

Subsea Technology

Copenhagen

Presented by
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Subsea Technology - Trends

MORE SUBSEA
PROJECTS

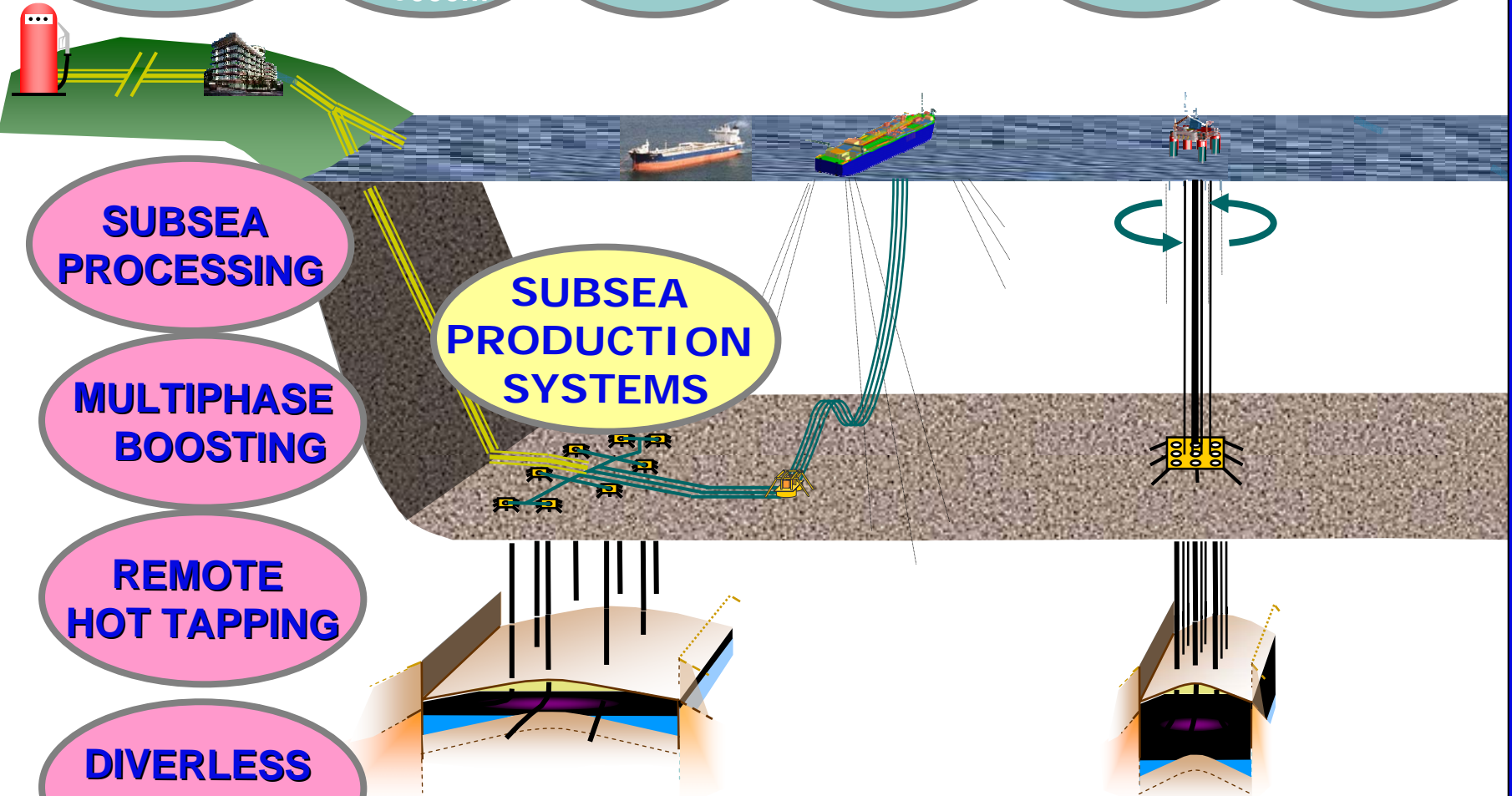
ULTRA
DEEP WATER
> 3000m

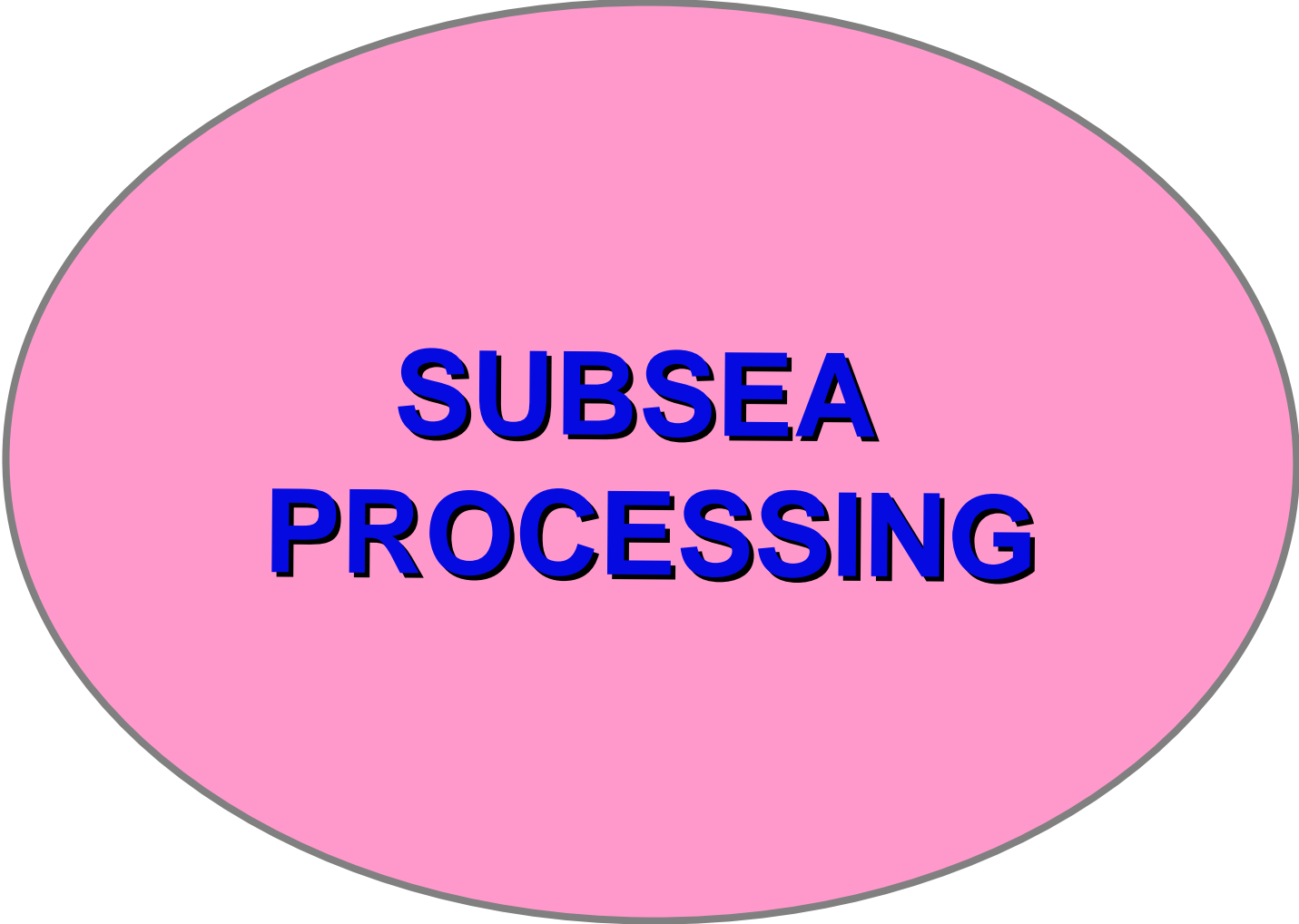
LONGER
STEP-OUTS

REMOTE
LOCATIONS

INCREASED
RECOVERY

HIGH TEMP &
PRESSURE



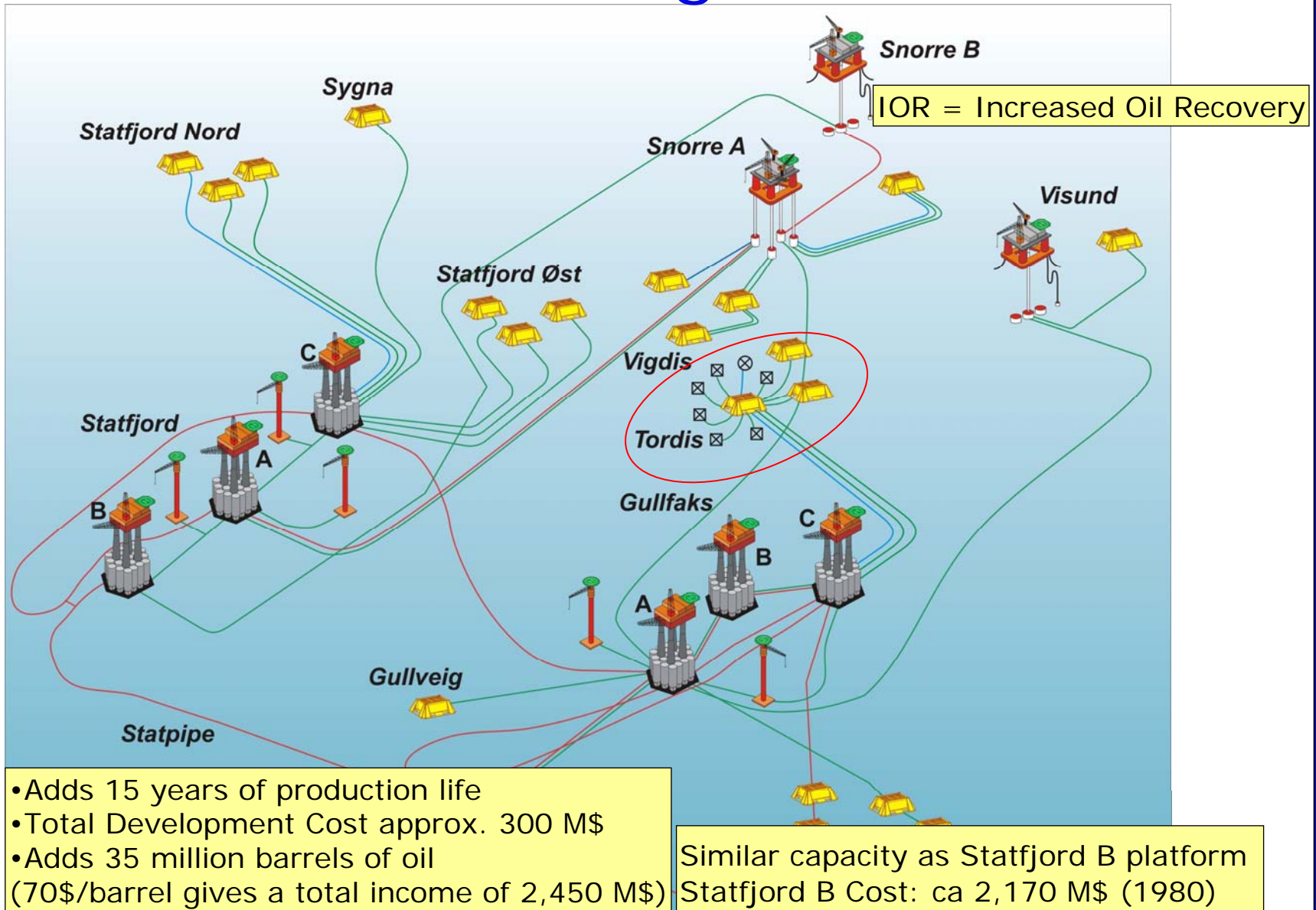
A large pink oval with a thin grey border, centered on the slide.

SUBSEA PROCESSING

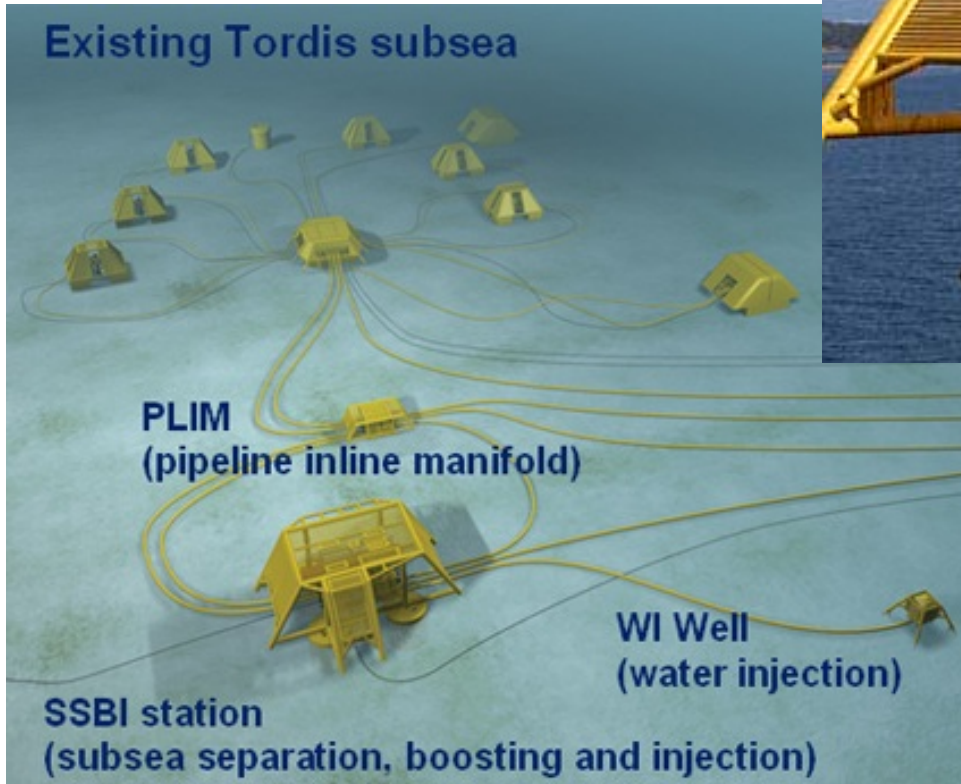
SUBSEA PROCESSING - Examples

- **Troll Pilot (Hydro/Norway)**
Water Depth: 345 m
Inst./Operation: 2000 (initial start up problems with power supply, hence did not reach full capacity until 2001)
System Includes: Water Separation/Re-injection;
60,000bpd (incl. 25,000 bpd oil)
- **Tordis IOR (Statoil/Norway)**
Water Depth: 200 m (but may also be used at 1500m–2000m)
Inst./Operation: 2007 / Q4 2007
System Includes: Water & Sand Separation/Re-injection, Boosting;
200,000bpd (incl. 50,000 bpd oil)
Recovery Rate: 55% (increased from 49%)
- **BC-10 (Shell/Brazil)**
Water Depth: 1700-2000 m
Operational: 2011
System Includes: Oil & Gas Separation/
Electrical Submerged Pumps for Heavy Oil
- **Perdido (Shell/USA)**
Water Depth: 2400 m
Installation: 2009
Operational: 2010
System Includes: Oil & Gas Separation/
Electrical Submerged Pumps for Oil

Subsea Processing - TORDIS IOR

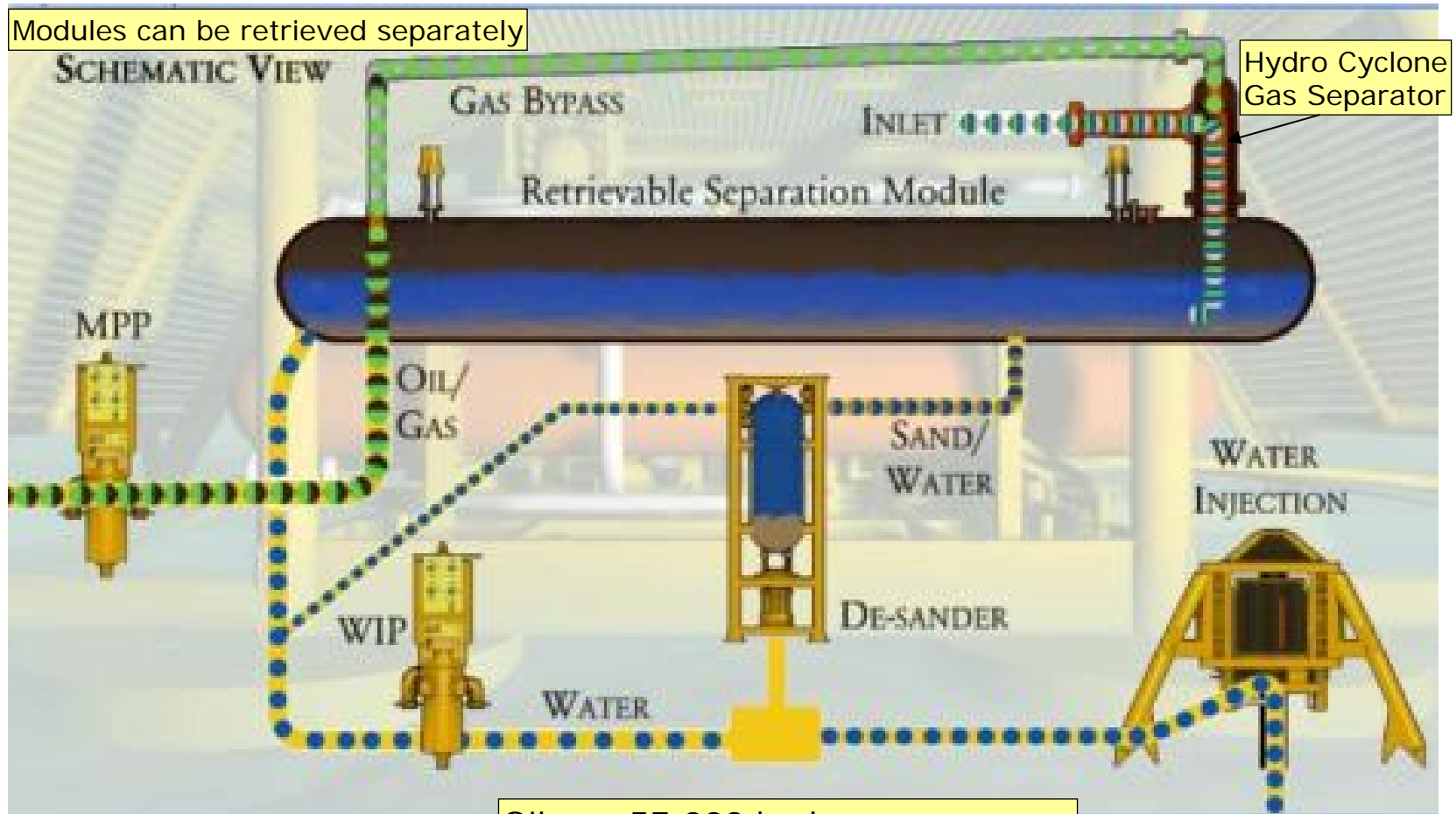


Subsea Processing - TORDIS IOR



Subsea Processing - TORDIS IOR

Modules can be retrieved separately



Oil: 57,000 bpd
Water: 150,000 bpd
Gas: 1 million Sm³/day
Sand Separation: 50 – 150 kg/day
2/3 of water separated

Subsea Processing - TORDIS IOR



Water Separator (250 Te)

Sand Separator (60 Te)



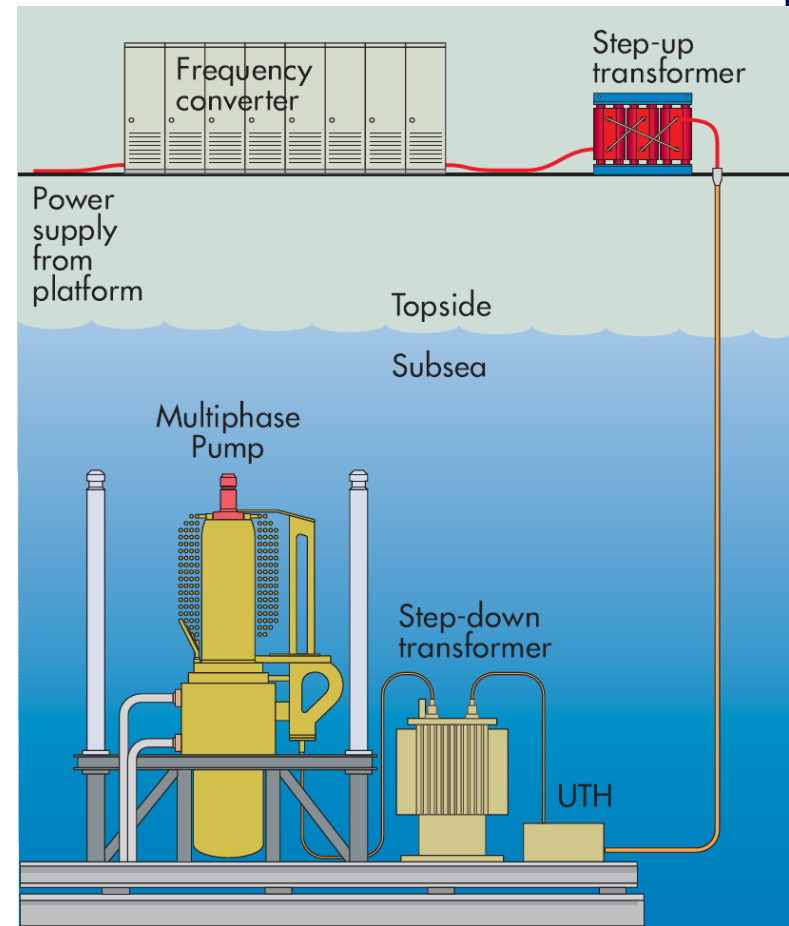
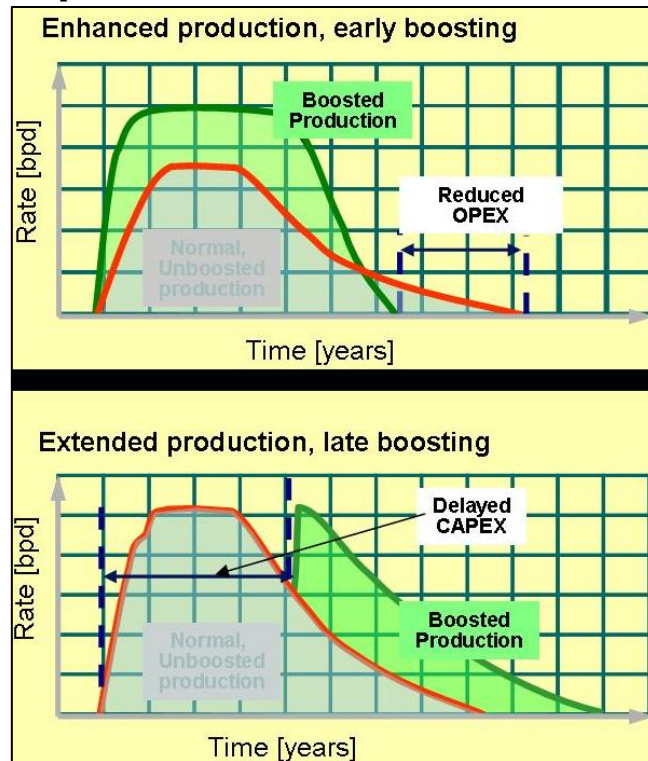
Multi Phase Pumps
(2 off, each 2.5 MW)



MULTIPHASE BOOSTING

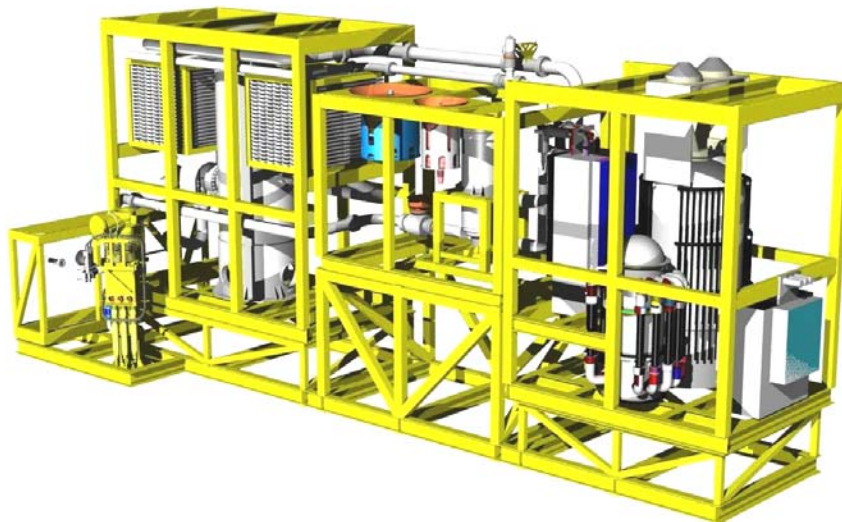
MULTIPHASE BOOSTING

- First Subsea application on Draugen (Shell) in 1994
- Has been used on several projects worldwide
- Now being considered for large scale projects, e.g. Ormen Lange outside Norway (instead of large topside facilities)



Multiphase Boosting - Ormen Lange

- Substantial savings over a conventional platform development (at a cost of ca NOK 37 billion?)
- Compression planned to start in 2015
- Full size pilot testing from 2009 to 2011
 - NOK 2.5 billion budget for development of a subsea compression station including;
 - Full size compressor pilot
 - Long step-out power supply pilot



Compressor Pilot:

Size (LWH): 27x8x12 m

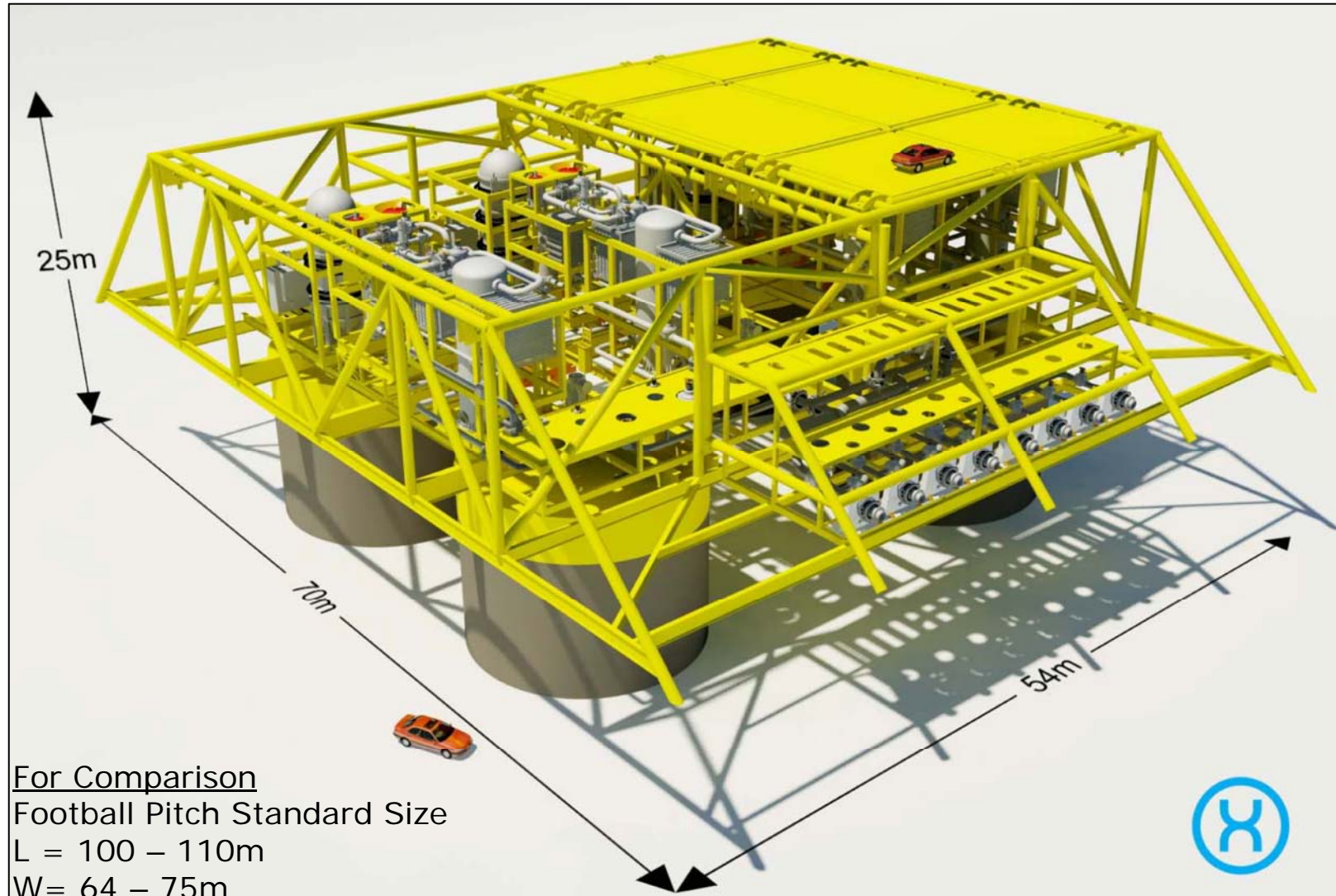
Weight: 480 Te

12.5 MW compressor

15 MSm³/day

Mirror of one of the four compressor trains considered for the permanent installation

Multiphase Boosting - Ormen Lange



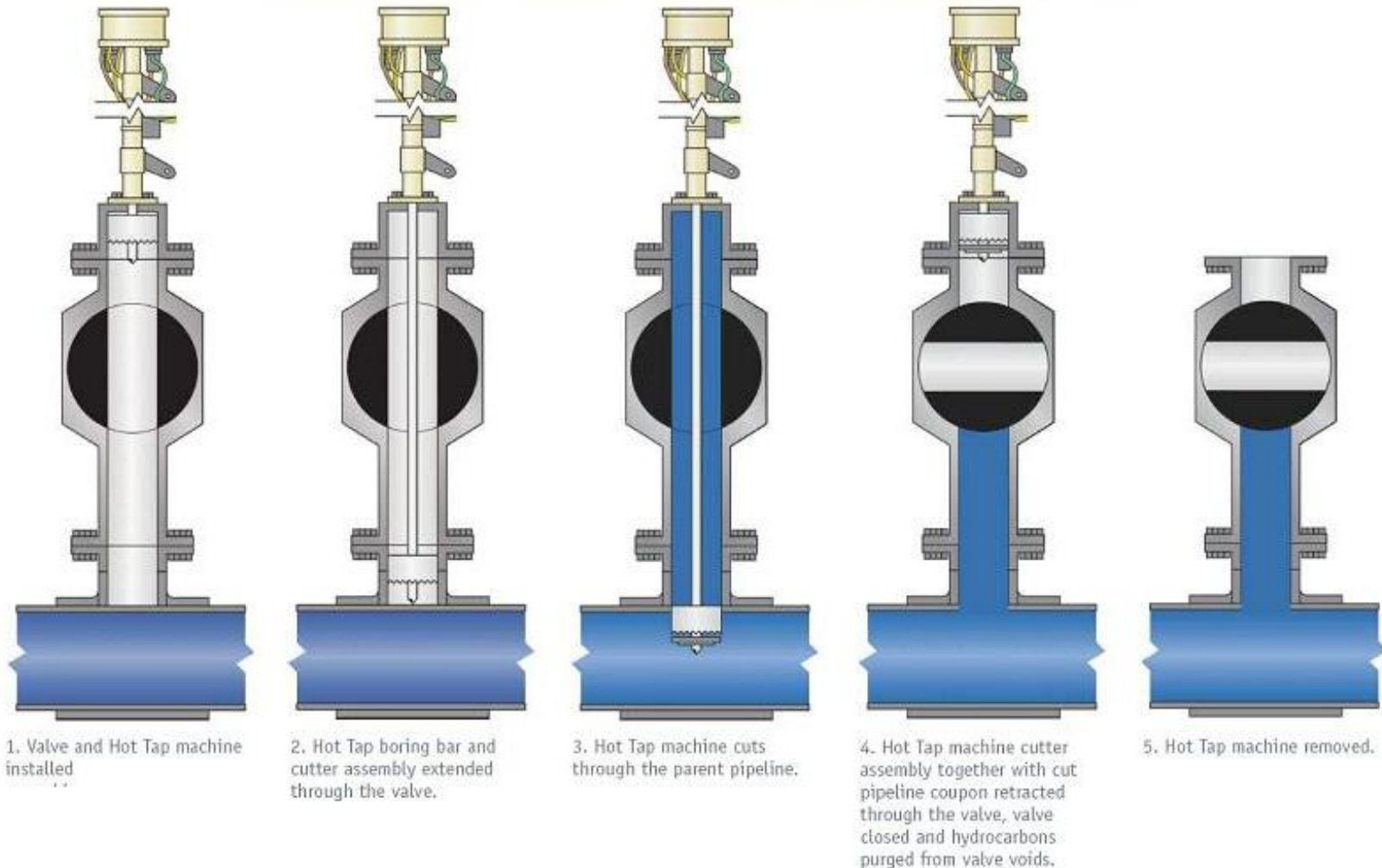
REMOTE HOT TAPPING

Hot Tapping

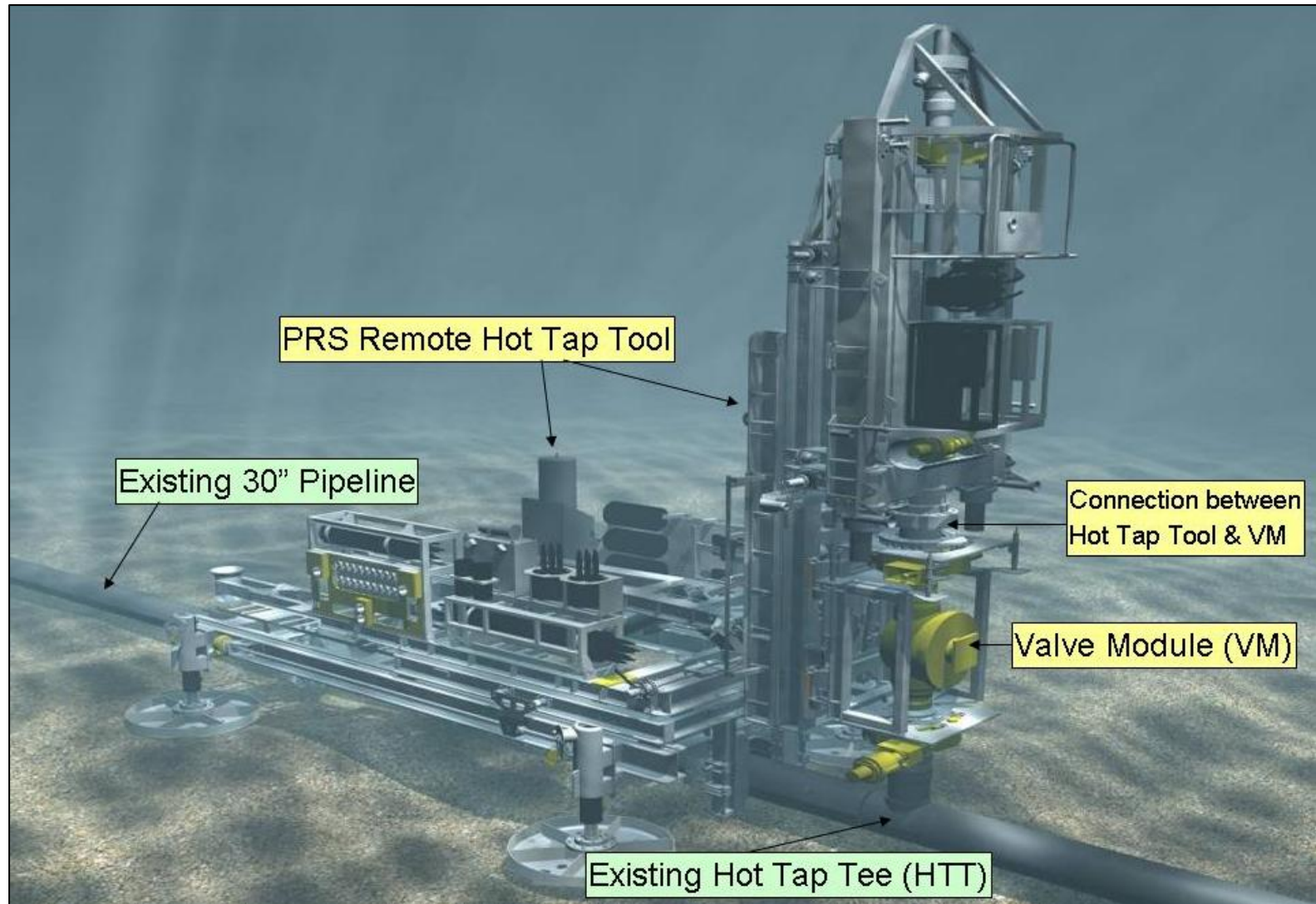
- Hot Tapping used for tie-in to existing installations (without production shut-down)
- Diver assisted hot tapping commonly used (but still requires comprehensive qualifications/trials for the actual conditions at the hot tap location – not aware of any major incidents)
- First remote/diver less hot tap operation planned in 2009 (at a water depth of about 850 m)
 - Deepwater Test planned in 2008

Hot Tapping - Principles

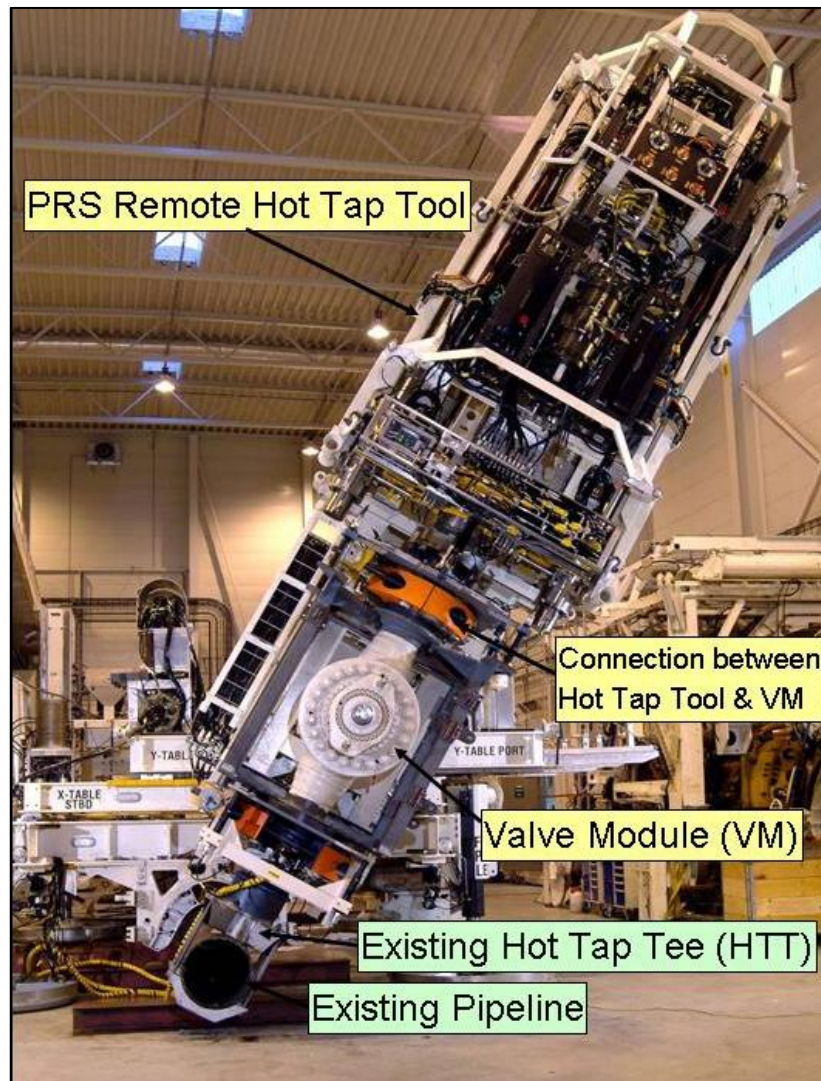
Typical Hot Tap Principles – Not specifically for remote hot tapping



Remote Hot Tapping



Remote Hot Tapping

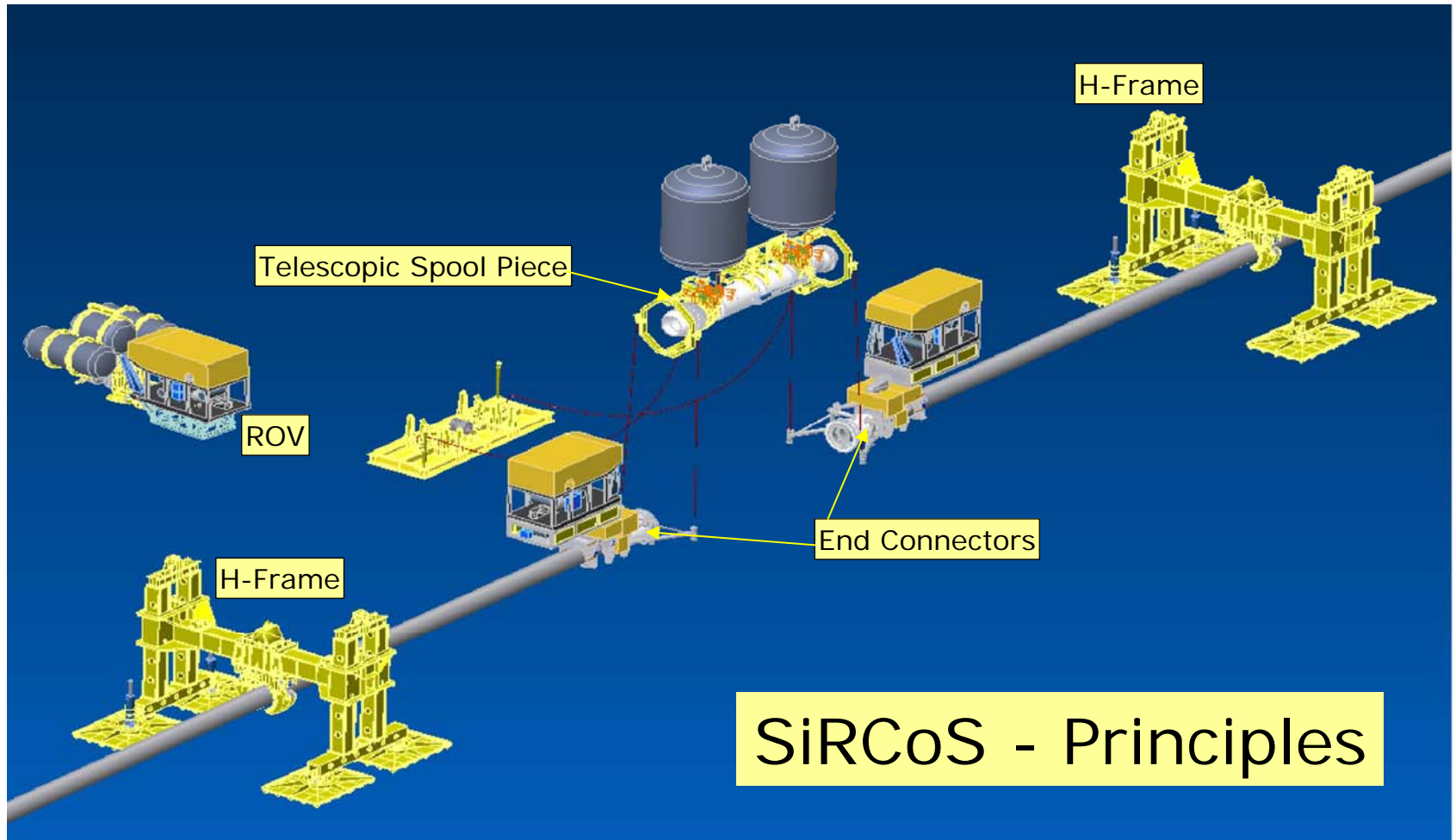


DIVERLESS REPAIR

Diverless Repair – Rigid Pipe

- Many deep water projects do not have adequate diverless repair contingency, hence any incidents may result in
 - Long and expensive shut-down periods
 - Expensive repair scenarios
- Some systems are currently available, although some modifications/upgrades may be required for each specific application
 - **Statoil/PRS** (PRS = Pipeline Repair System)
Commonly used in Norwegian Sector. Has been used for several planned interventions. Available for a wide range of dimensions and water depths – both for diver assisted and diverless applications
 - **SiRCoS** (Sistema per Riparazione Condotte Sottomarine)
Operated by Eni. Pipeline Repair Consortium established for some major trunk line projects

Diverless Repair – Rigid Pipe



Thank You for Attending!

Questions?

Acknowledgments:

- Egil Martinussen/Pål Helsing, Aker Kværner
- Lars Ole Bjørnsrud, FMC Kongsberg
- www.statoil.com
- www.hydro.com
- www.sonsub.com