

Using Torque Converters to Reduce Cost in Subsea Applications

Houston, 2016-Feb-04, Gas/Electric Partnership



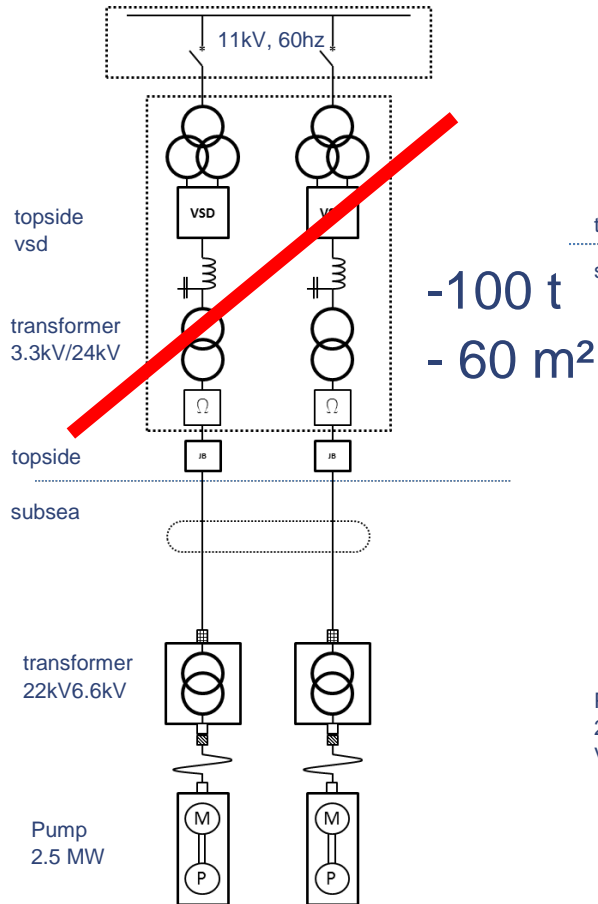
Trends in Subsea Technology

Progress in technologies, growing experiences, new ideas and developments have been creating smart concepts.

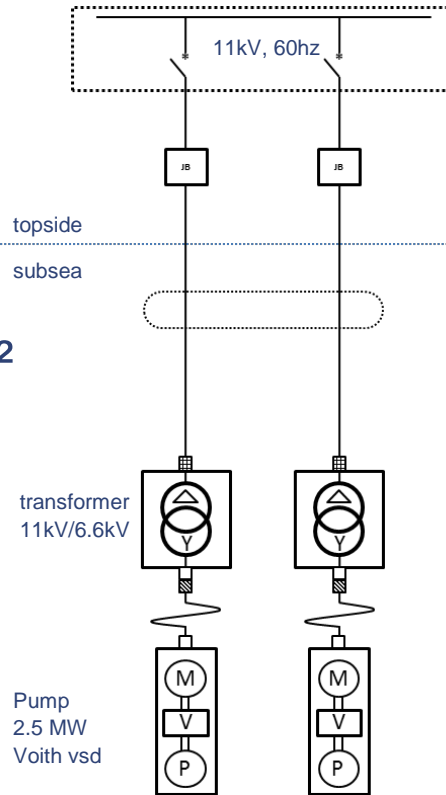
- Increase lifetime of O&G platforms by additional supplies from near or far wells.
- Exploit small and mid-sized fields as well as fields that are far away from existing infrastructure.
- Equipment growth by power and diversification of processing.
- Focus on cost, focus on subsea systems, standardization, etc.

Overall System Design

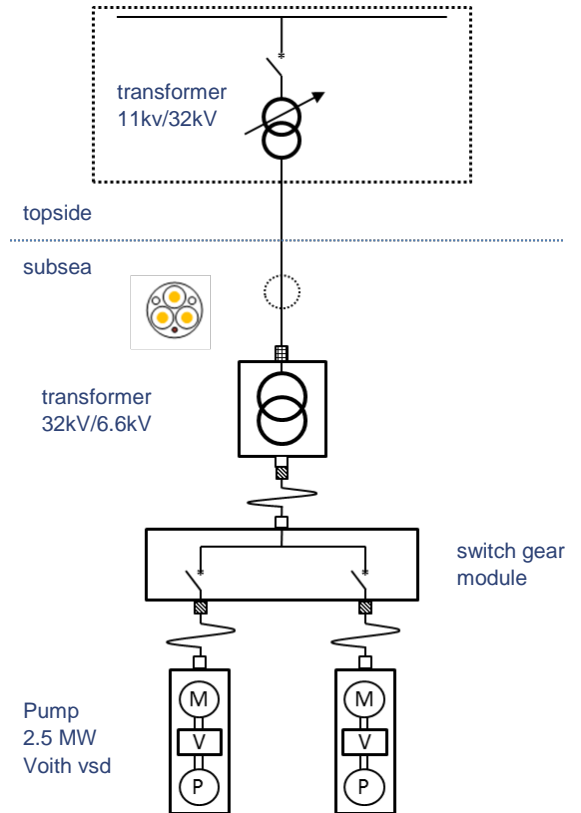
Topside VFDs



VSDs short stepouts



Voith VSDs long stepouts



Topside VFD Module for Subsea Pump Drive



Photo Oyvind Hagen 2013-Jun-26 / Courtesy of Statoil

including

- Switchgear
- VFD
- Step-up transformer

plus

- Subsea step down transformer

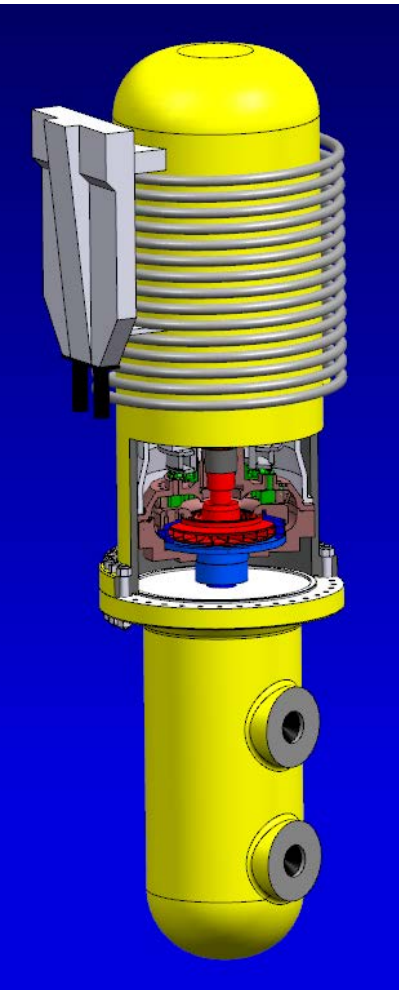
Topside Power Equipment



Switch Gear (topside)
Dimension 2400x2200x1000 (WxHxD)
weight 1.3t

- Significant Power system CAPEX saving by up to 40% - 50%
- Reduced top side space and weight by up to 75%
- Significant reduction of complexity

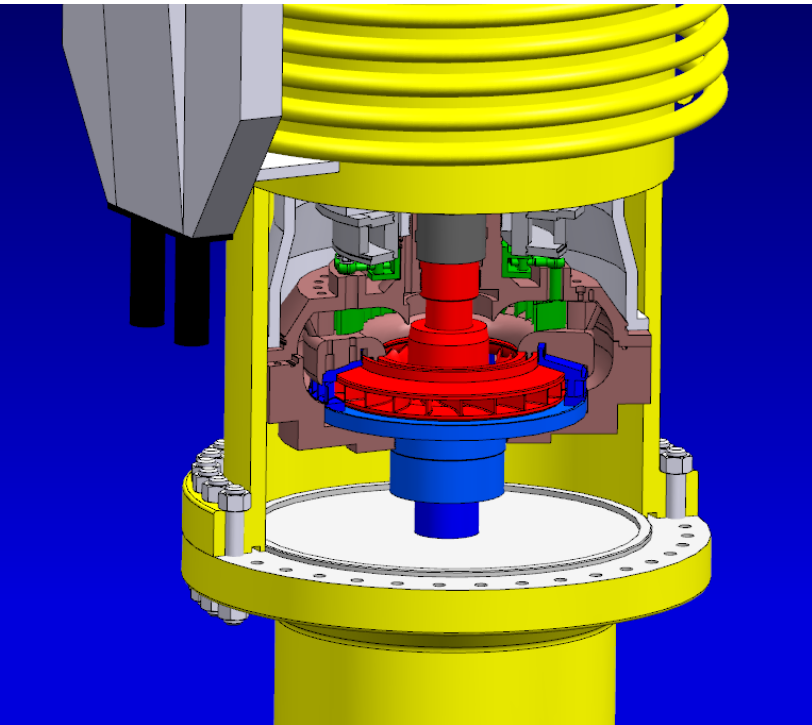
Subsea Pump Drive



Fully integrated torque converter

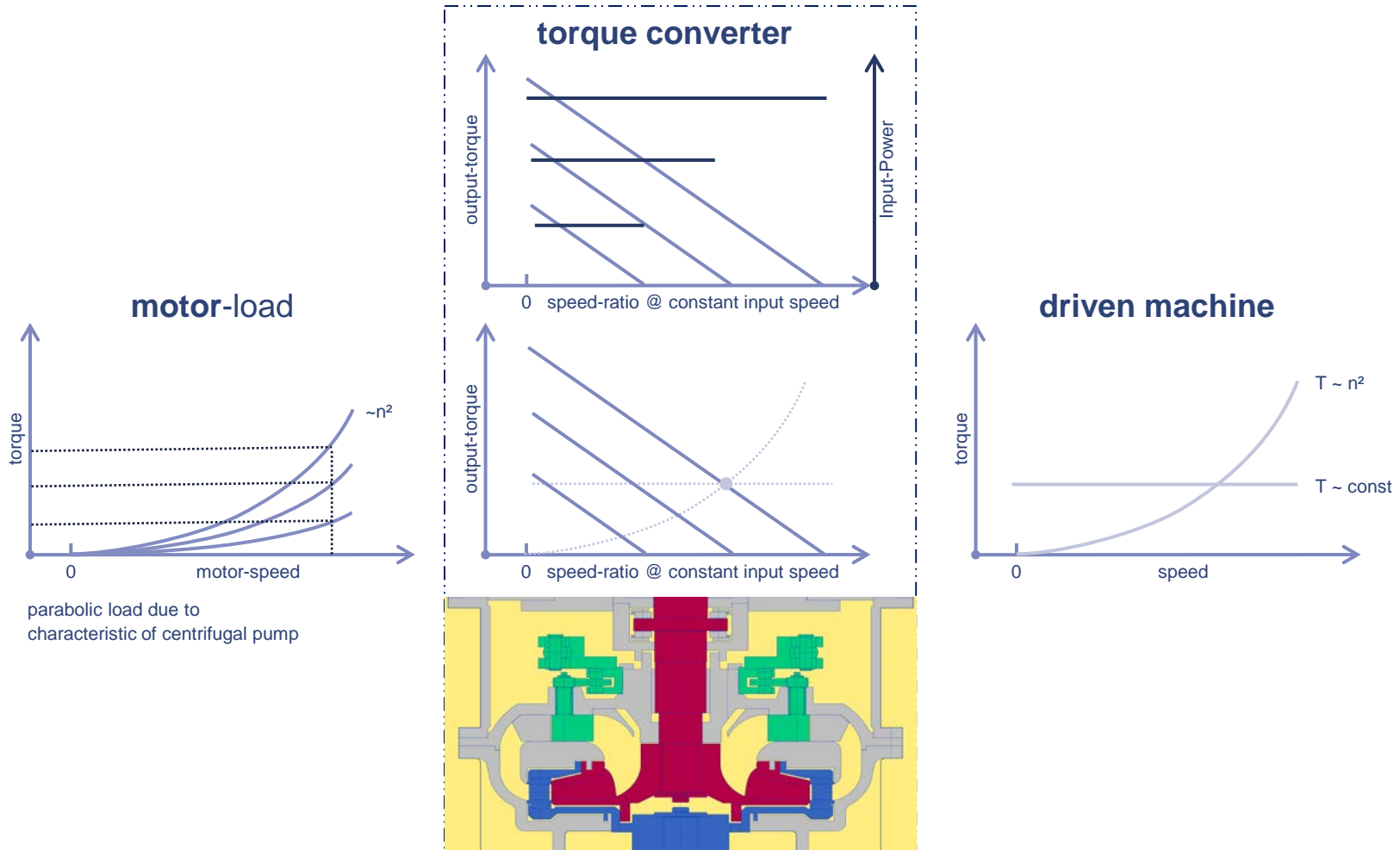
- converter replaces the connecting coupling.
- rotating parts are mounted on motor and pump shaft.
- very compact design.
- no additional bearings.
- Simple design, small number of components.

Subsea Pump Drive



Input power	2795	kW
Input speed	3600	rpm
Output speed max.	4300	rpm
Type	EL 8 subsea	
Outer diameter	731	mm
Profile diameter	562	mm
Length	506	mm
Additional length	350	mm
Weight kg	500	kg

Hydrodynamic torque converter Operating characteristic



Advantages of the Torque Converter

Miscellaneous advantages:

- overload protection of motor & lower cable costs & (TC output shaft from input shaft un-coupled, motor speed const.)
- high start-up torque & nearly unloaded motor start
- precise operation of working machine (TC reacts fast on input signal to guide vane actuator)
- easy to control (e.g. 4-20 mA signal)

Advantages of the Torque Converter

Miscellaneous advantages:

- various working machines with variable speed need (e.g. SPP, MPP, compressors, generator for all kind of pumps)
- high reliability (thousand TC's running on-/offshore)
- robust design (“only steel and oil” with no/little electronics)
- high flexibility (large speed range, various TC types)
- size / power scaling possible with same principle (be prepared for future needs)

Concepts with Torque Converter

Ongoing actions:

- pre-JIP- / project phases
- design simulations
- tests
- studies

VOITH

Engineered Reliability