

# Subsea Separation – the Next Focus Area for Subsea Processing?

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Many conferences, projects, workshops have covered a variety of topics covering subsea boosting, pumping, separation etc. – what is new?

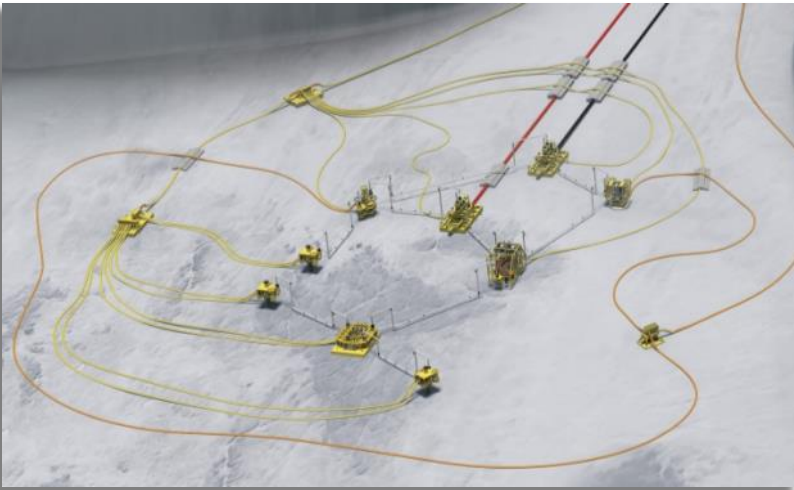
This presentation is made to highlight the potential and readiness of subsea separation, as one possible solution, whenever applicable.

The advances in separation technology, project implementation and qualification facilities have leap frogged to a new level over the past years.

# Introduction

The deepwater challenges varies between regions: deepwater, deep reservoirs, heavy oil, lack of infrastructure, age of facilities, remote locations, harsh to hostile environment

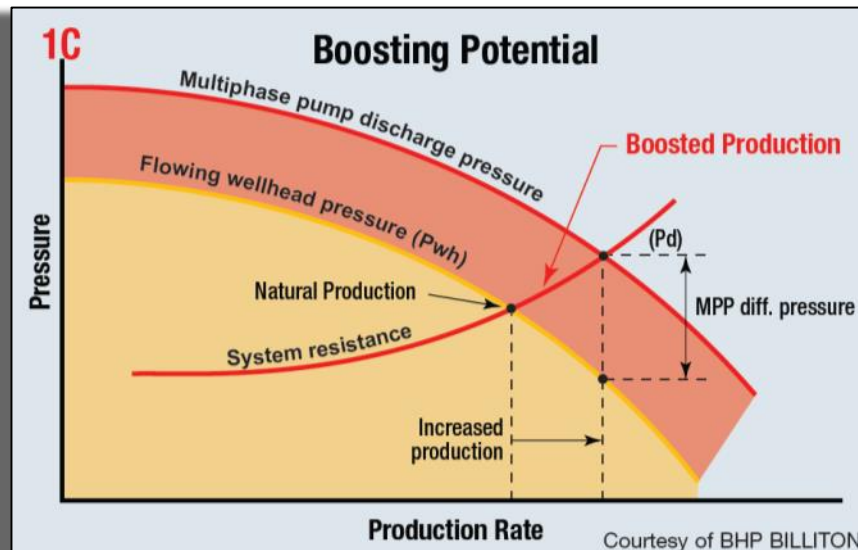
The requirements on subsea boosting/separation are wide-ranging and requires an extensive toolbox: varying water depths, GOR, light crude to heavy oils, bulk separation to dehydration.



*Picture courtesy Intecsea*

## Some Key Benefits with Subsea Boosting

- Improved well productivity/extending economic field life
- Longer tie-back distances possible
- Reduce/avoid gas hydrates issue
- Reduce capital and operating costs by reducing surface processing needs



### Tordis Full-Scale Separation

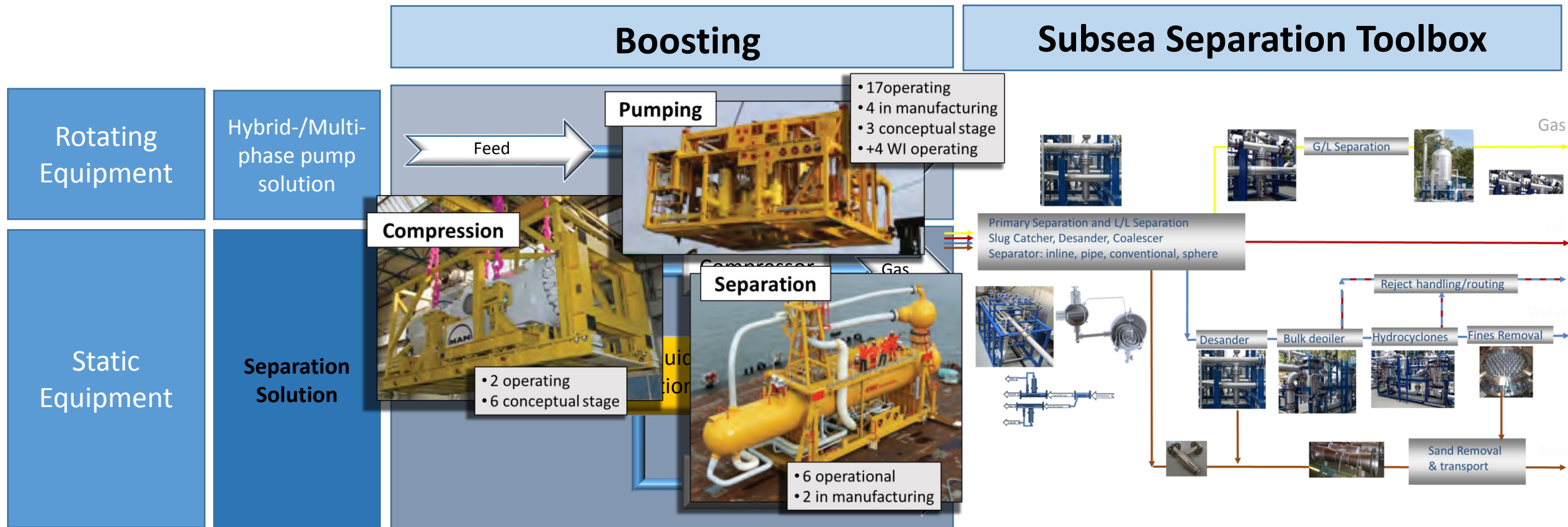
- Overall recovery improved from 49% to 55%
- Additional 35 million barrels of oil reserves



Picture courtesy Intecsea



# Subsea Boosting Solutions

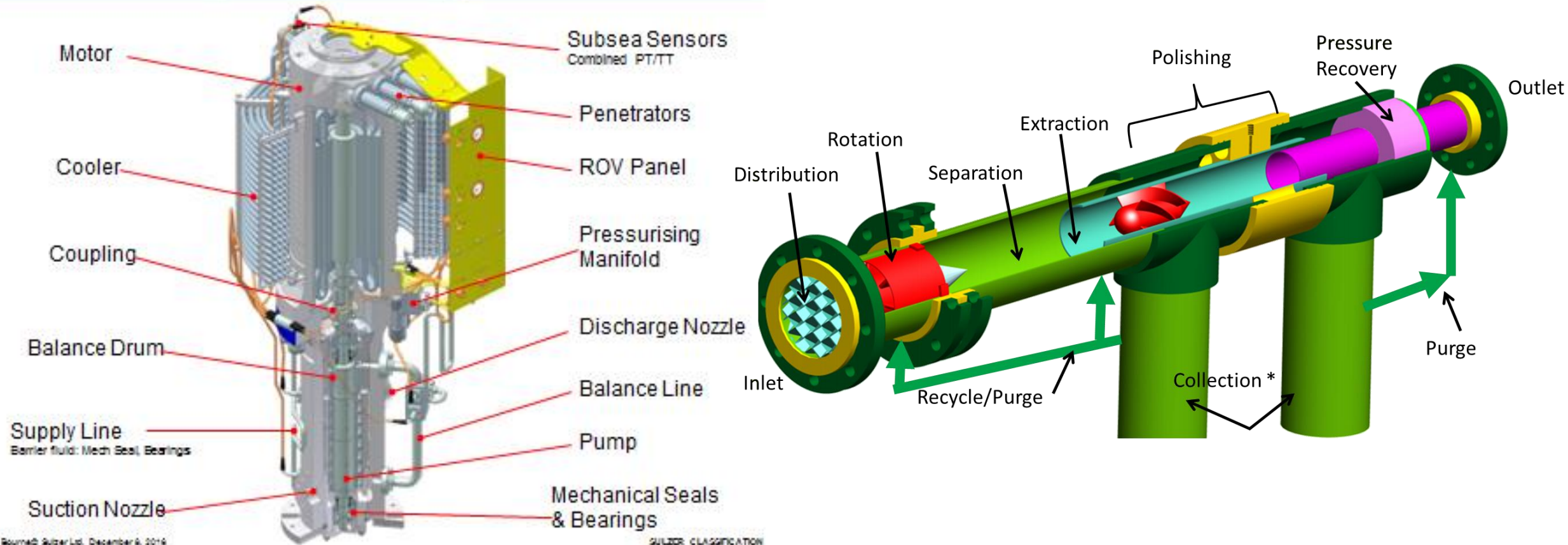


Water Depth	Separator Design
Shallow	Vessel-based
Deep	Compact (pipe-based or Spherical)

Picture courtesy Sulzer Chemtech

# Subsea boosting – pumping or separation

## Sulzer Subsea Pump – Pump/Motor Layout



Picture courtesy Sulzer Pumps Equipment and Sulzer Chemtech



## Subsea Separation - examples

Total



Subsea separation is being used on some subsea boosting projects and further work in terms of design and qualification has been done and is ongoing.

Subsea separation works!

Petrobras



ExxonMobil



Picture courtesy Intecsea



# Subsea Spherical Separator JIP



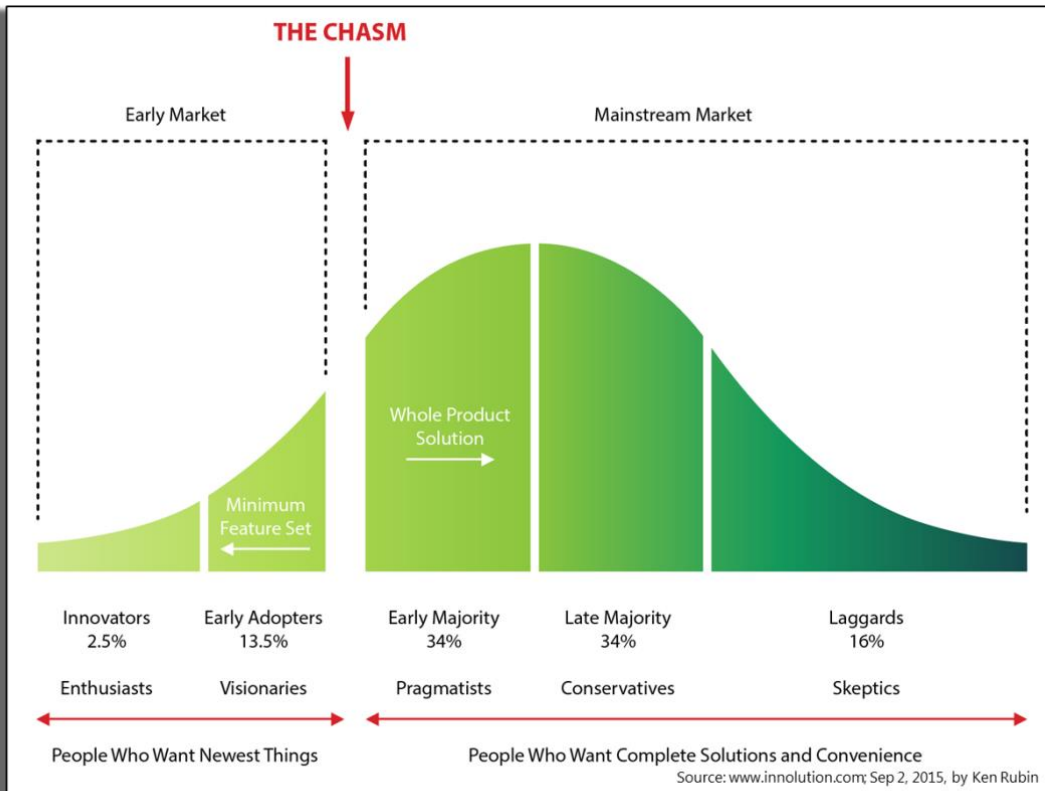
**Participants:** Chevron, ExxonMobil and GE Oil & Gas

**Test site:** ProLabNL (Arnhem, NL)

*Picture courtesy ProLabNL & Subsea Spherical Separator JIP participating companies*



# Technology Gaps & Developments



Further **development**, better qualification, better general understanding (separation)

Subsea design for life needs very detailed considerations

Understand the **boundaries and limitations** of what is possible or feasible.

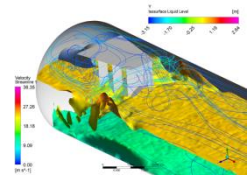
Set realistic goals and **communicate** clearly the purpose of the project.

Work and engage as much as possible of the **supply value chain**

Adequate **testing and qualification**!

*Recent successful example: CMIST compact gas dehydration technology*

# Technology Qualification (TRL)



## TECHNOLOGY READINESS LEVEL

TRL references from  
API 17N

Stage	Description	Remark
0-1	Experimental research ("Concept")	Design, CFD
2-3	Lab test pilot – robust & reliable ("Proof of Concept/Prototype")	Small-to-large scale, atm, model fluids
4-6	System tested in environment ("Ready to use")	Large-scale, real hydrocarbons, high
<b>ProLabNL example:</b> <b>50.000 BLPD, 0-100% GVF, 0-100% watercut, up to ~1000 psig</b>		

Picture courtesy Sulzer Chemtech and ProLabNL

# Next steps – Increase the Industry Awareness

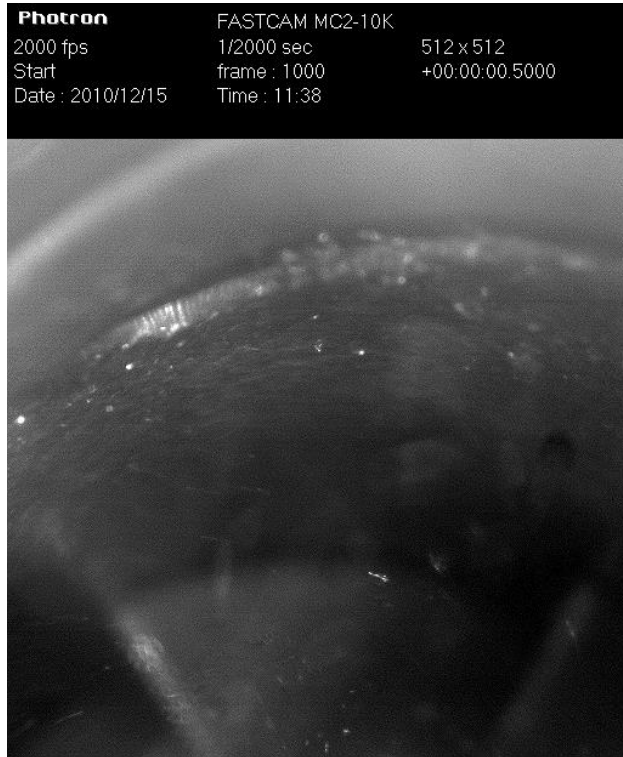


- De-mystify separation and subsea boosting (technology potential)
- Examine and determine possibilities for standardization without sacrificing performance and customization needs (from design to project execution including installation)
- Ease of maintenance and process monitoring possibilities (operational aspects)
- Quantify potential with concrete business cases (money talks)

What's the road map and potential with subsea boosting – further talks and possibilities for workshops/JIPs? (Industrywide)



## Conclusions



*High pressure testing  
Gas/liquid separation*

- Increase your production/recovery rates – consider subsea boosting as an alternative
- Subsea separation has matured vastly over the last decade
- Overcoming technology gaps and the chasm requires solid business cases, technology as key enabler and proper qualification
- The industry needs to talk across the value/supply chain to maximize the value of any project
- What's the next step for subsea separation – how to increase awareness and industrywide collaboration?

# THANK YOU!

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