Subsea separation as enabler for subsea artificial lift solutions

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Presentation Outline

What is subsea processing?
Introduction
Background
Motivation
Troll Pilot
Tordis SSBI
Oil-Water separation
Gas-Liquid separation
Conclusion
What is subsea processing?

Definition:
“Any active handling or treatment of produced fluids at or below the seabed”

Separation
Pumping – for boosting or injection
Compression
Introduction

New opportunities

Integrated approach

One plant
Background

Subsea Processing Pioneer

Re-using existing technology

Game changers

- Hydrocarbon boosting at Lufeng (1997)
- Separation and injection at Troll Pilot (1999)
- Separation, injection and boosting at Tordis (2007)
- Raw seawater injection at Tyrihans (2009)
- Partnership in Pazflor gas/liquid separation and boosting (2010)
- Compression at Gullfaks and Åsgard (2015)
Motivation

Profitability

Host capacity/complexity

Enabling new solutions

Carbon efficiency
Troll Pilot

OiW content 500 ppm
15 years subsea

Reduced WI wellhead pressure
2000-2500 Sm³/d WI rate

Topside capacity
Reduced gas lift required
Tordis SSBI

OiW content 500 ppm

Installed subsea for 7 years

Separator inlet pressure 32 bar

Easy to operate

Boosting increases oil recovery
Oil-Water Separation

Moving from 1000 ppm to 100 ppm OiW

Next is 10 ppm OiW

New possibilities

Pipe separator, Statoil patent
Simplified process overview

100 ppm oil in water

10 ppm oil in water

Pipeseparator

Hydro-cyclones

Water injection pump

Well

100 ppm

5 barg

Choke

Water polishing units

Well or Sea

Ejector

Oil and Gas

Flowline to host

Water injection pump

Well
A Game Changer

1000 ppm oil in water (OiW):
- Re-injection of water in dump wells or some reservoirs
- Reduced need for artificial lift
- Reduced carbon footprint
- Subsea pre-processing of water for topside cleaning
- Less need for riser capacity at high water cuts

100 ppm OiW:
- Possible to re-inject in more reservoirs
- Reduced need for/size of topside processing

10 ppm OiW:
- All subsea produced water treatment
- Possibility for discharge to sea in some areas
- Re-injection possible in most reservoirs
Gas-Liquid Separation

Several applications worldwide

Carbon Efficiency

Artificial lift

Economics

Asgard subsea compression - 2015: Gas liquid separation (scrubber)

Horizontal gravity separator
Conventional topside process

What happens if we move the first stage separator to subsea?
Gas-Liquid Separation Riser base

A different design philosophy

One plant
Simplified topside
Reduced CAPEX
Reduced OPEX
Mature technology

Flowline
A new type of solution

Simplified flow assurance
Simplified artificial lift
Simplified topside process
Reduced CAPEX and OPEX
Increased recovery
Carbon efficiency
Conclusion

Enabling new solutions

Game changing

Carbon efficiency

Simplifying and enabling better artificial lift solutions
Thank you!

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