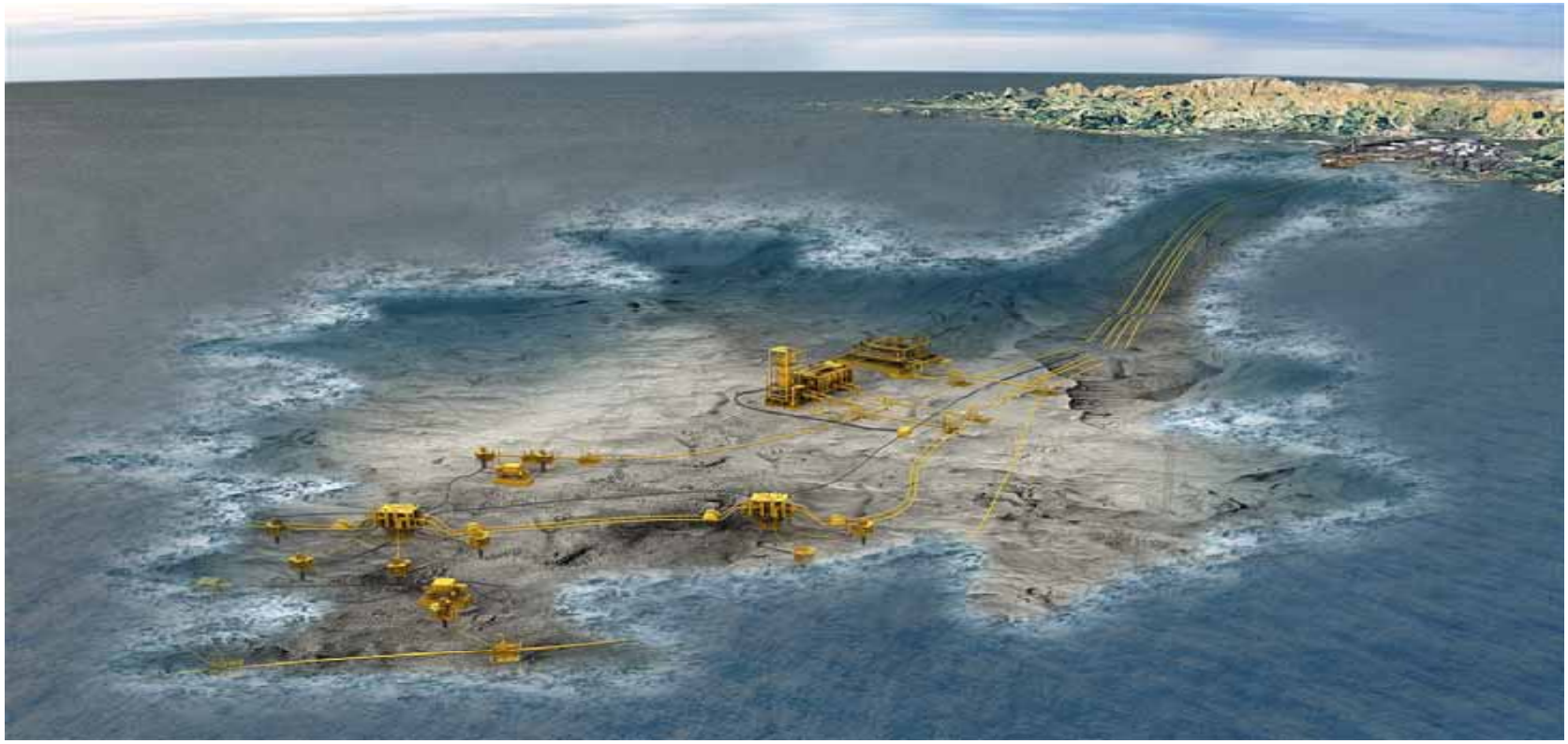
All Subsea – The Future Field Development Scenario



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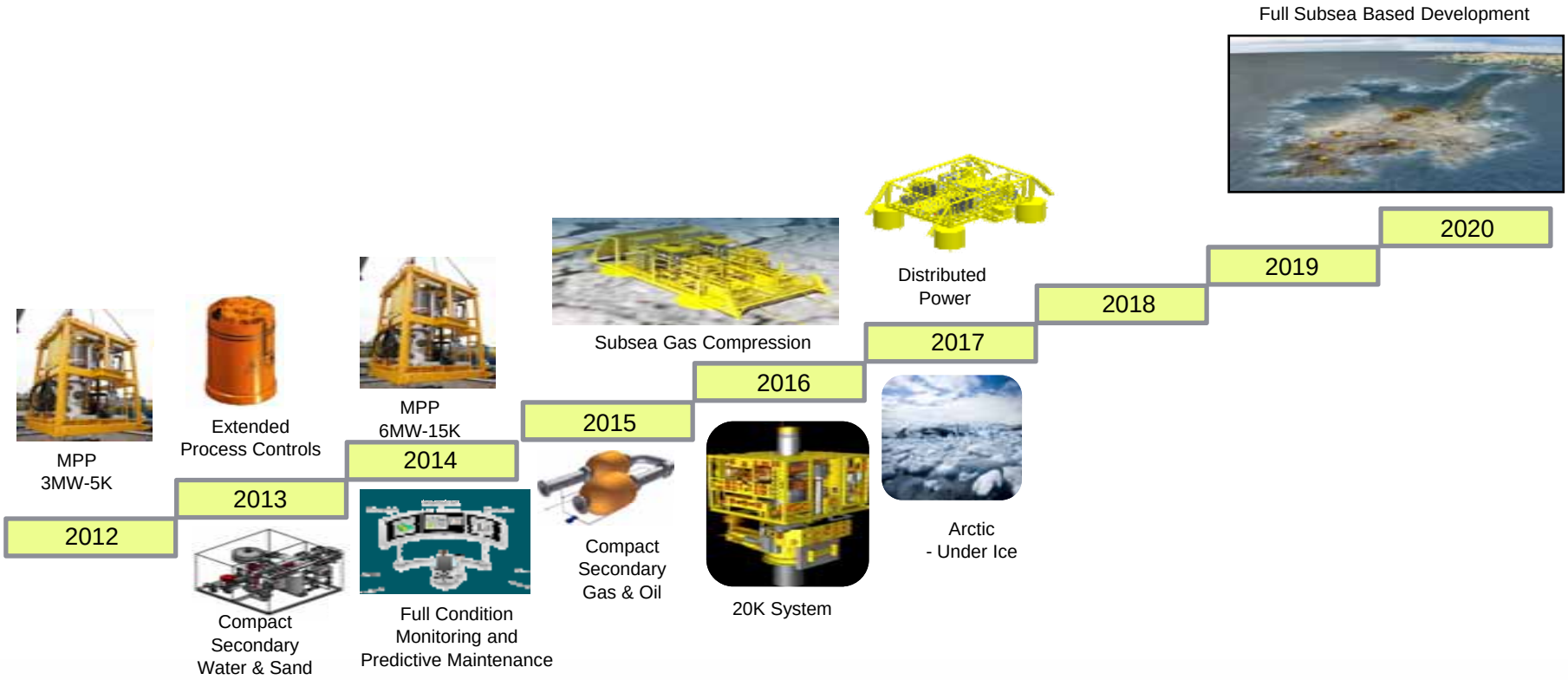
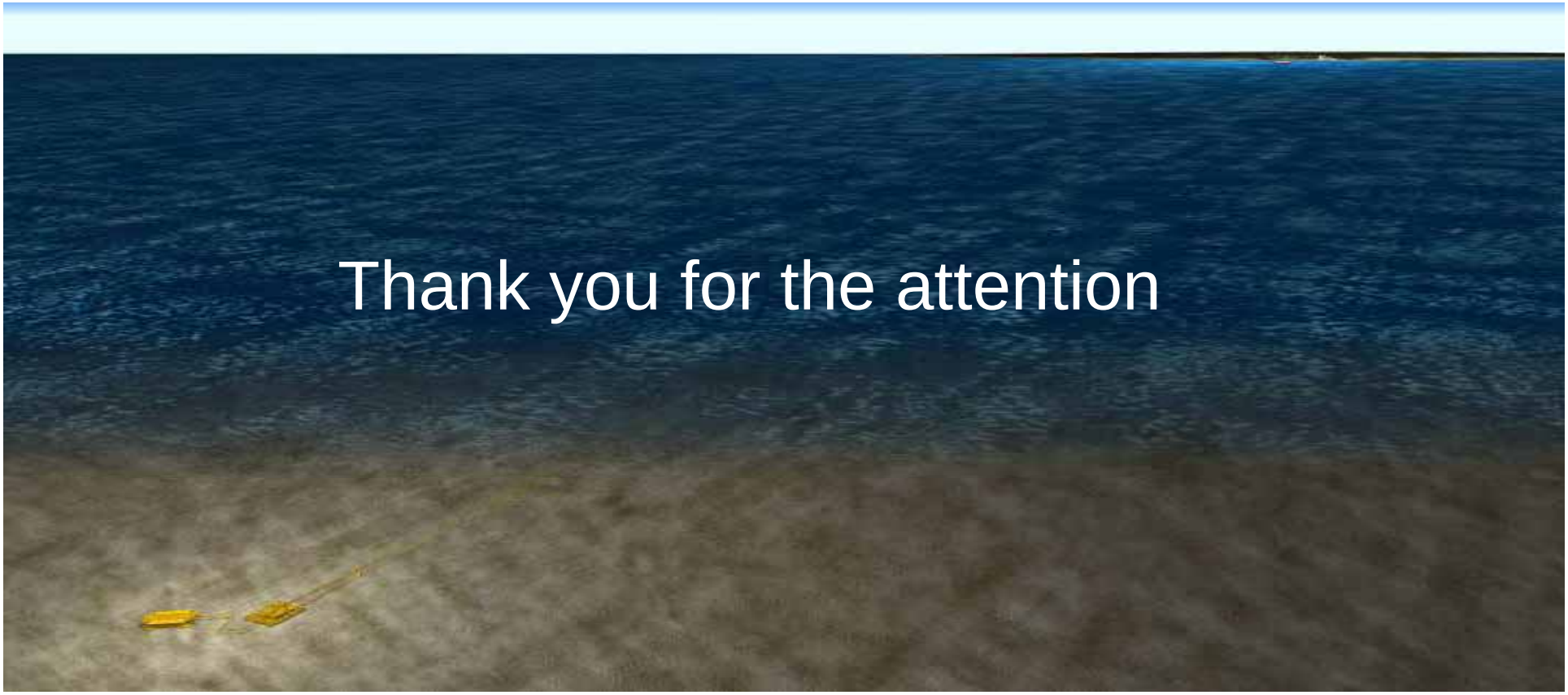
Subsea Technology R&D Ladder



Thus - the Subsea R&D Wishlist is still long ….

- Low-cost subsea drainage points
  - MPD systems in mature reservoirs (with significant pressure gradient variations)
- Cost-effective interventions
- Pumping, separation and compression on the seabed
  - Higher duty, secondary separation, heavy oil, deep-water systems
- Long-distance communications
- High-voltage power and transmission systems
  - Distributed power systems
  - Local power generation
- All-electric systems
- HPHT technologies
- 24/7 CPM and Production Management systems including centralised advice and support functions



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