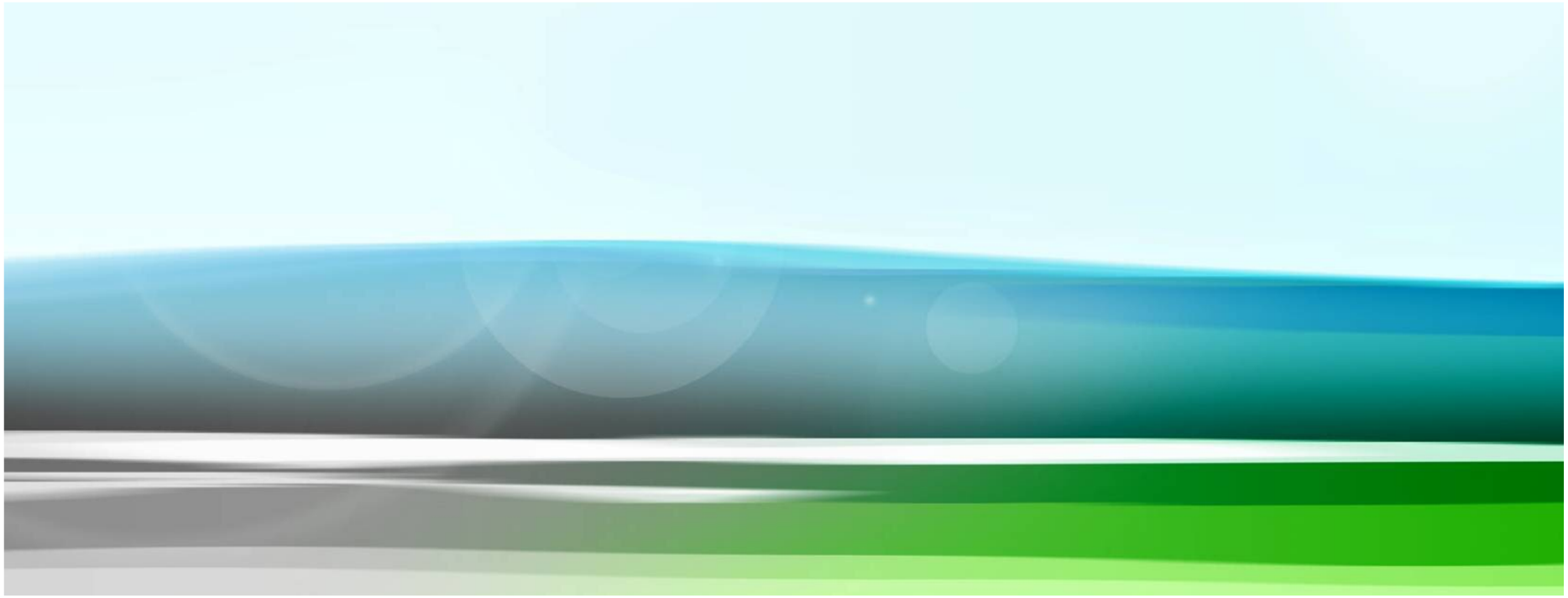

Reliability of Deepwater Technologies

Technical Risk Management during R&D

Alex Imperial, MD - Deepwater Technology Centre
SMI Workshop - 3 April 2012

MANAGING RISK DNV

- **Reliability and Technical Risk Management**
- **Why New Technologies?**
- **Why qualify New Technologies?**
- **Examples**

- **Reliability and Technical Risk Management**
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Reliability and Technical Risk Management

API RP 17N
Subsea Production System Reliability and Technical Risk Management

Framework for reliability management throughout the life cycle of subsea projects

Aim: ***"…****effectively manage the risks from using novel equipment and standard equipment in novel applications"*

"The achievement of improved subsea equipment availability requires good engineering and management processes, practices and behaviors at an organizational level to manage and minimize the potential for ***equipment failure****"*

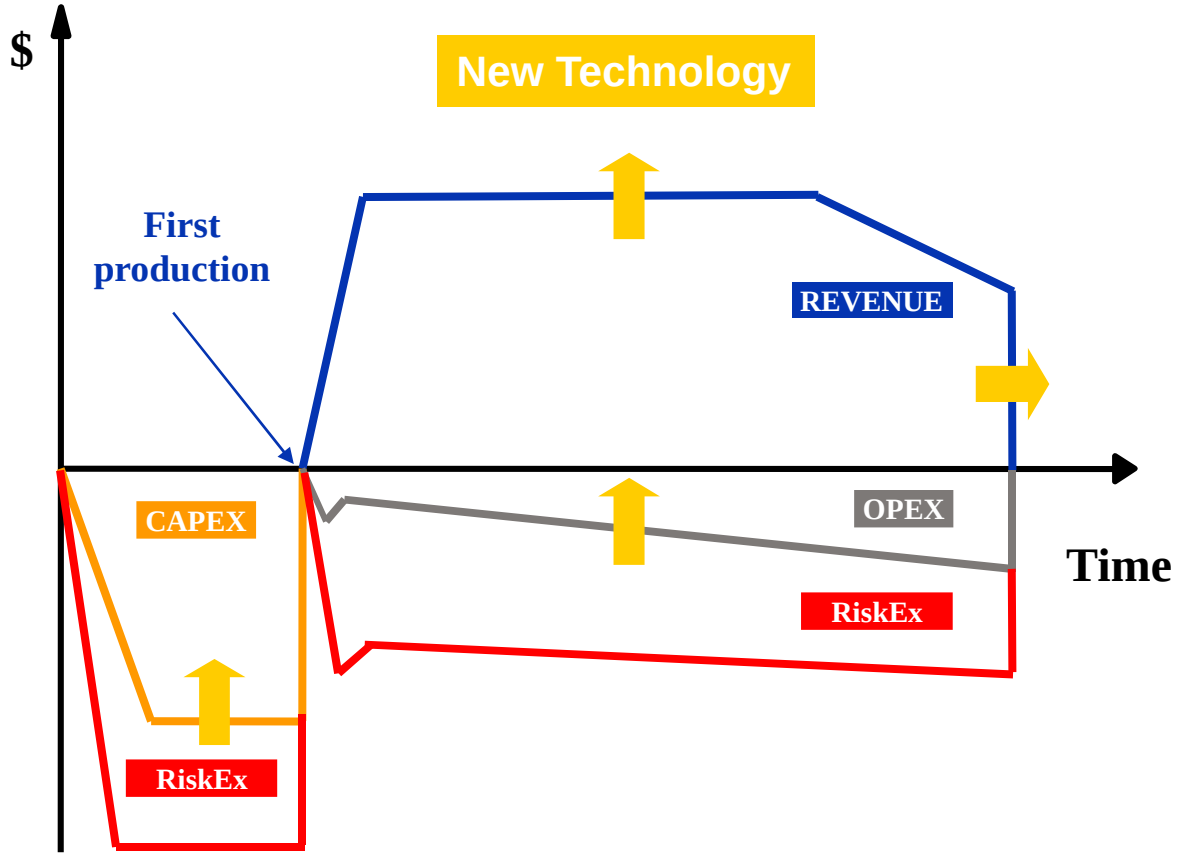
Philosophy
"…to prioritize reliability and technical risk management efforts based on the level and source of technical risk in the project"

Objective of this presentation

To demonstrate the importance of properly managing technical risks related to new technologies, since the R&D phase, as a means of contributing to the increased reliability of deepwater developments

- Reliability and Technical Risk Management
- **Why New Technologies?**
- Why qualify New Technologies?
- Examples

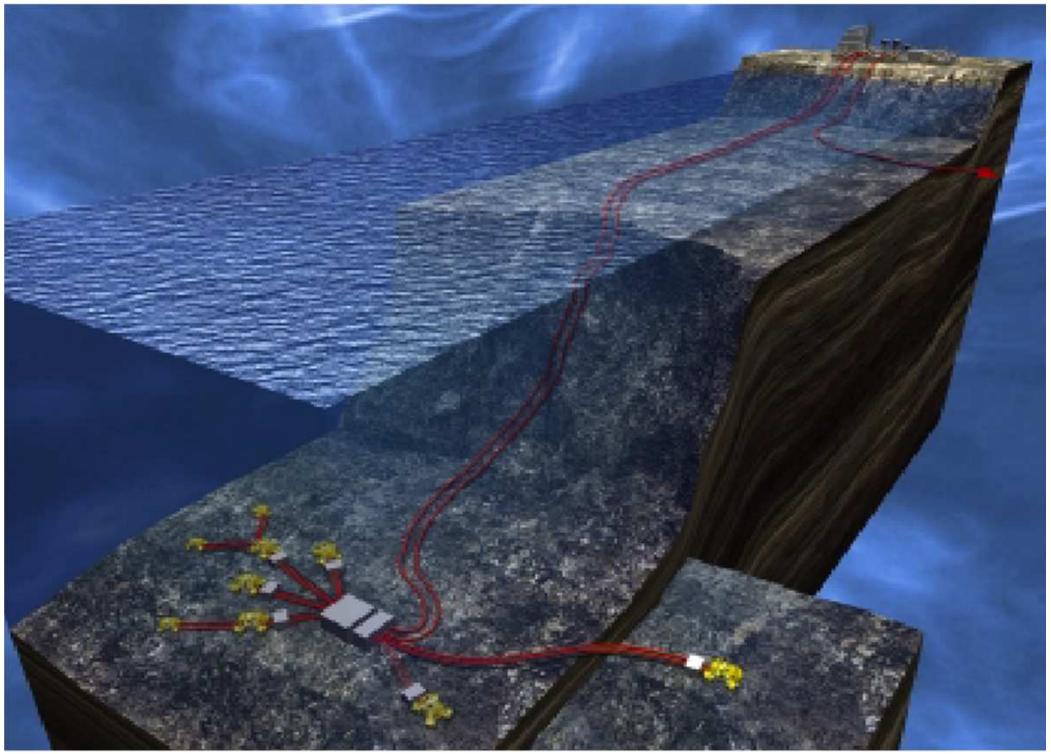
What to gain with New Technology



Profit = NPV {Revenue - CAPEX - OPEX}

New Technologies introduce uncertainties to the project, which generally generate unforeseen Risk Expenditures (RiskEx)

Common practices that increase uncertainty



- Failure modes and failure mechanisms not systematically identified
- Reliability targets not determined
- Lack of proper analytical models
- Design / qualification by “Trial and Error”

Schedule and budget overruns & poor reliability

What end users think?

Survey: *understand perceptions from oil companies with respect to the uptake of **new technologies***

"Main barriers to the uptake of Subsea Processing"

- *"Technology shortfalls"*
- *"The general lack of experience in the industry…"*
- *"The lack of familiarity with the technology and limited internal experience"*
- *"The lack of trustworthy reliability and performance data"*
- *"The view that the systems do not meet reliability requirements…"*

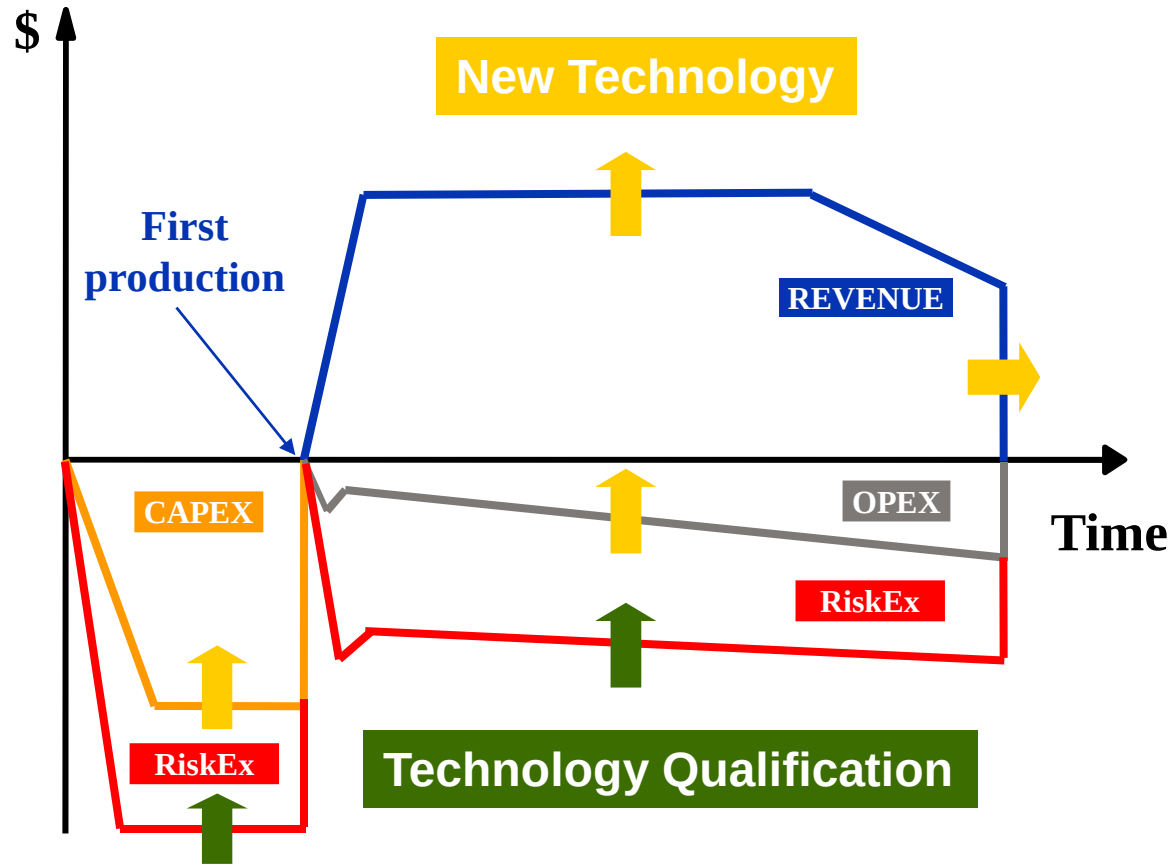
Reinforces the need for Technical Risk Management

Source: Douglas Westwood

- Reliability and Technical Risk Management
- Why New Technologies?
- **Why qualify New Technologies?**
- Examples

Photo: Statoil

The role of Technology Qualification



Profit = NPV {Revenue - CAPEX - OPEX}

Technology Qualification eliminates the uncertainties related to new technologies and, therefore, associated RiskEx

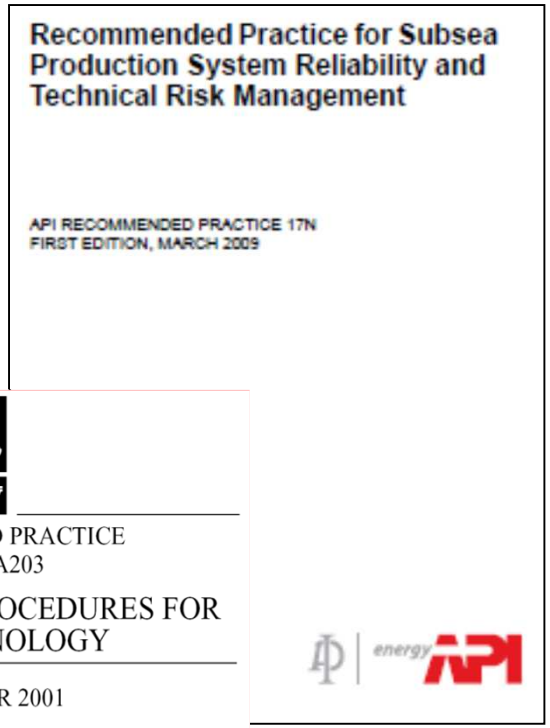
Qualification Procedure For New Technology

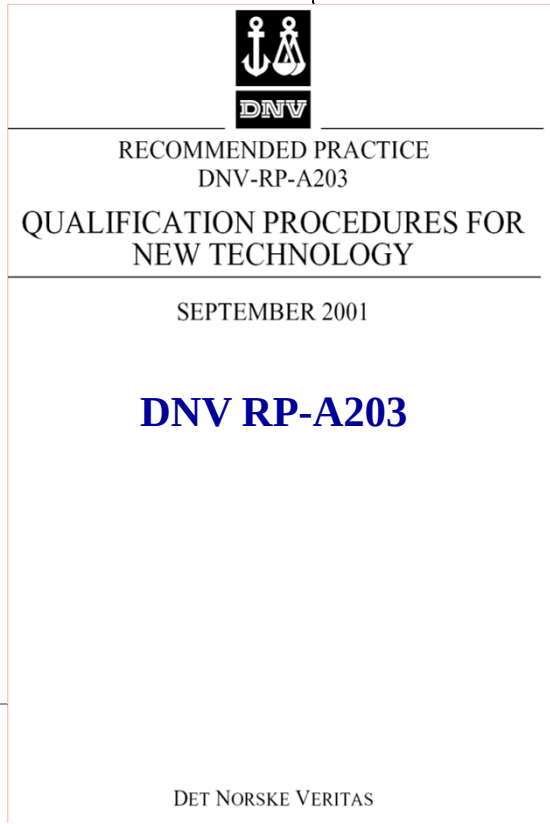
Definition:

Qualification is the process of providing the evidence that the technology will function within specific limits with an acceptable level of confidence.

Objective:

To provide a systematic risk based approach ensuring that the technology functions reliably within specified limits





- Reliability and Technical Risk Management
- Why New Technologies?
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- **Examples**

Pipelines

Subsea 7:

BuBi® Mechanical Lined Pipe

To address corrosive medium

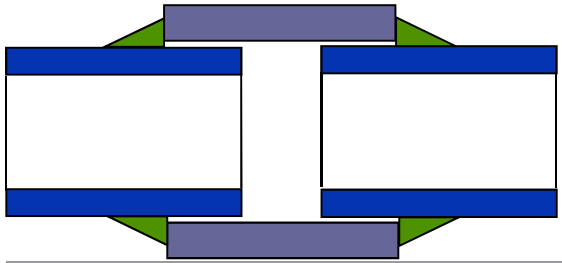
Subsea 7:

Electrically Heat-Traced Pipe-in-Pipe

To address flow assurance

Statoil:

Remote Pipeline Repair System

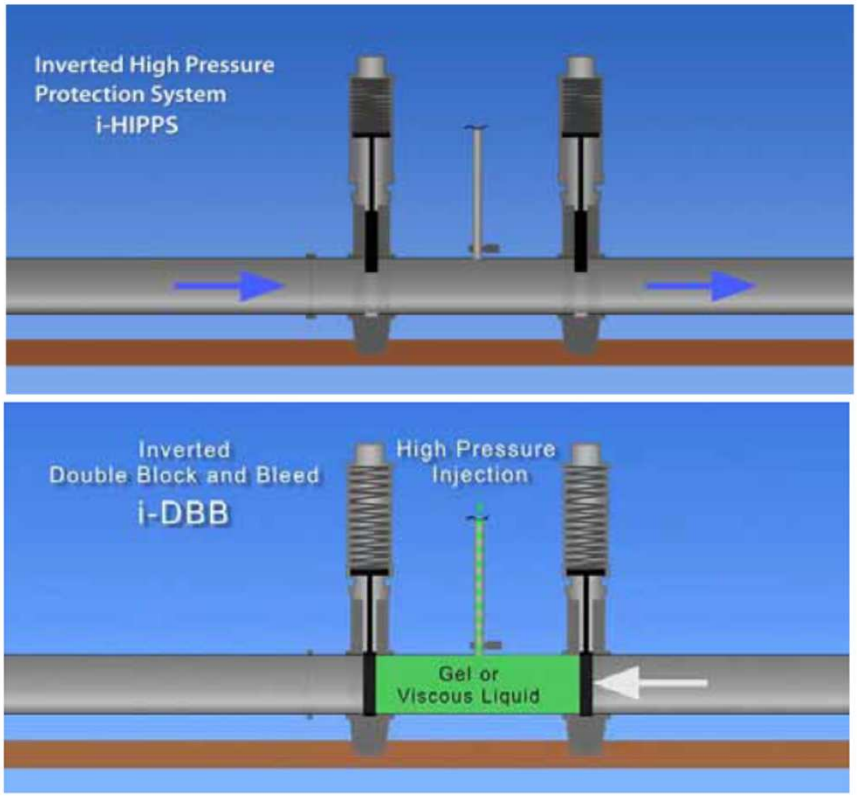


Pipelines

DNV's X-Stream:

Ultra-deep pipeline concept

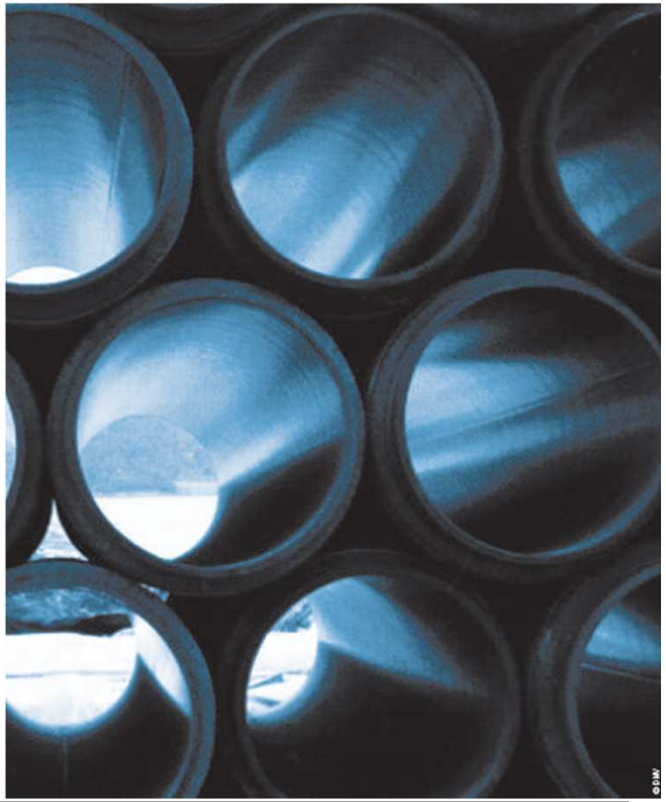
Internal pressure protection during installation and shutdowns - i-HIPPS and i-DBB



DNV's High Strength Steel:

Qualification of X80 pipes

Develop guidelines considering the effect of 'sour service' on fracture toughness

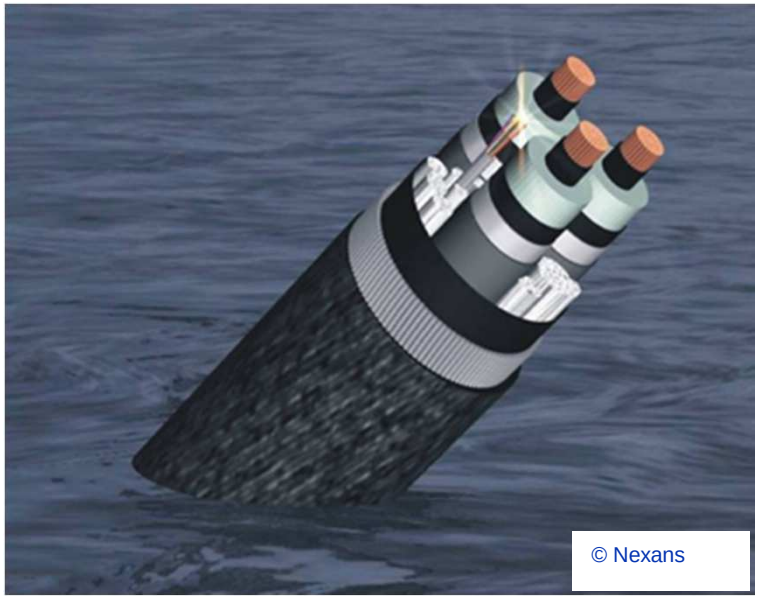


Subsea electrification

JIP:

Electrical power cables

Recommended practice for design of power cables in Subsea dynamic applications



Statnett:

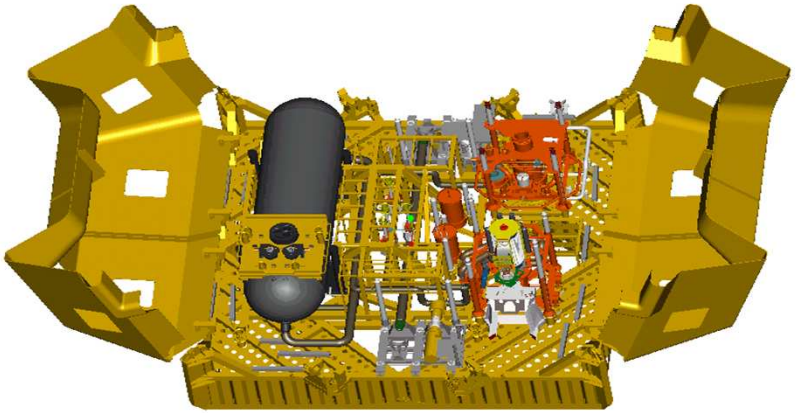
HVDC cables

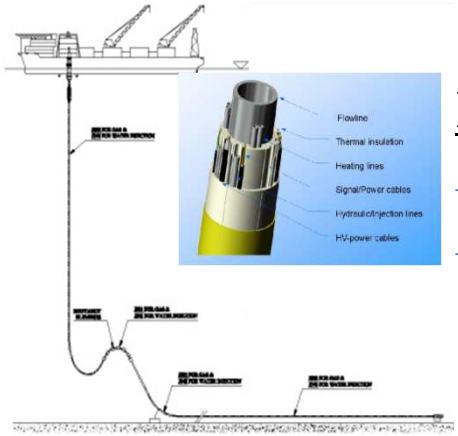
Design issues related to Dynamic Riser Cables load conditions and load effects from design up through installation and service

Subsea

Statoil, ABB, KOP, FKS

Troll Subsea Separation



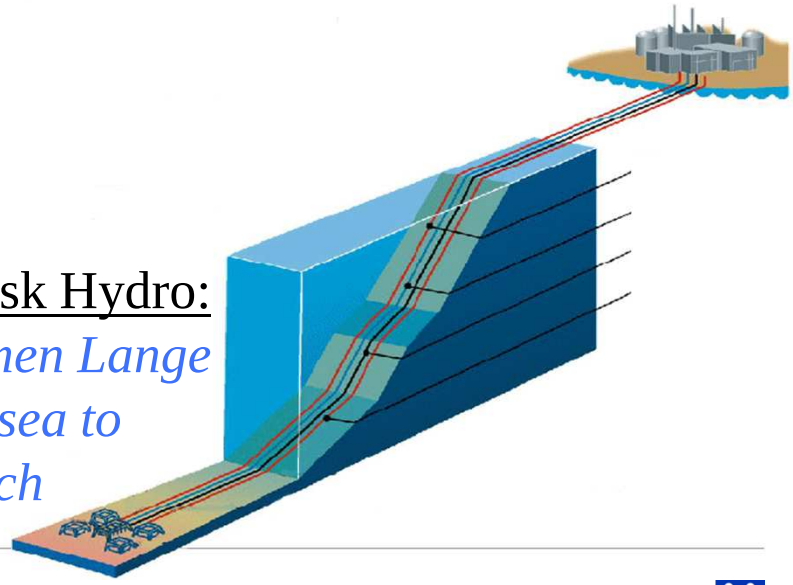


KOP:

Integrated Production Umbilical

Norsk Hydro:

Ormen Lange Subsea to beach

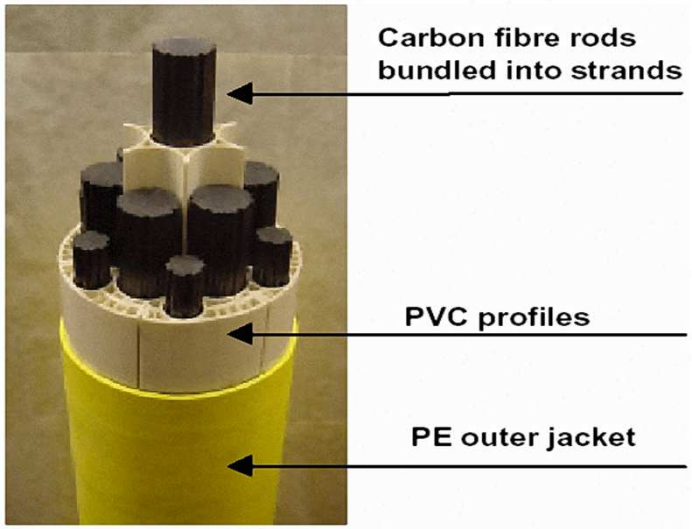


Integrated approach

ConocoPhillips:

Carbon fiber composite Tethers

Kværner's CompTether



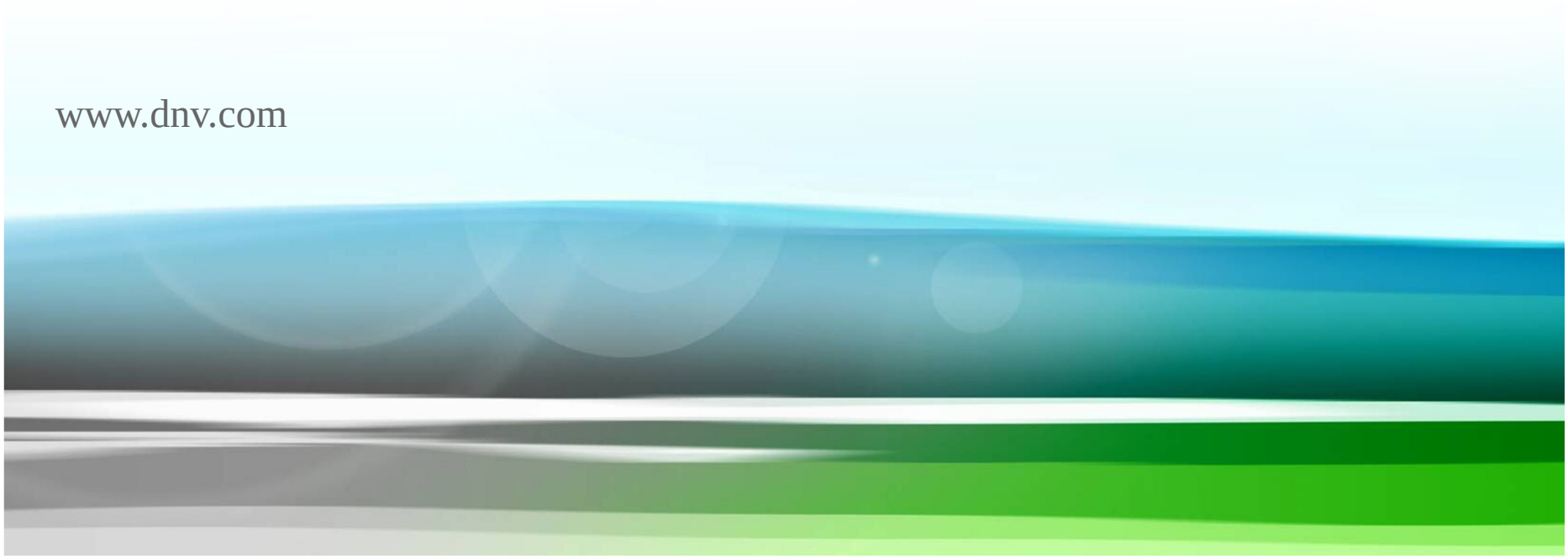
Kværner's CompRiser :

Carbon fiber composite Risers

multiple layers of carbon fiber and epoxy resin composite wound around a thin-walled titanium liner

Safeguarding life, property and the environment

www.dnv.com



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