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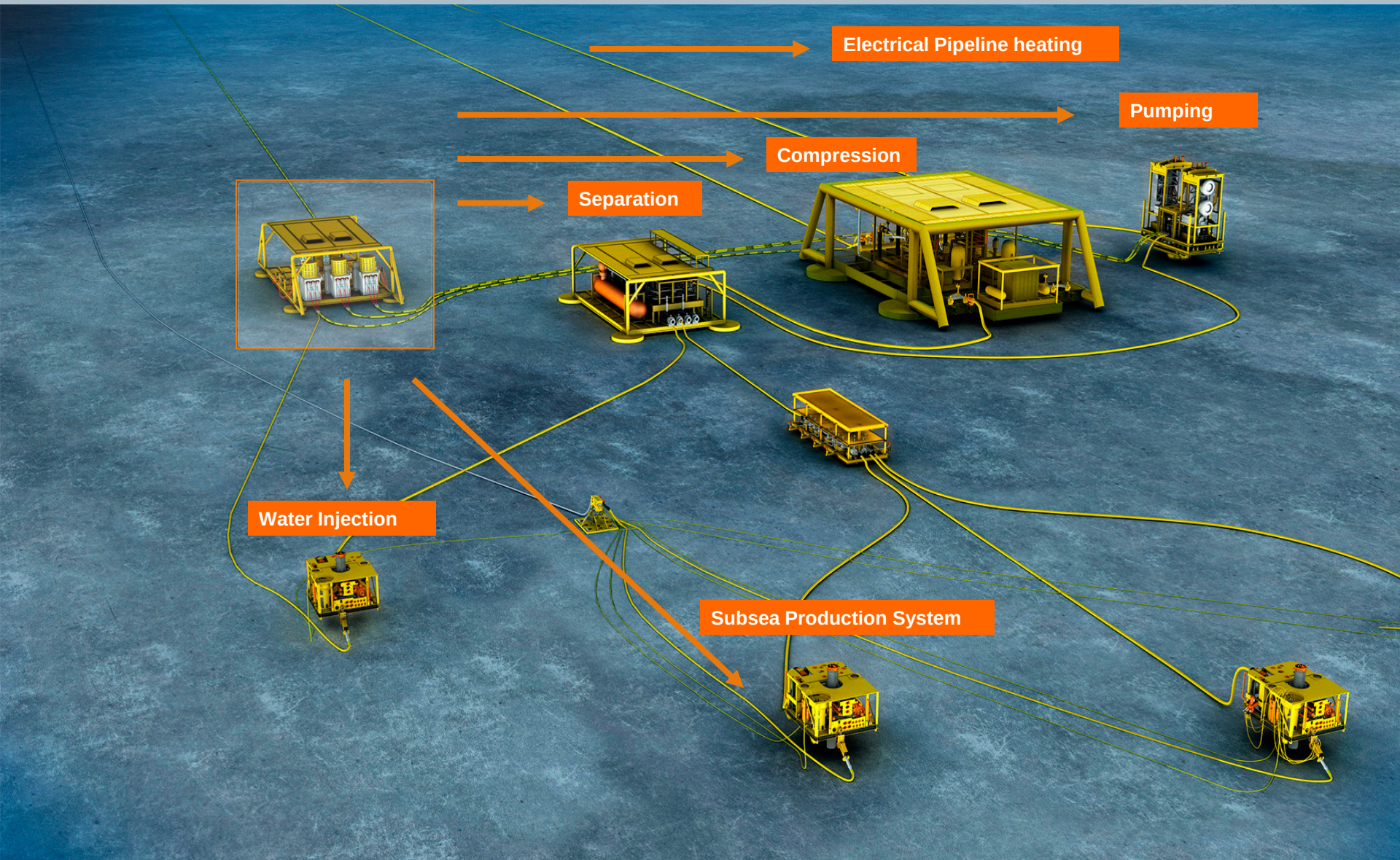
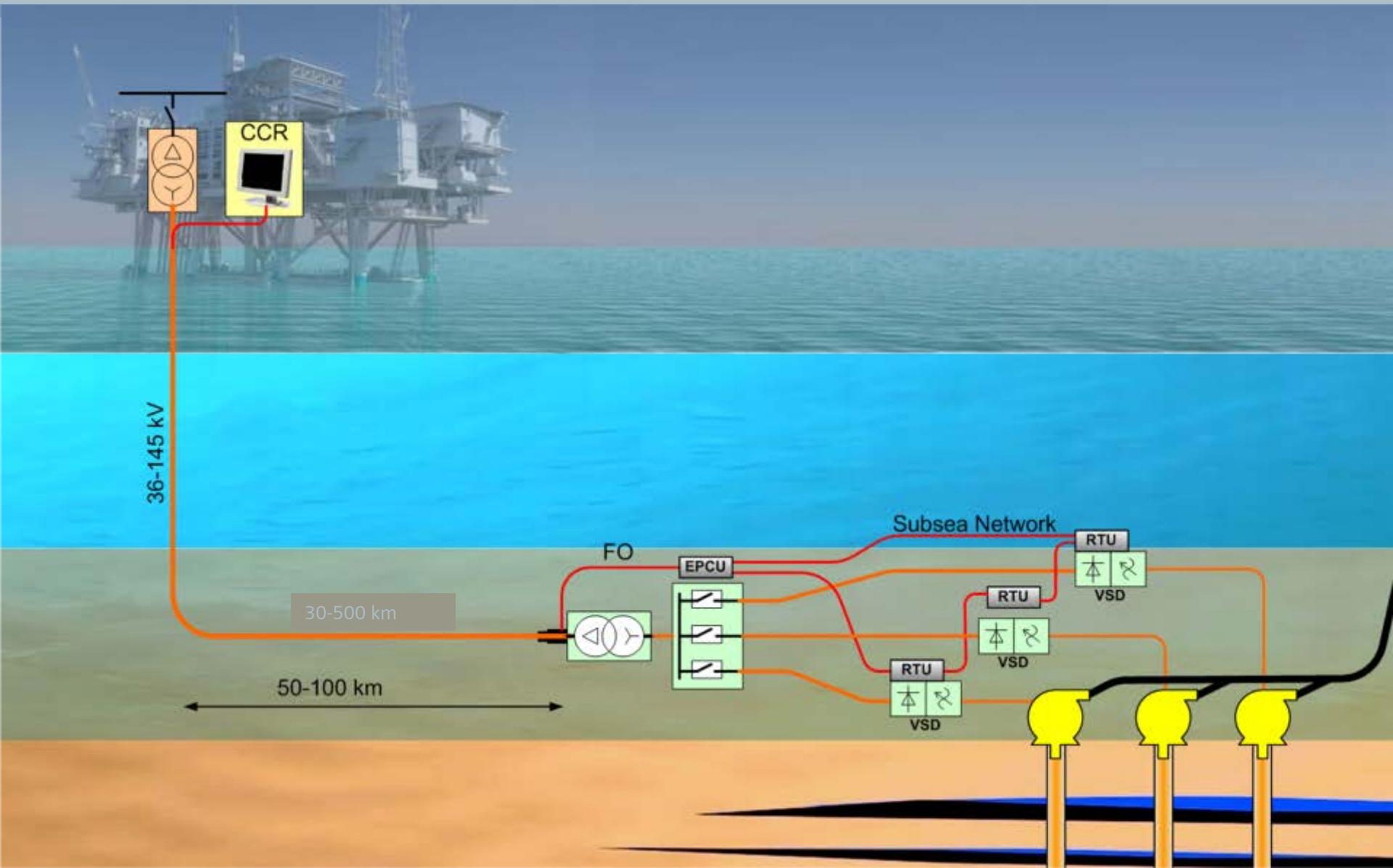
Anngjerd Pleym, Siemens Subsea
Head of department, Technology and Innovation, Technology Qualification

Reliability Management as an Important Part of the Technology Qualification Process for a Subsea Electric Power Grid

Elements of a possible subsea factory



The Siemens Subsea Power Grid

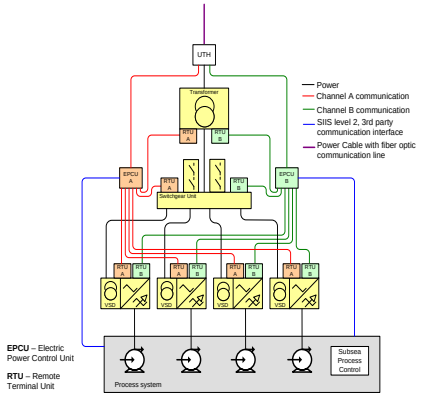


Subsea Power Grid

Transformer

Switchgear

Control and monitoring system



Variable Speed Drive

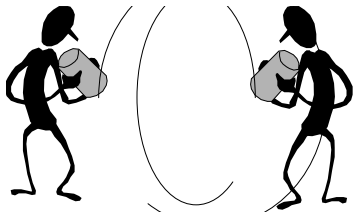
Connector

Why qualification?

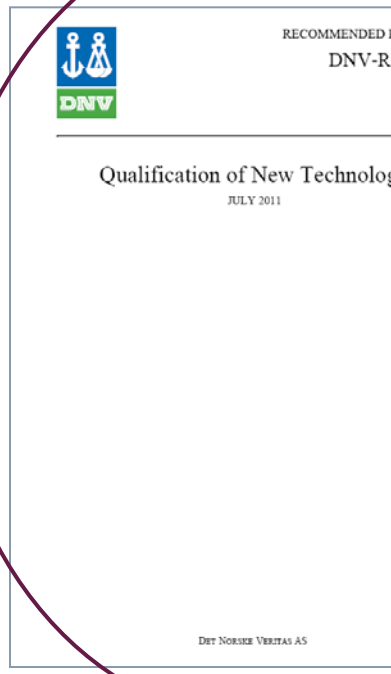
- New technology, not proven
- Not enough knowledge about the technology
- Not the necessary trust in the technology to apply it straight away

The customer/end user must trust the technology

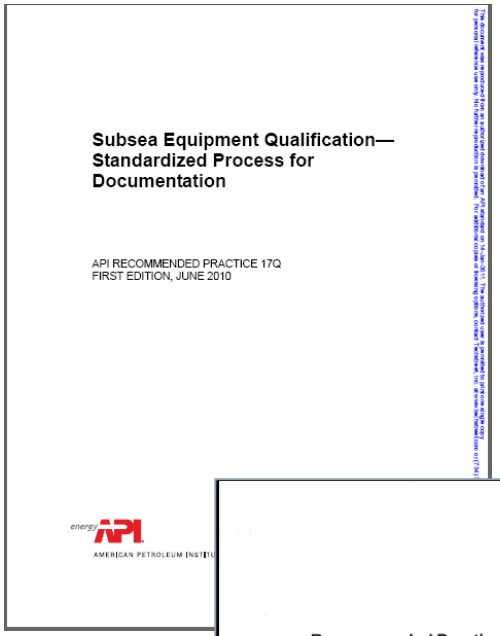
- ✓ Qualification is to **build trust** in the new technology
- ✓ Qualification is to **build knowledge** about the new technology
- ✓ Qualification is to show that the new technology is **fit for purpose**
- ✓ Necessary to include the customer/end user in the qualification work - **dialogue**



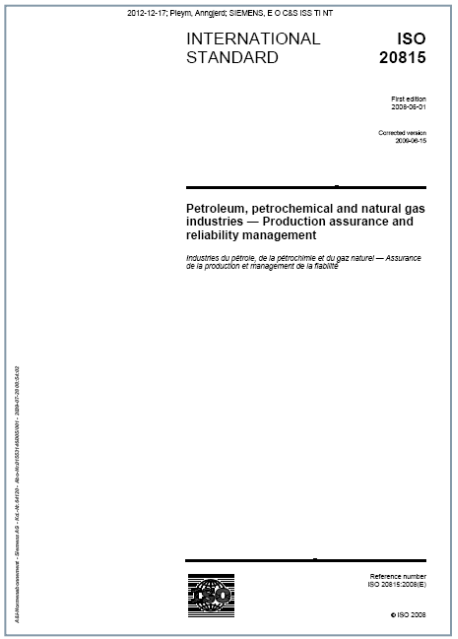
Standards and procedures



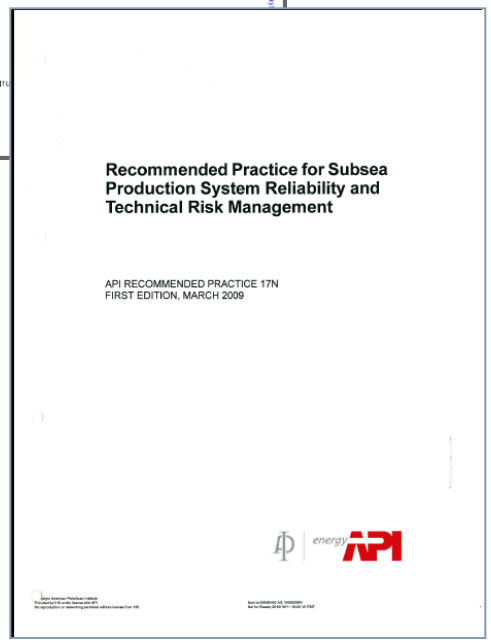
DNV RP-A203



API 17Q



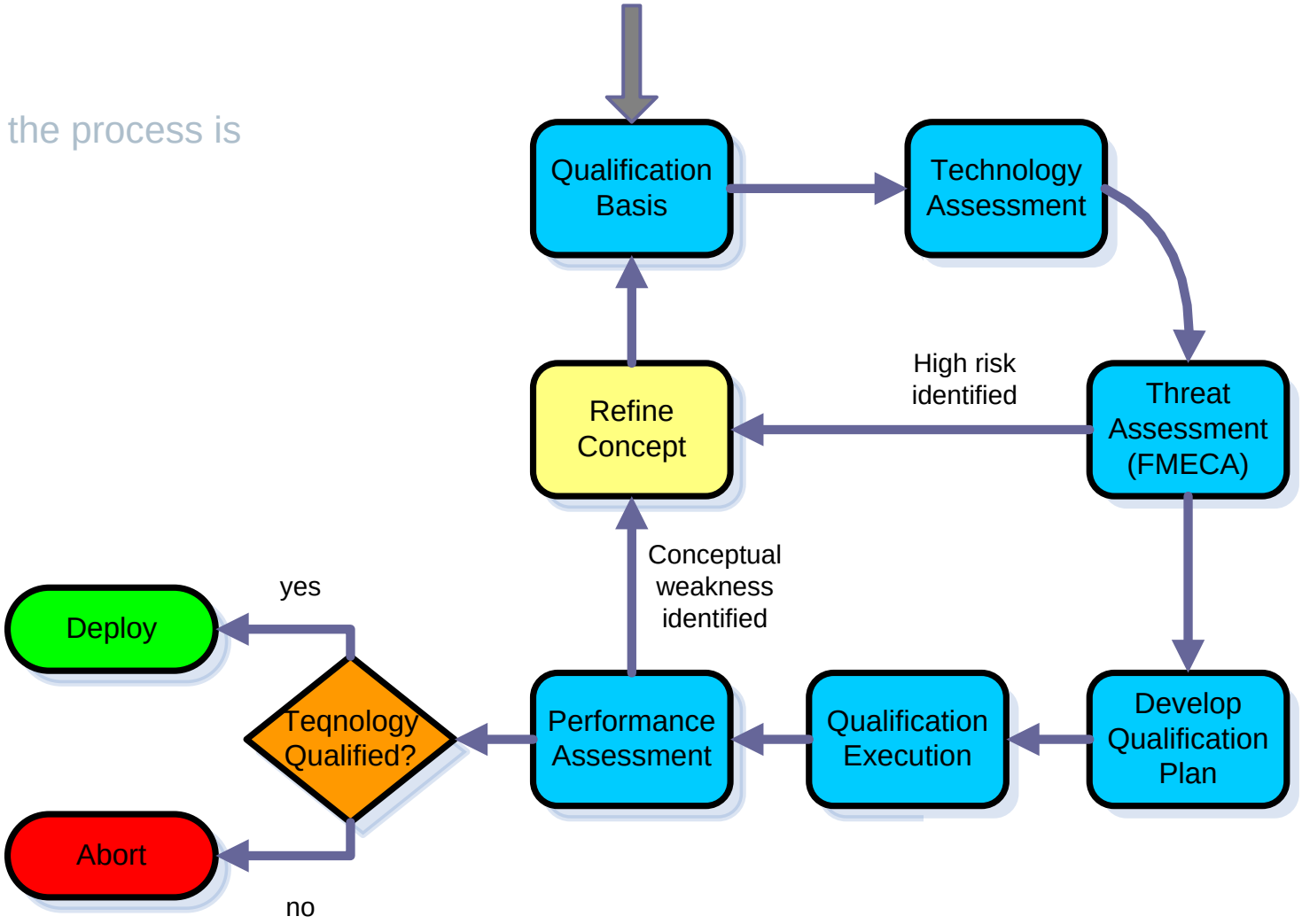
ISO 20815



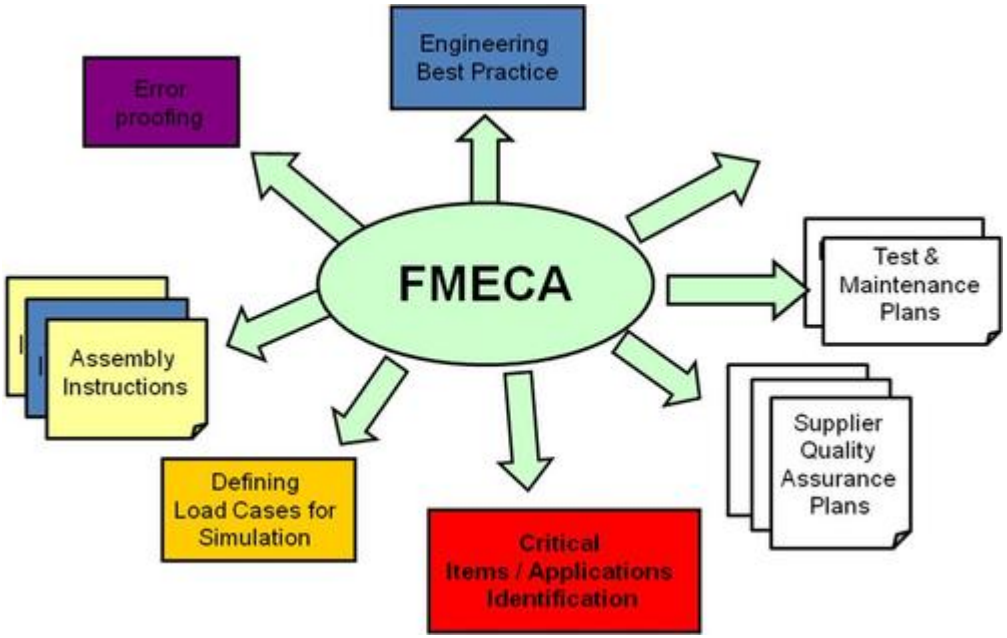
API 17N

The qualification process

Note that the process is iterative.



Main tool for threat assessment is FMECA

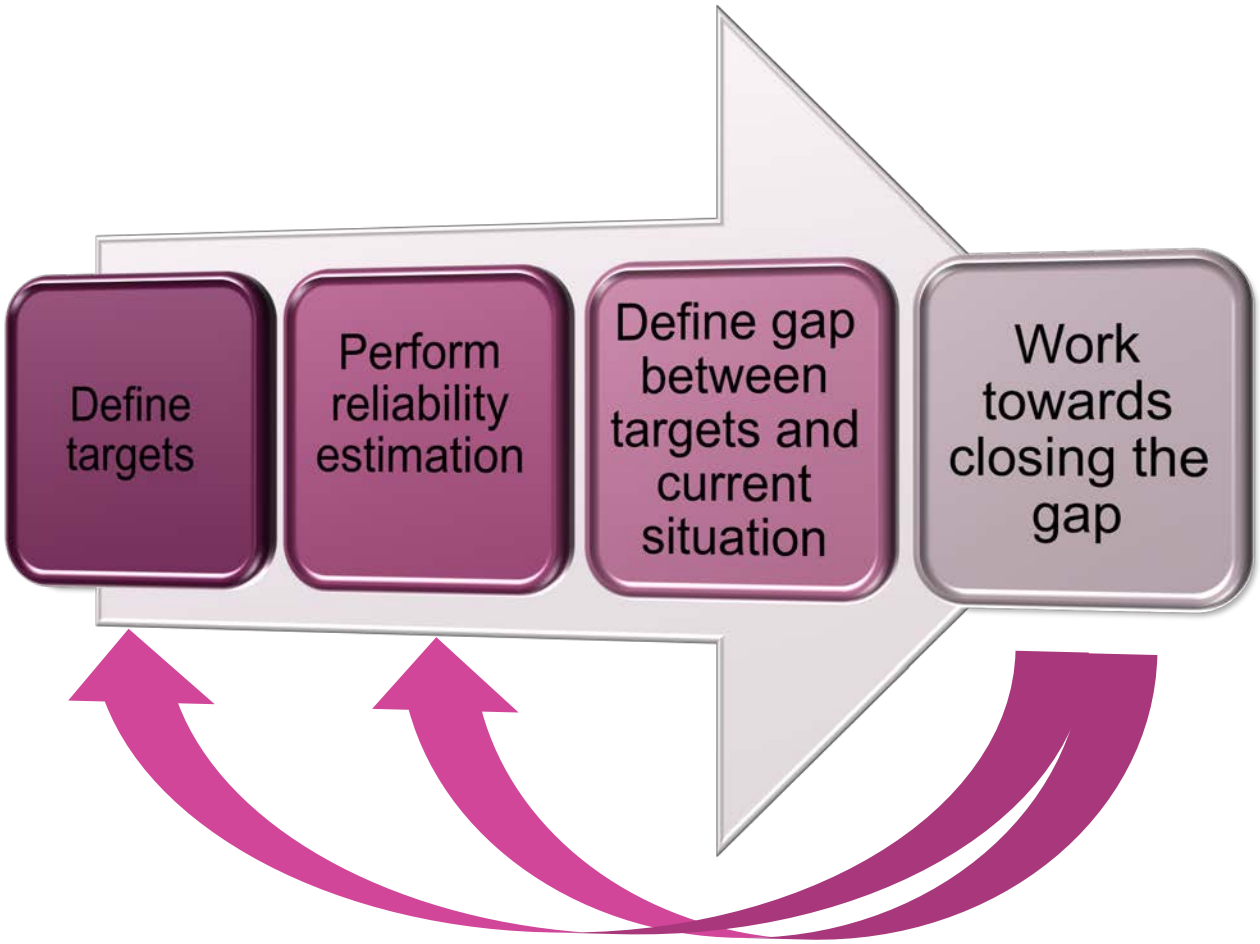


(Illustration from: wildeanalysis.co.uk)

✓One component at a time

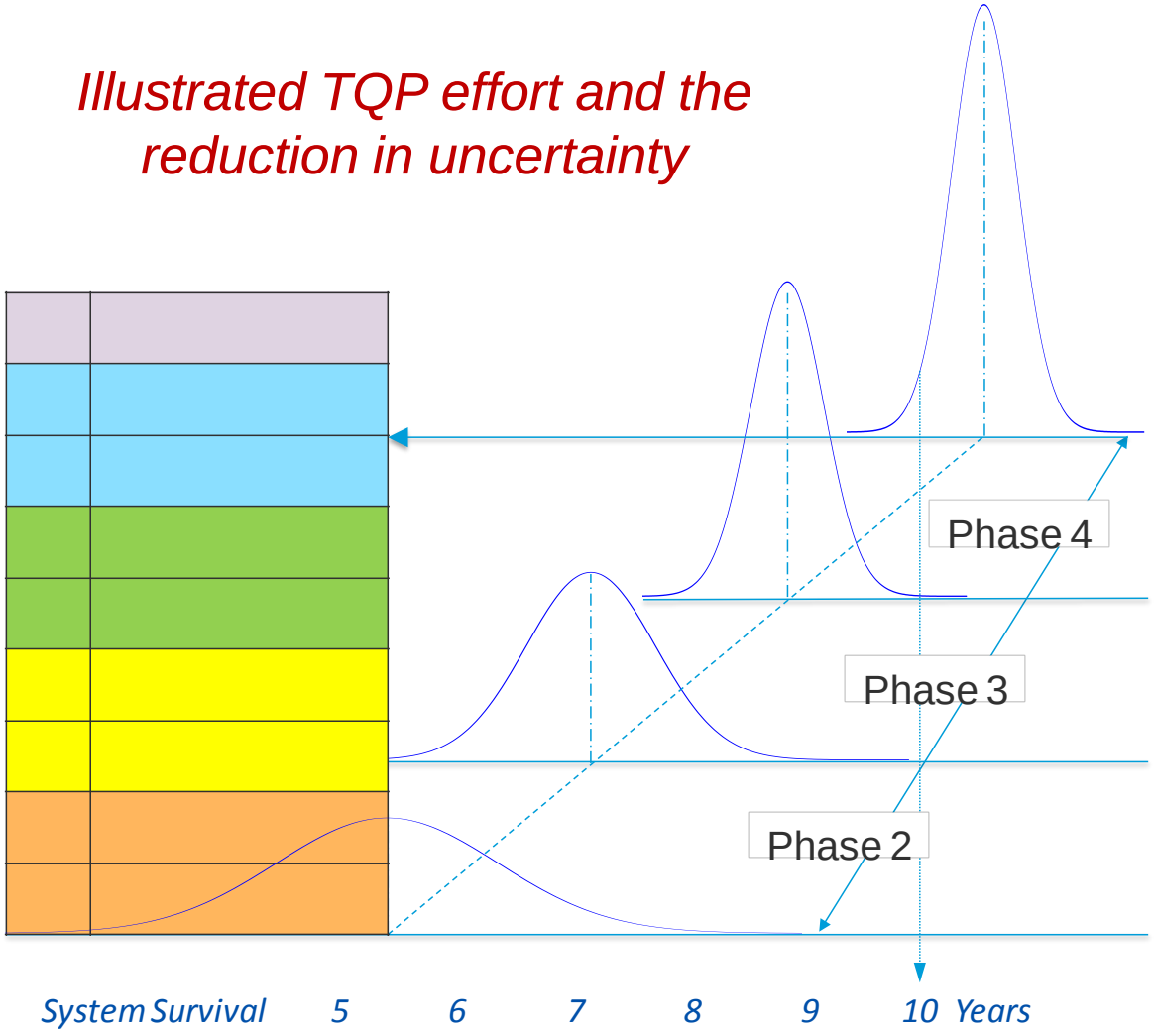
✓Evaluate single failures

Reliability management as part of the technology qualification

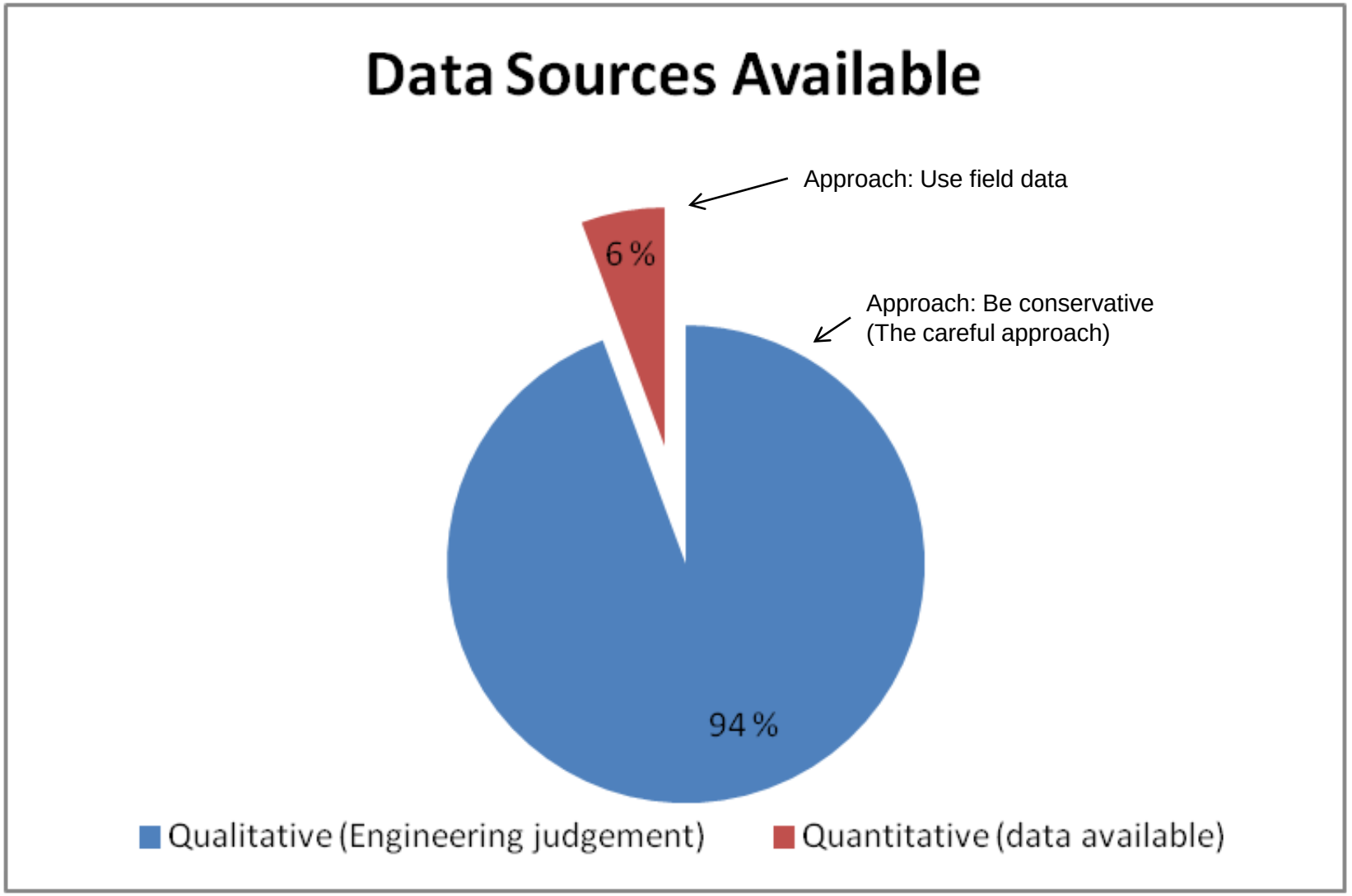


Journey to Qualification and Demonstrated Survival Target

Illustrated TQP effort and the reduction in uncertainty



Reliability Input values – Subsea Switchgear



Use of reliability estimations in the qualification work

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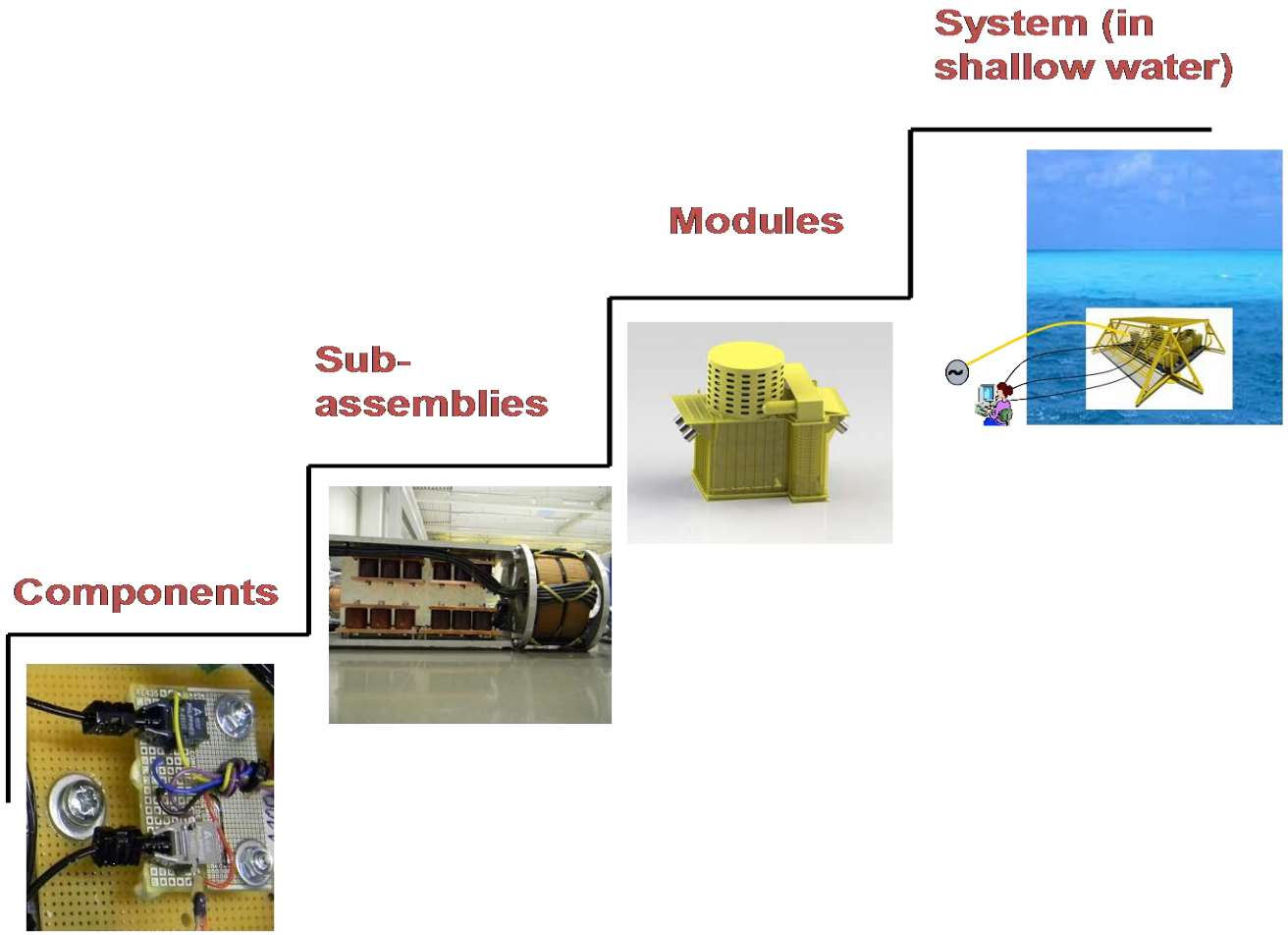
- Reliability analysis gives us a picture of where we are compared to where we want to be.

- Reliability analysis gives better quality in the qualification through correct focus and feedback

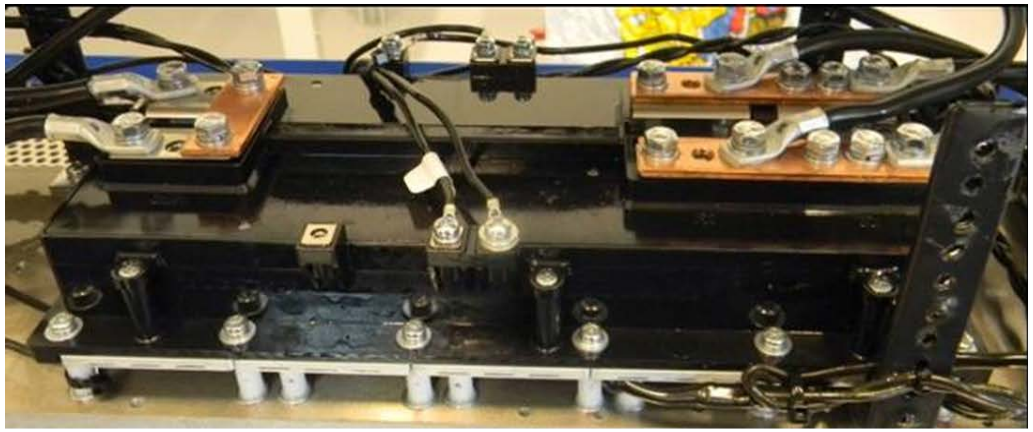
Do not judge the technology based on the outcome of the numerical analysis alone

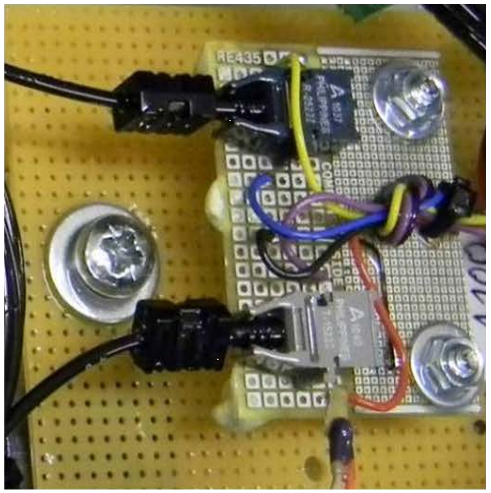
Qualification in stages

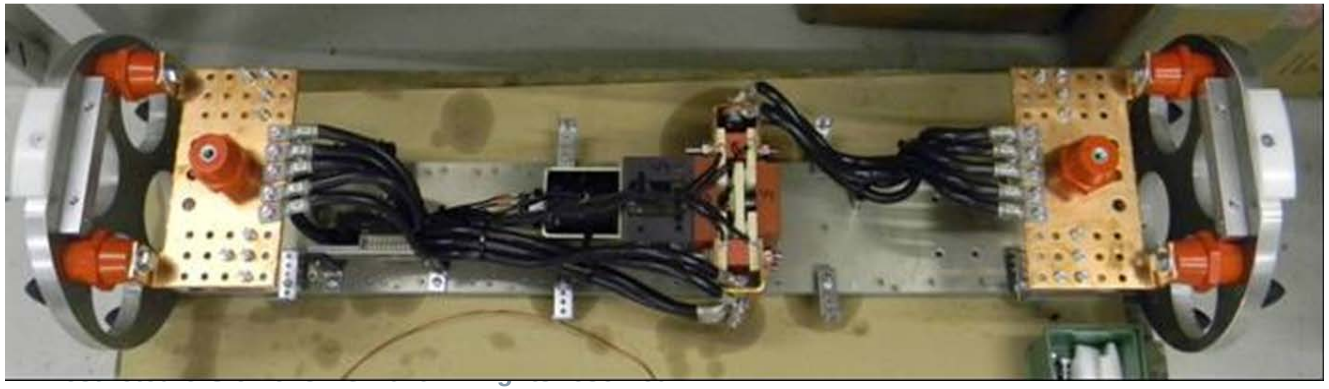


Component Qualification

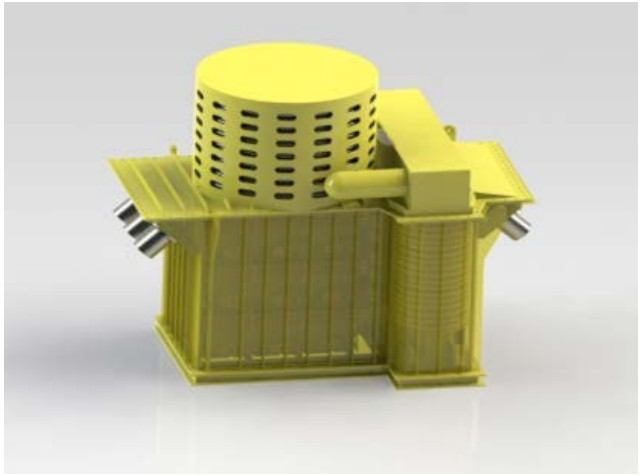
Start by building trust in the smallest building blocks – the components







Test of complete units



- In the factory
- Using applicable standards

Test site for shallow water test

- Test site in the Trondheim area
  - A dry dock (L 113 m, W 20 m, D 12 m)
  - Already used to test other types of equipment for offshore use

A good laboratory

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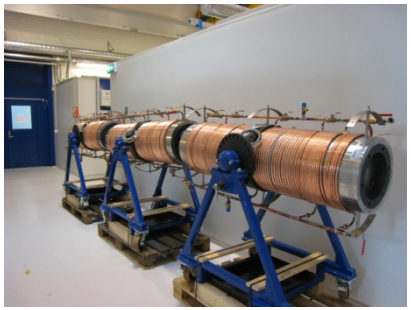

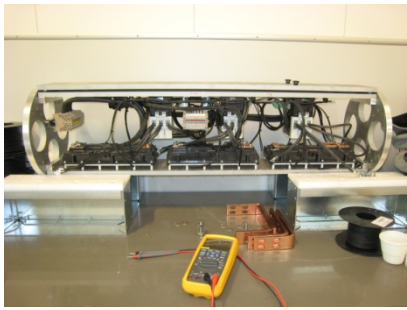

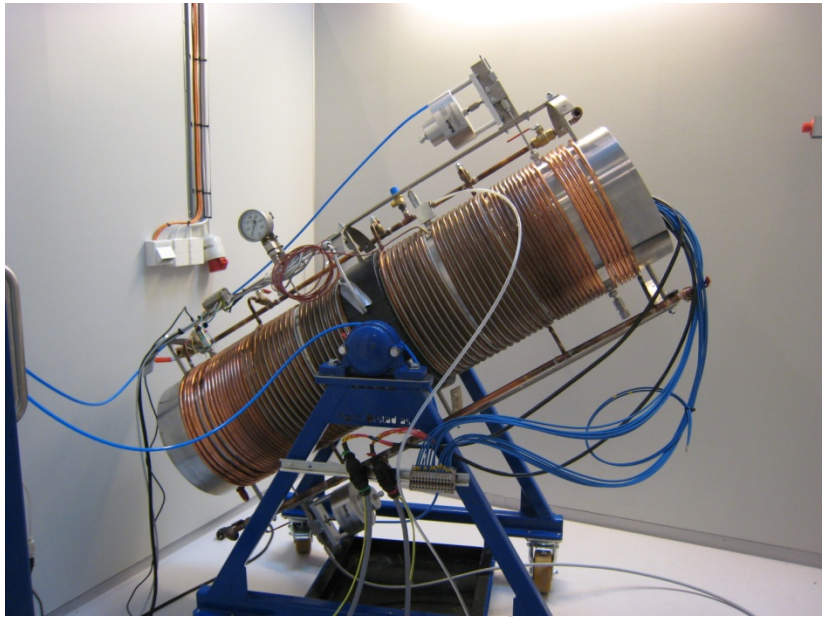

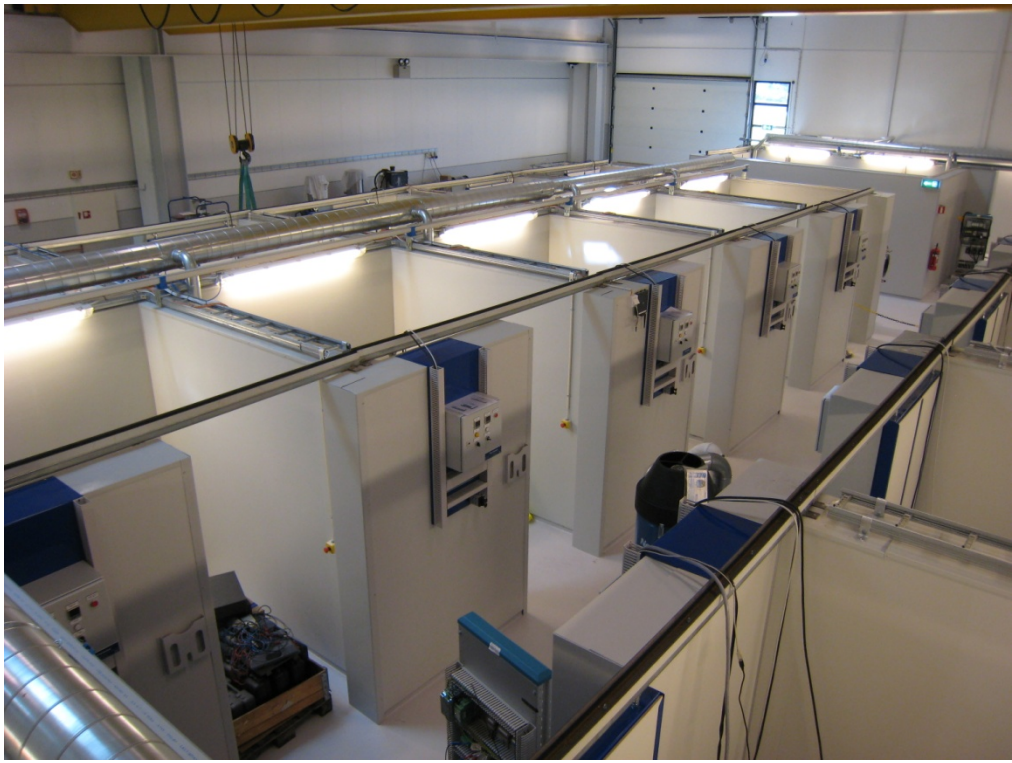

Summary

- Siemens is developing and qualifying a Subsea Power Grid
  - A general development and qualification project, not targeted towards a particular field
- Reliability management is important in the technology development and qualification
- Standards for reliability management can be of help, but methods and tools must be adapted to the technolgy development situation
  - Written for field development and operation