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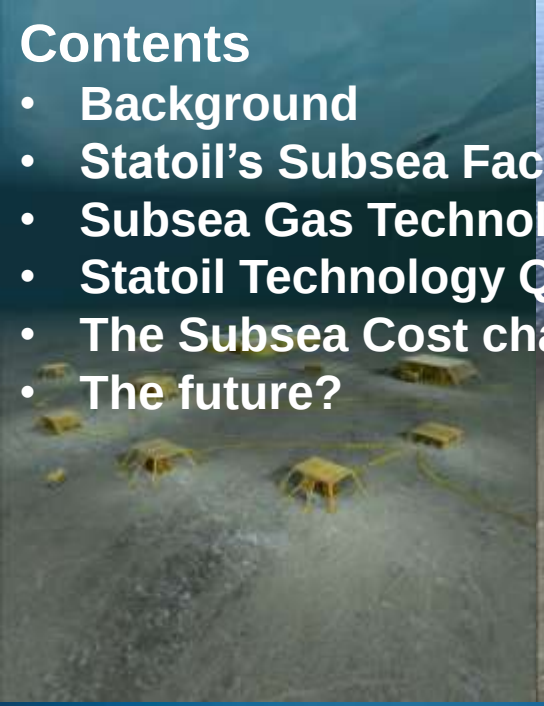

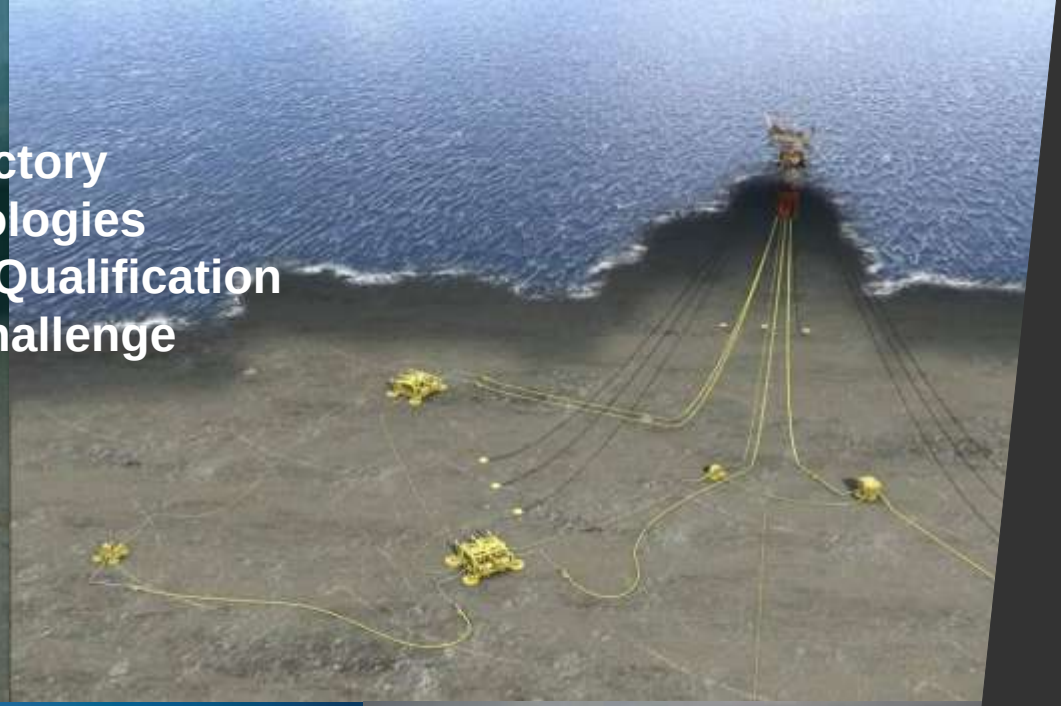

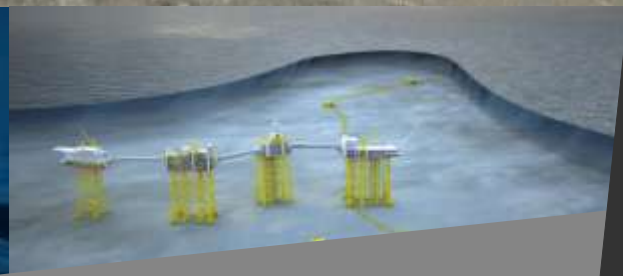

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Trondheim Gas Technology Conference

# Statoil Subsea Factory

June 4, 2014

Hege Rognø, VP Statoil RDI Subsea & Gas Treating Technologies

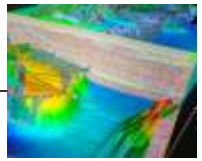
# A technology focused upstream company

Corporate strategy

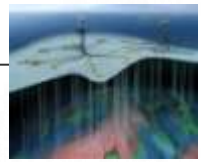
- Continue portfolio management to enhance value creation
- Revitalise NCS with high value barrels
- Apply technology to expand in unconventionals
- **Production above 2.5 mill boe/day after 2020**
- Create value from a superior gas position
- Develop a leading global exploration company
- Build material positions in 3-5 offshore business clusters

Technology strategy

Seismic imaging and interpretation



Drilling and well construction



Reservoir characterisation

Subsea technology

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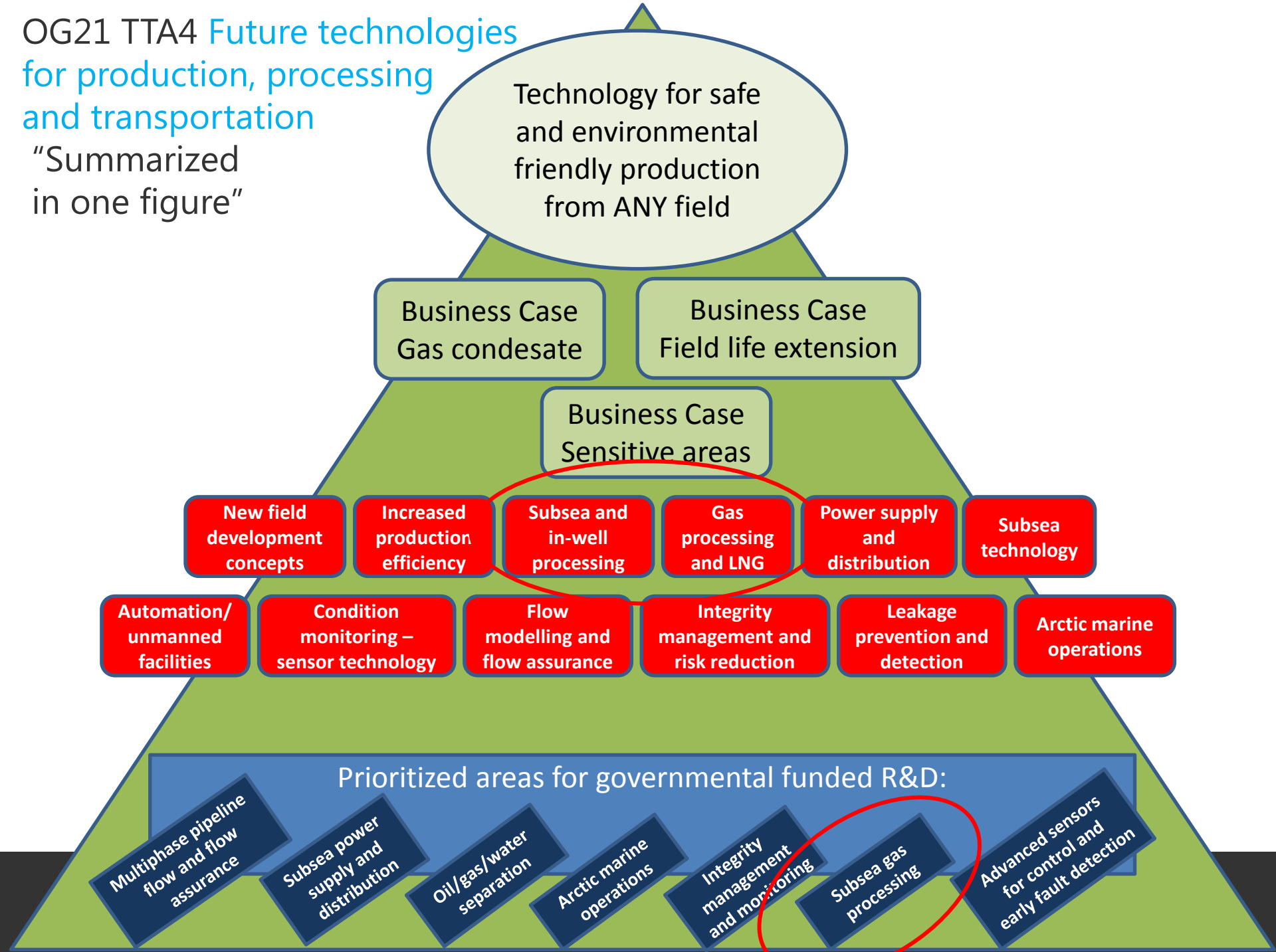
# OG21 TTA4 Future technologies for production, processing and transportation

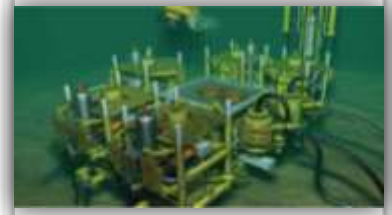
"Summarized in one figure"



# Statoil's subsea future

- building on the existing toolbox

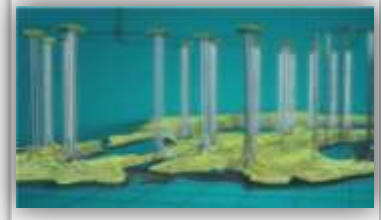
**Lufeng**
**Multiphase pumping**



**Troll**
**Water separation**

**Tordis**
**Separation and**

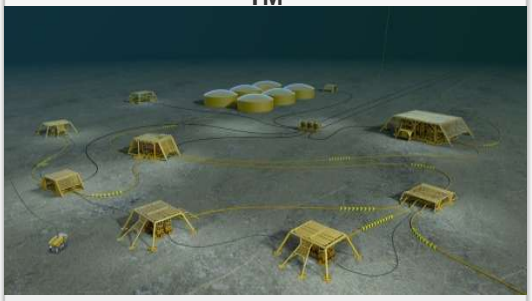
**Tyrihans**
**Sea water injection**



**Gullfaks**
**Compression**

**Åsgard**
**Compression**

**The Statoil Subsea Factory™**



- Realise by 2020
- Towards 60% recovery
- Improved CAPEX OPEX HSE



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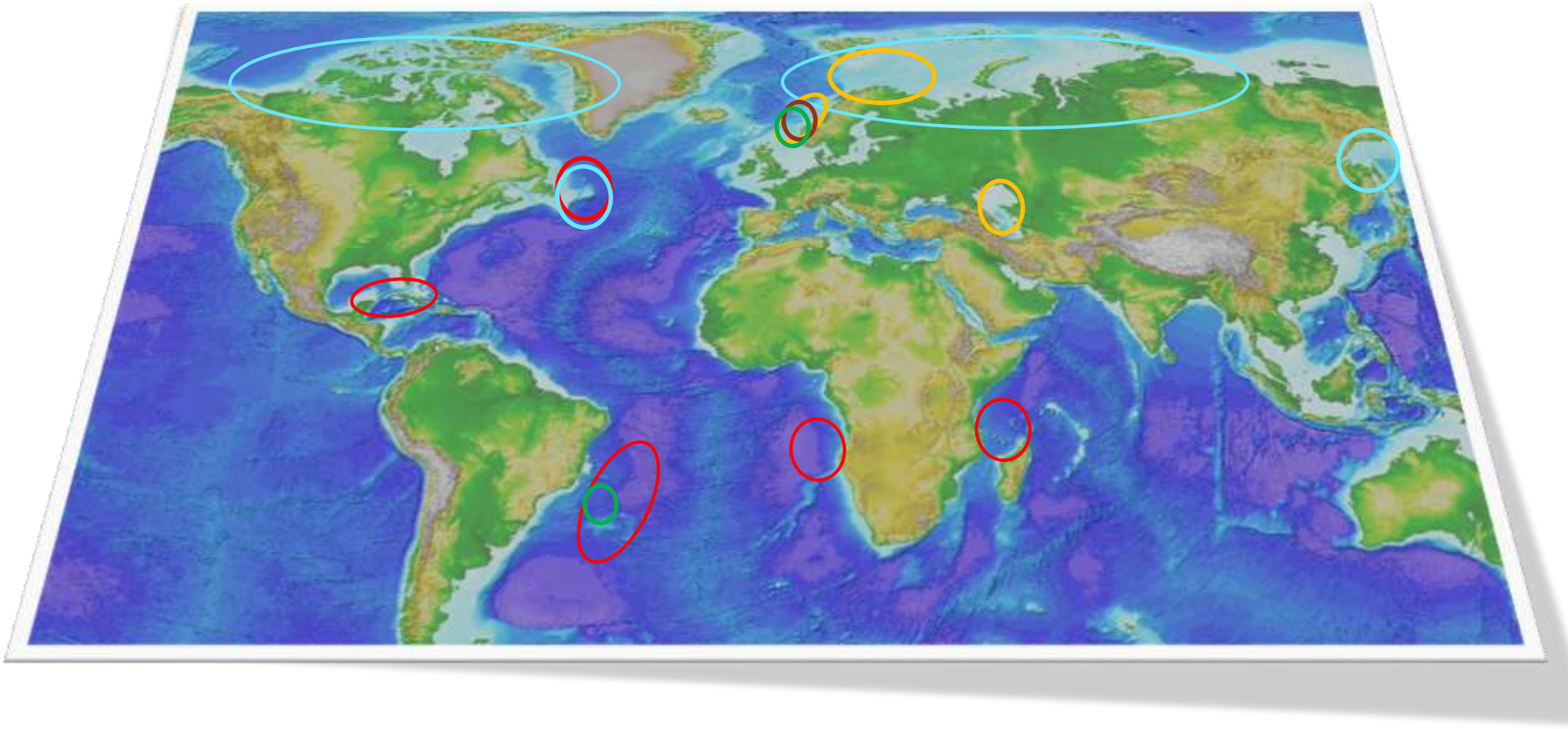
# Longer, deeper, colder, heavier and older





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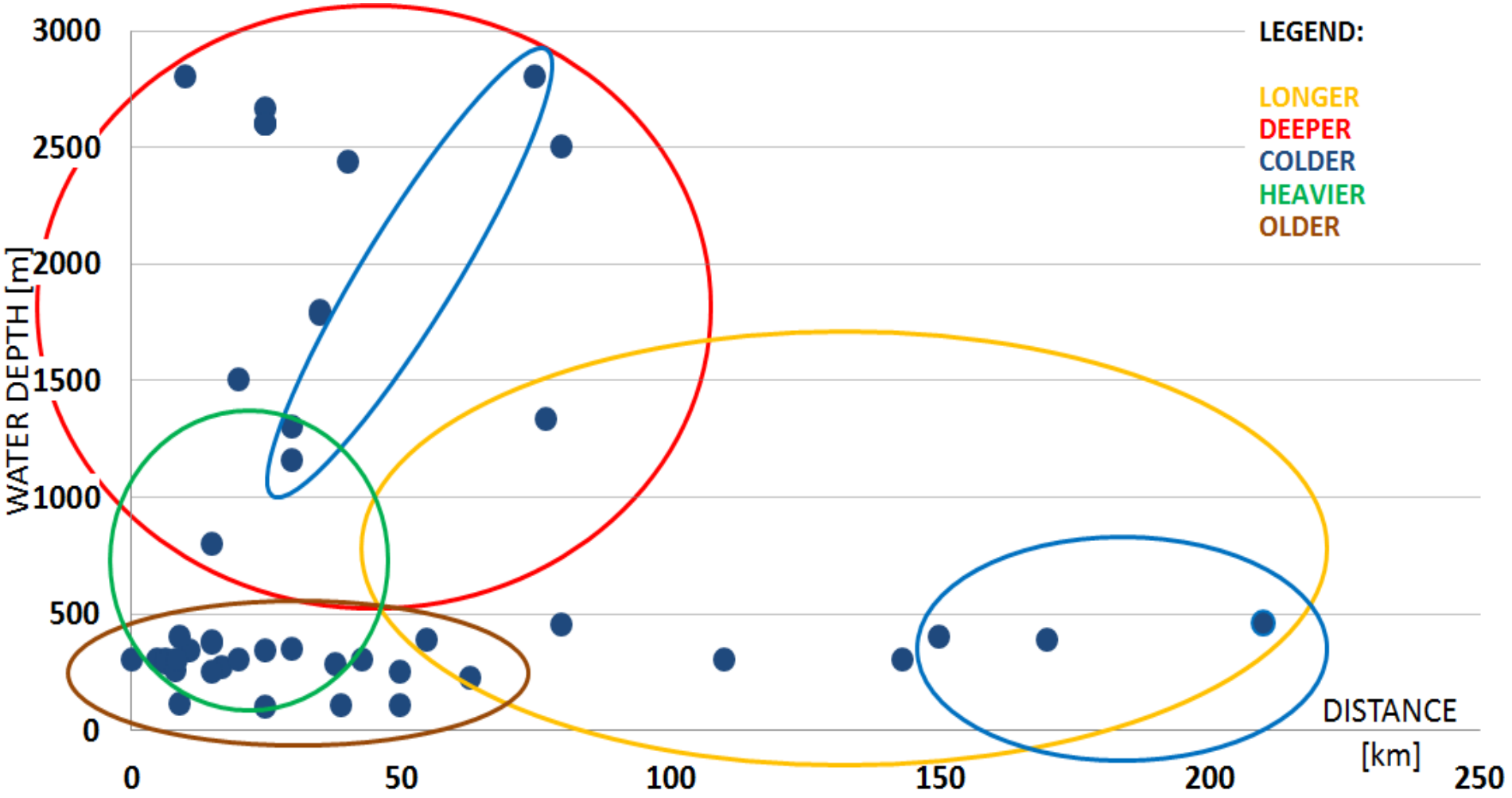
# Potential subsea factory developments



# Defining Subsea Factory

Short term

Medium term

Long term

New / improved factory building blocks

BROWNFIELD FACTORY
FOR INCREASED RECOVERY

SIMPLIFIED BOOSTING | SIMPLIFIED COMPRESSION | WATER SEPARATION & INJECTION | POWER DISTRIBUTION | INTERVENTION

SUBSEA-TO-HOST FACTORY
FOR DE-BOTTLENECKING

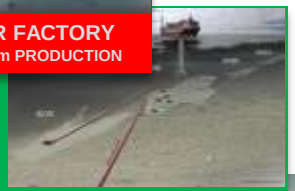
SUBSEA FIELD CENTRE | GAS TREATMENT | SEA WATER INJECTION

EXTENDED REACH FACTORY
FOR LONG TIE-BACKS

LONG DISTANCE OIL TRANSPORT | HIGH CAPACITY BOOSTING

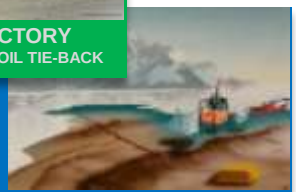
DEEP WATER FACTORY
TO ENABLE 3000m PRODUCTION

ARTIFICIAL LIFT ESP & DUAL BOOST | COMPACT SEPARATION | DEEPER INSTALLATION & IMR



HEAVY OIL FACTORY
TO ENABLE VISCOUS OIL TIE-BACK

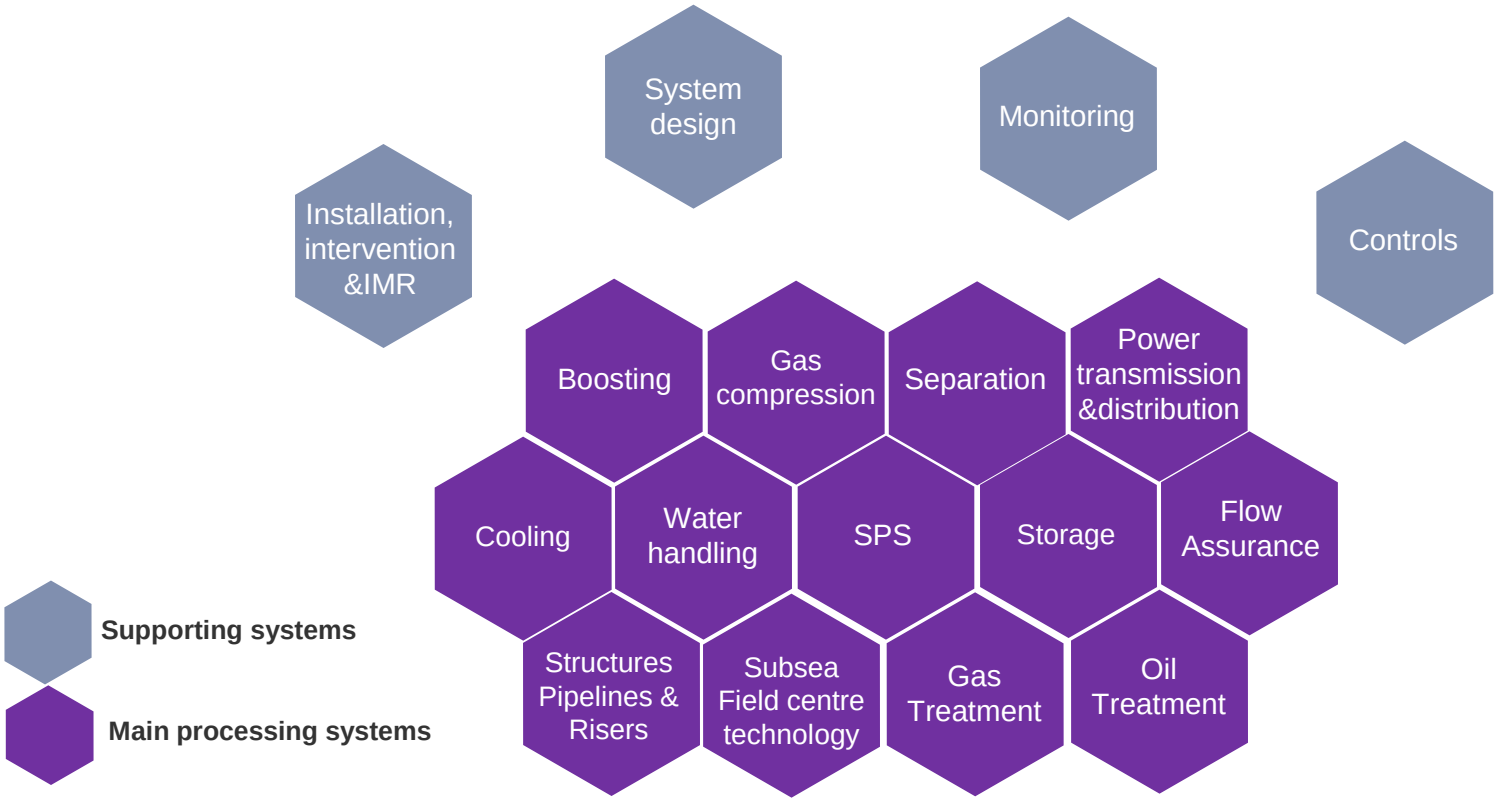
HIGH VISCOSITY BOOSTING



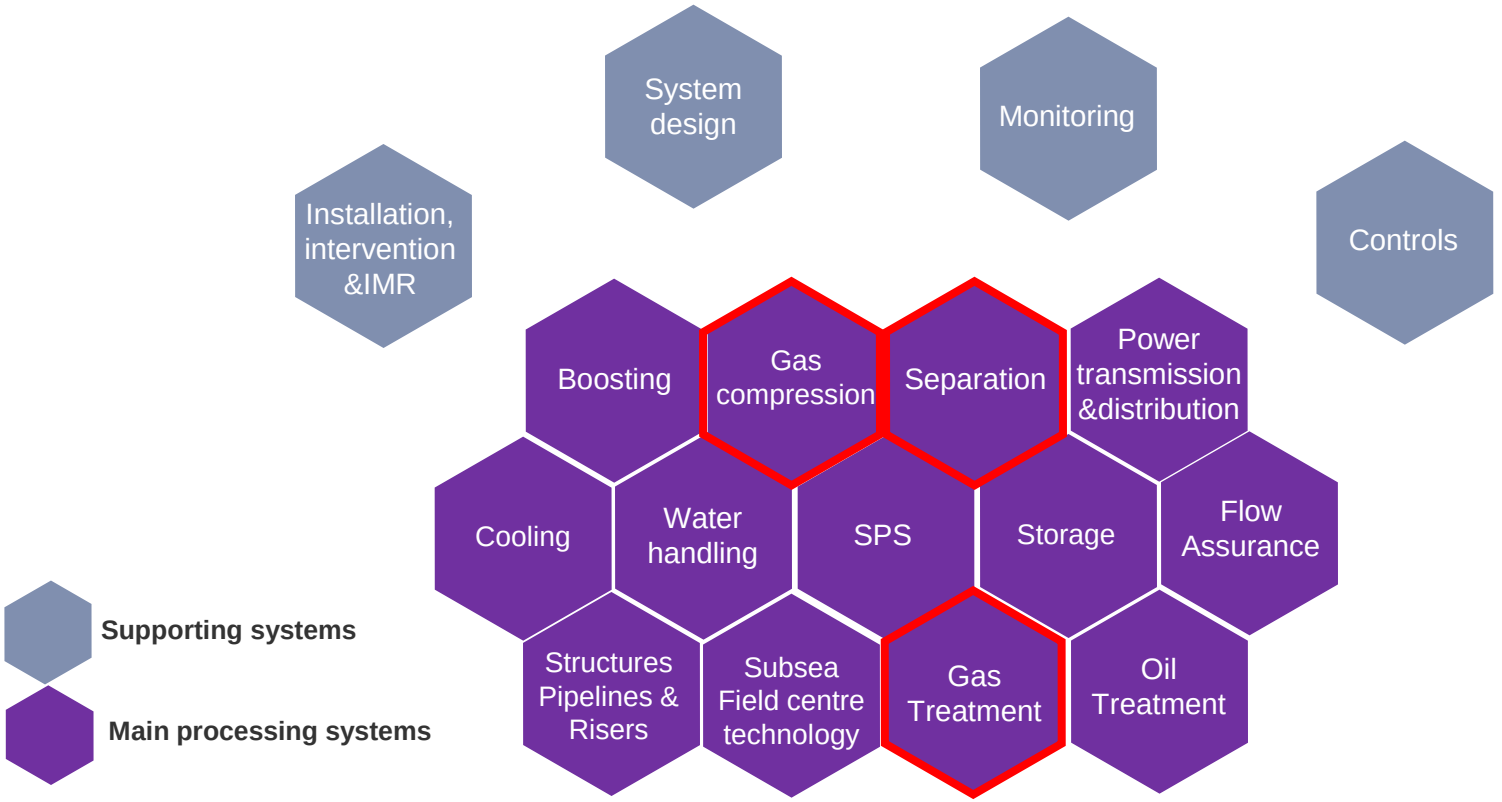
ARCTIC FACTORY/
SUBSEA TO GAS MARKET

OIL TREATMENT | OIL STORAGE & OFFLOADING

# Subsea Factory- Key Building Blocks

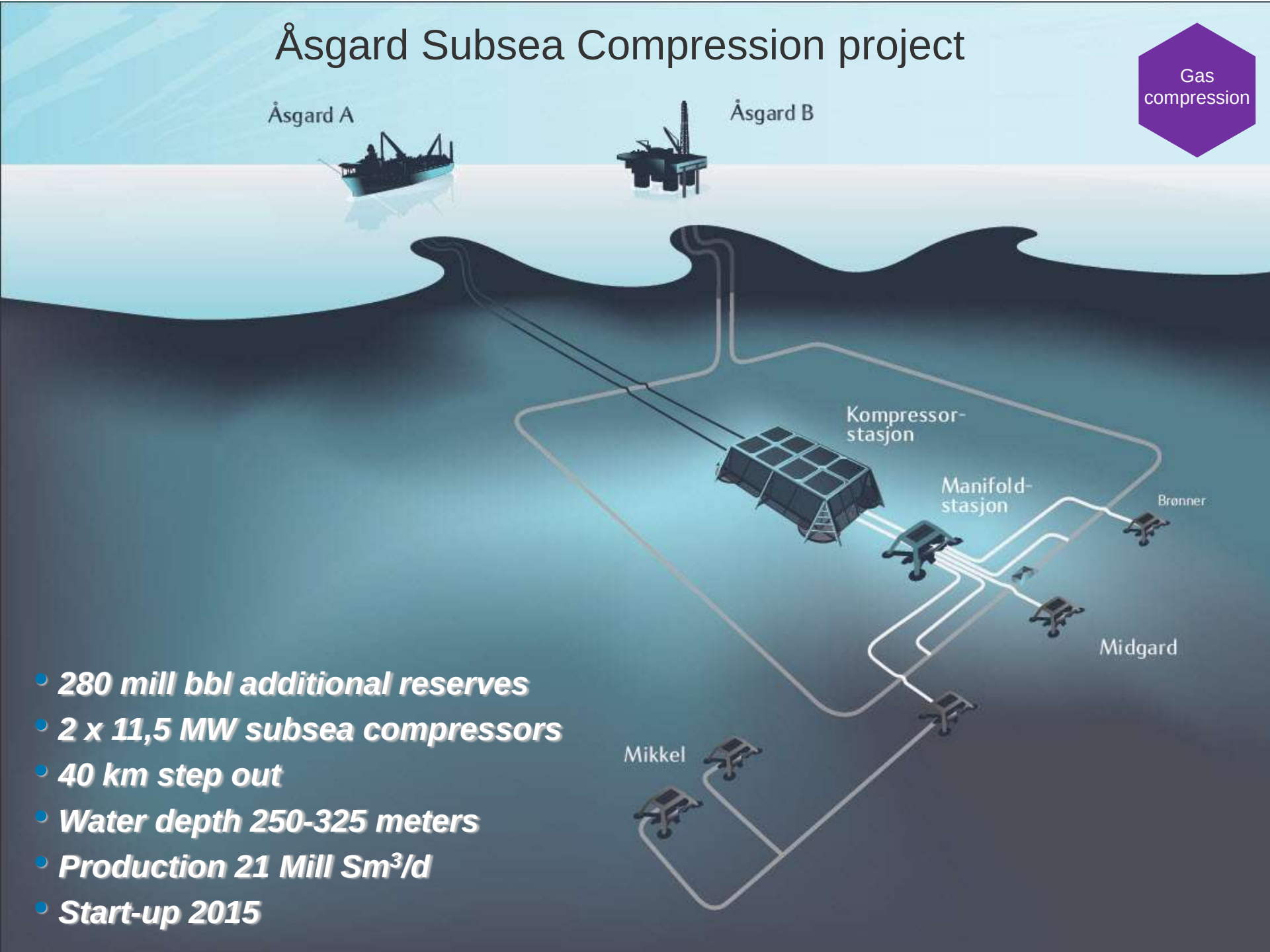


# Subsea Factory- Key Building Blocks



# Åsgard Subsea Compression project

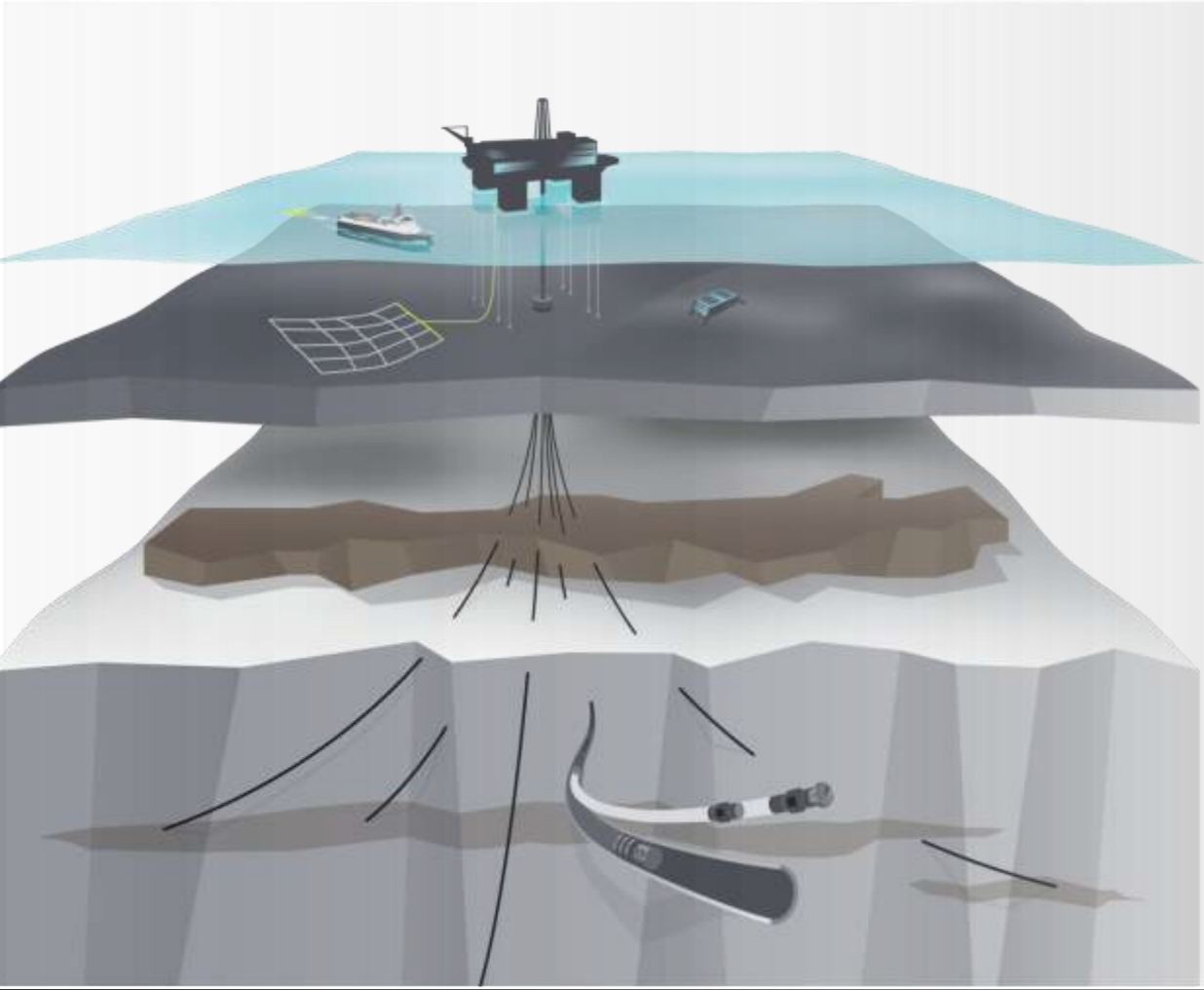
Gas compression

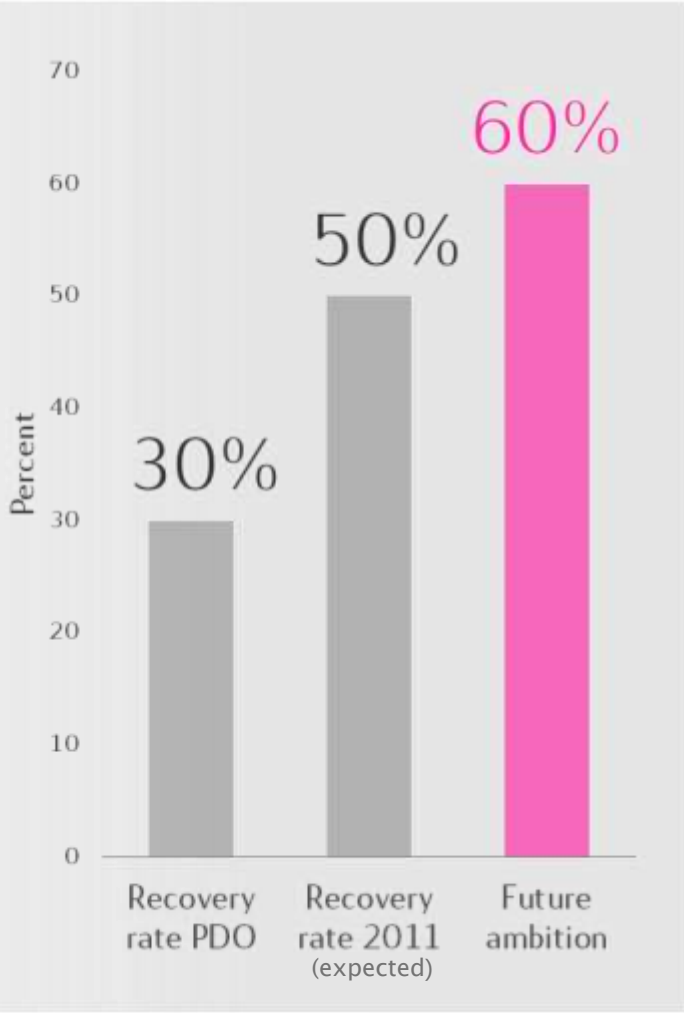



- ***280 mill bbl additional reserves***
- ***2 x 11,5 MW subsea compressors***
- ***40 km step out***
- ***Water depth 250-325 meters***
- ***Production 21 Mill $Sm^3/d$***
- ***Start-up 2015***

Gas compression

# World class recovery rate



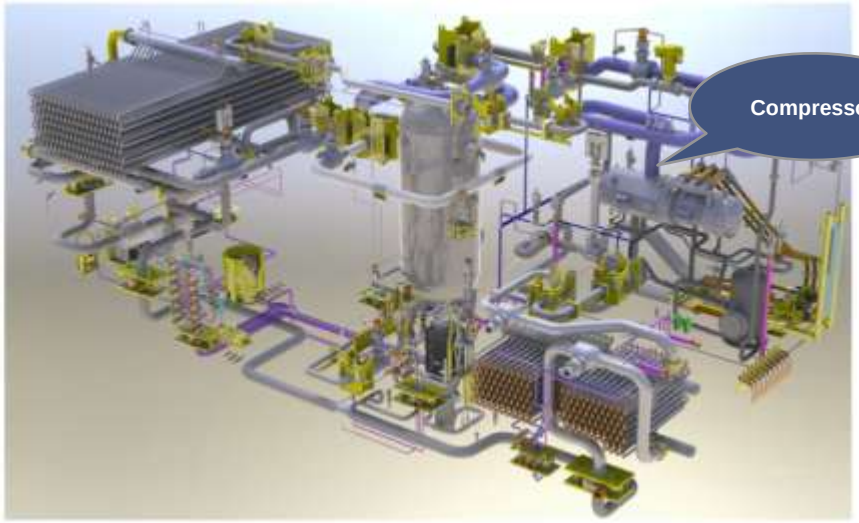


Key building block

# Subsea compression

Gas compression

## Åsgard Subsea Compression Project

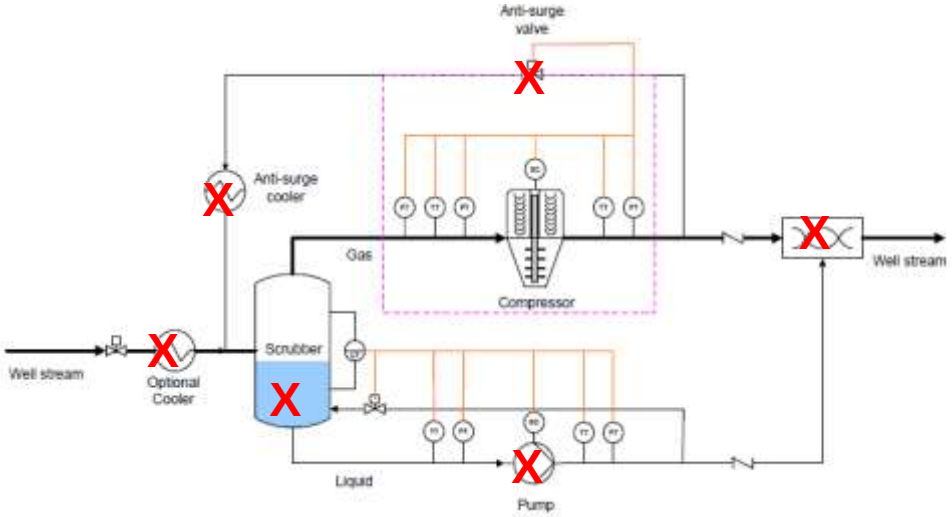


# Wet gas compression

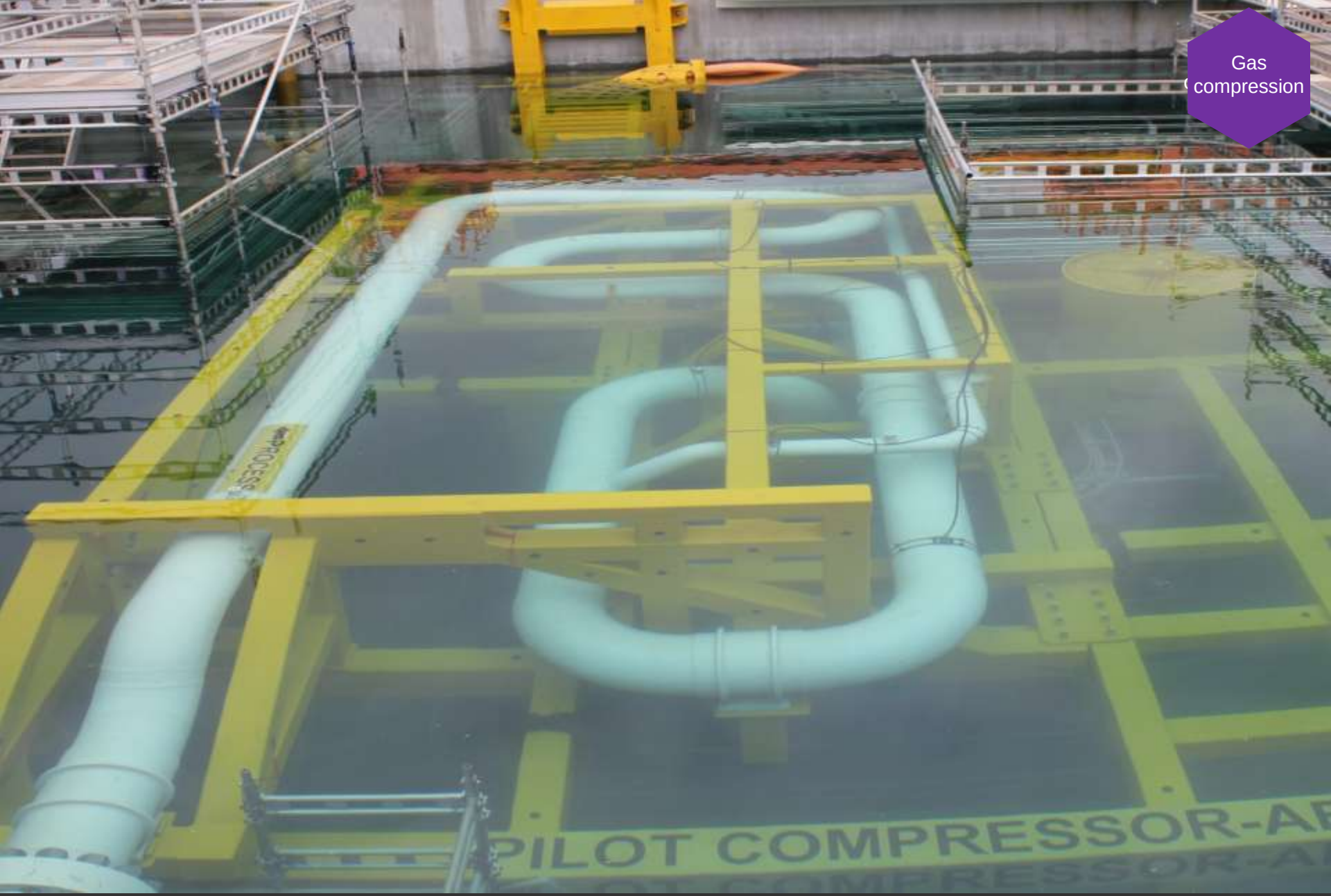
Gas compression

**Goal:** Simplified subsea compression system based on centrifugal compressor technology (high dp, high flow)

First generation




Next generation



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# Persistence is key

Subsea compressor technology evolution

Gas compression

**1997-1998**

Master& PhD thesis Multiphase pressure recovery in diffusers

**2003-2004**

Multiphase full scale test on K-lab compressor

**2003-2006**

Screening of droplet erosion and corrosion of impeller materials & PhD: EOS for multiphase compression

**2004**

Multiphase flow in axial compressor blades

**2005**

Feasibility study Siemens, Man Turbo& PhD: Surge behavior of multiphase centrifugal compressor

**2006-2007**

Motor and AMB insulation screening, particle erosion, droplet erosion, corrosion

**2008**

Installation of subsea compressor at K-lab

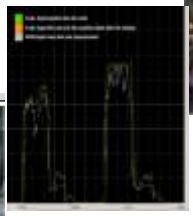
**2006-2008**

Design of motor penetrator

**2009**

Subsea compressor technology qualified after 3150 running hours

**2006-2009**



Pulse monitoring system

**2007-2010**

PhD: Motor insulation system

**2011**

Subsea compressor testing at K-lab completed after new 3150 hrs

**2012**

New subsea compressor test loop to be completed at K-lab Q3 2012.

**2015**

Startup of subsea compressors at Midgard/Mikkel 2015

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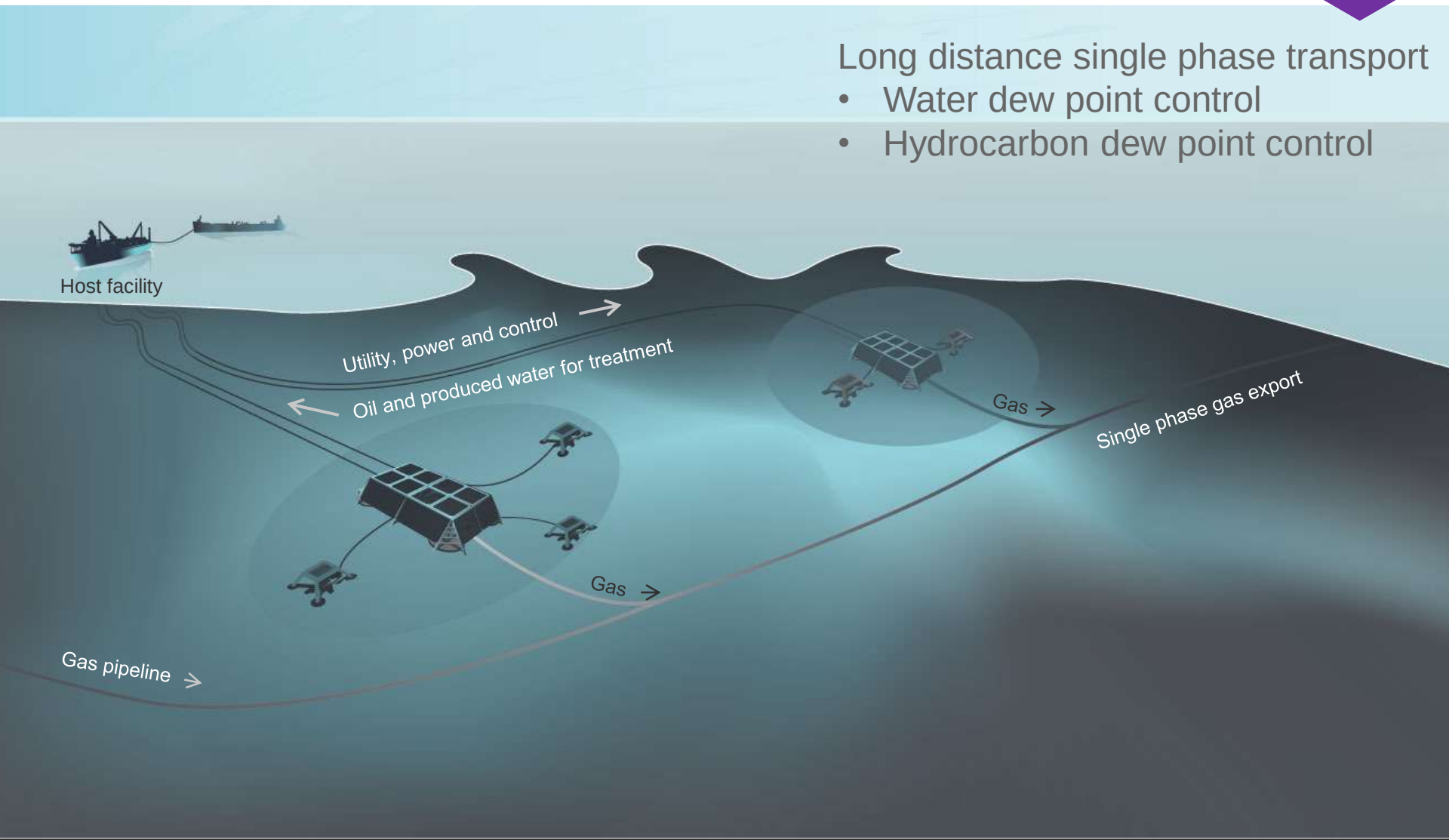
# Subsea gas processing

Gas Treatment

Long distance single phase transport
- Water dew point control
- Hydrocarbon dew point control

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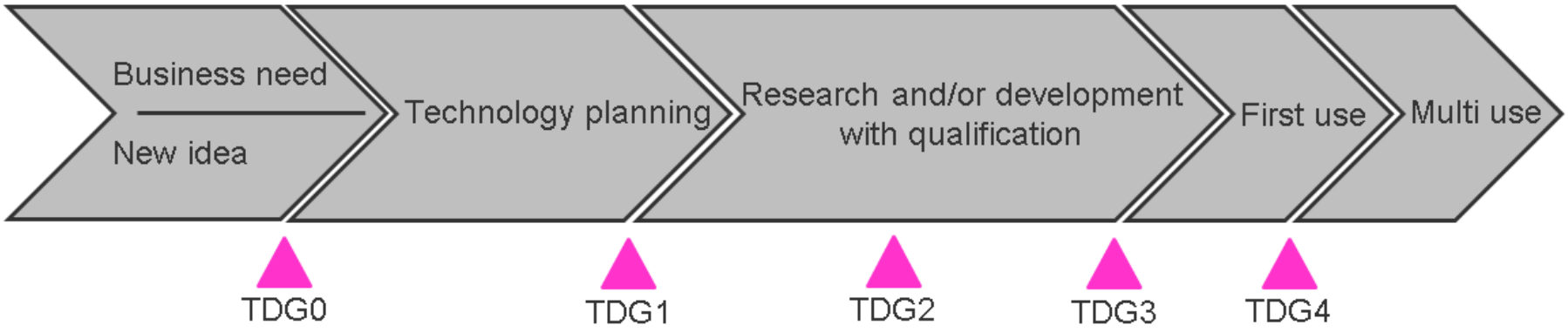
# Statoil Technology development and implementation?

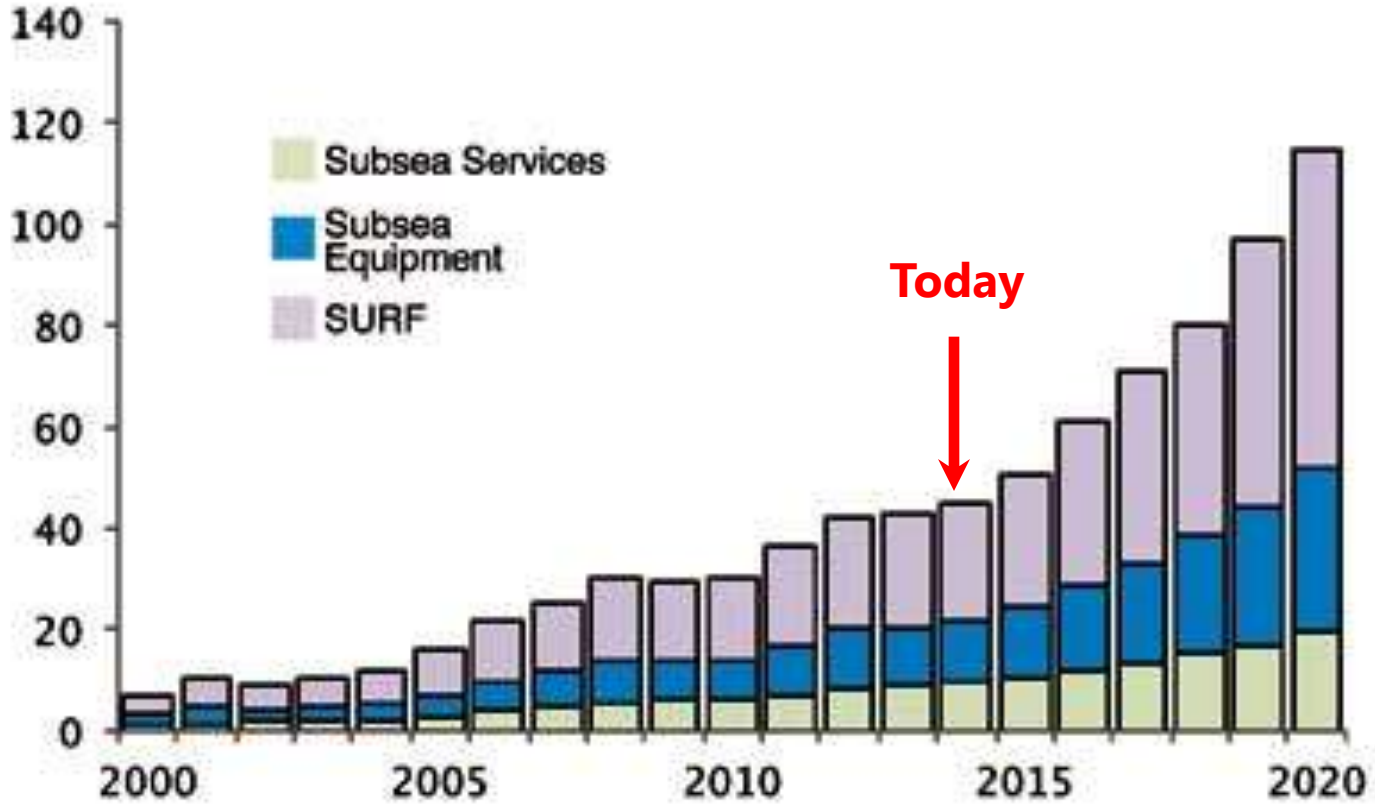
- Governing document: FR12 - Technology Development and Implementation




- Why focus on first use implementation of technology (FUIT)?
- Why focus on multi use implementation of technology (MUIT)?

# The Subsea Cost Challenge

## Global E&P subsea expenditure ($ billions) going forward




SURF: subsea installation, umbilicals, risers, and flowlines
Subsea equipment: trees, wellheads, manifolds, etc.
Subsea services: inspection, maintenance, and repair

Source: DCube by Rystad Energy



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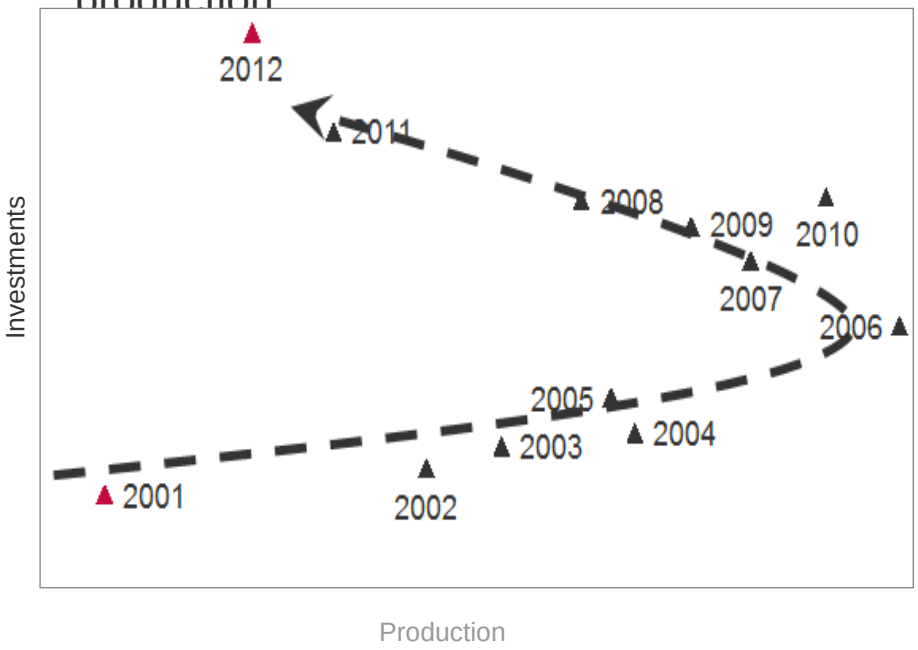
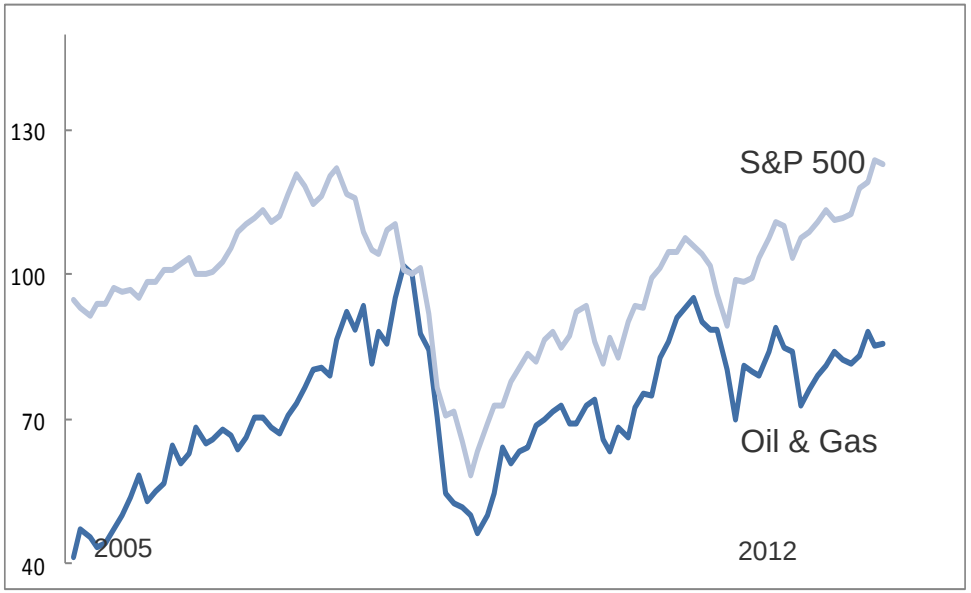
# Challenges:
# Profitability in the industry is under pressure
## Despite increase in oil price

Higher investment cost, reduced production




Total return vs. other industries




Kilde: Statoil; Wood Mackenzie; Bloomberg; JP Morgan; Company reports.

Peer group inkluderer BG, BP, CVX, COP, ENI, XOM, RDS, STL, TOT

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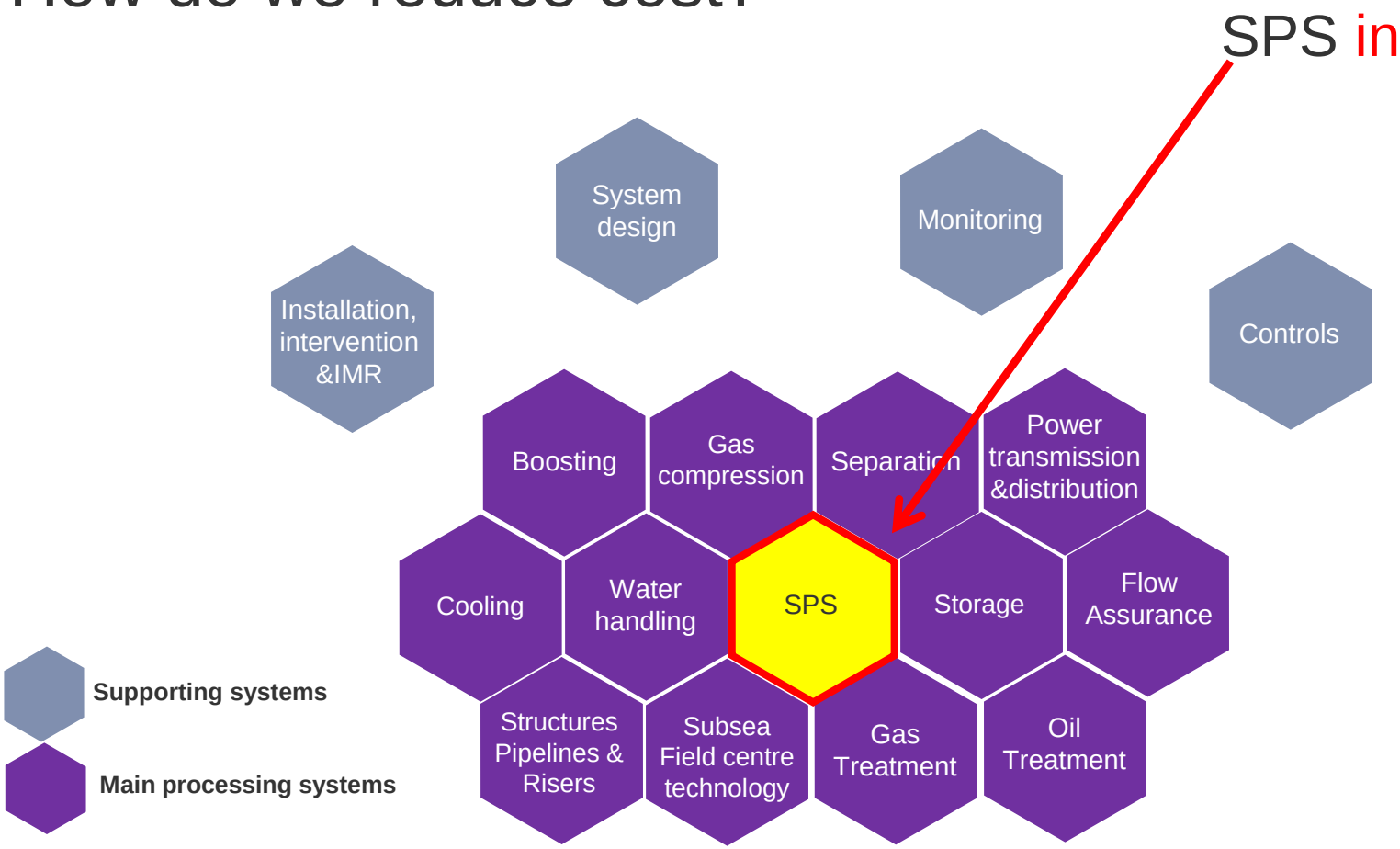
# Towards The Subsea Factory:
## How do we reduce cost?



# Standardization of interfaces

1

**Requirements**

2


**Adapters**

3

**Interfaces**



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# The Future in Subsea (Gas) Processing?

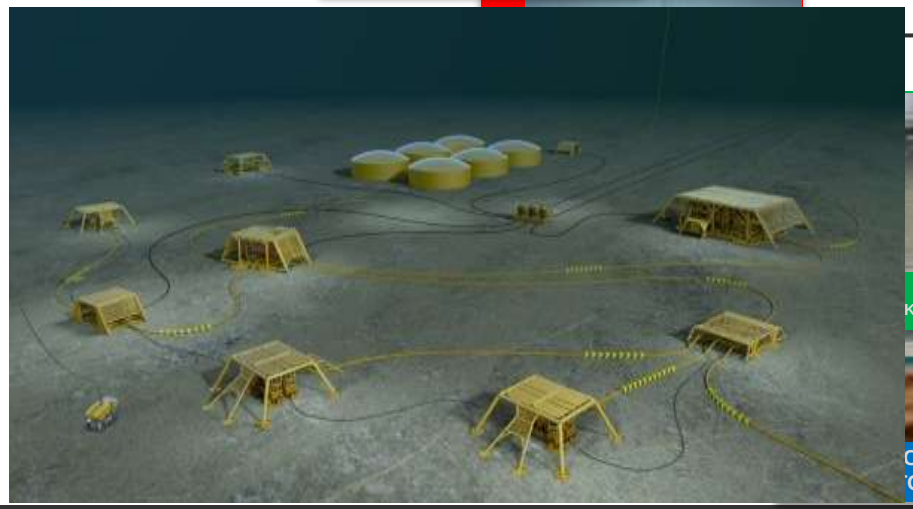
Short term

Medium term

Long term




- Will depend on profitable technology solutions and cost sharing
- The ability and willingness to establish industry standards
- Solid business cases
- Willingsness (by O&G industry) to take technology bets

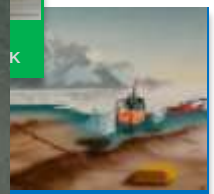


ARTIFICIAL LIFT ESP & DUAL BOOST

COMPACT SEPARATION

DEEPER INSTALLATION & IMR

HIGH VISCOSITY BOOSTING




OIL TREATMENT

OIL STORAGE & OFFLOADING