



equinor

## *Simulation of New Gas Processing Concepts*

# Introduction



*In operation*  
Subsea compression



*In operation*  
Offshore floating wind



*Ongoing*  
Unmanned Wellhead Platform (UWP™)



Unmanned production platform, supported from host (UPPT™)



Stand alone gas/condensate development

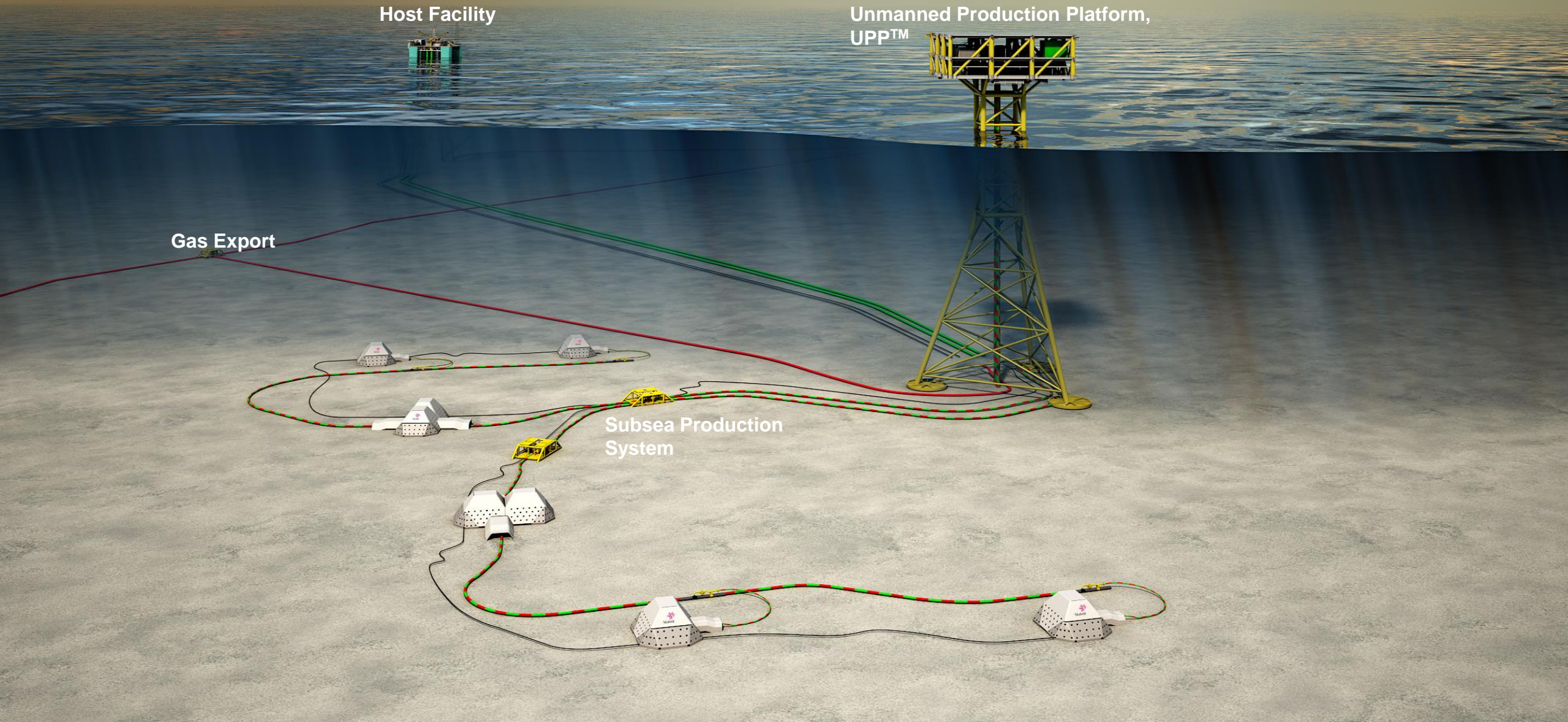


Stand alone remote oil and gas field developments

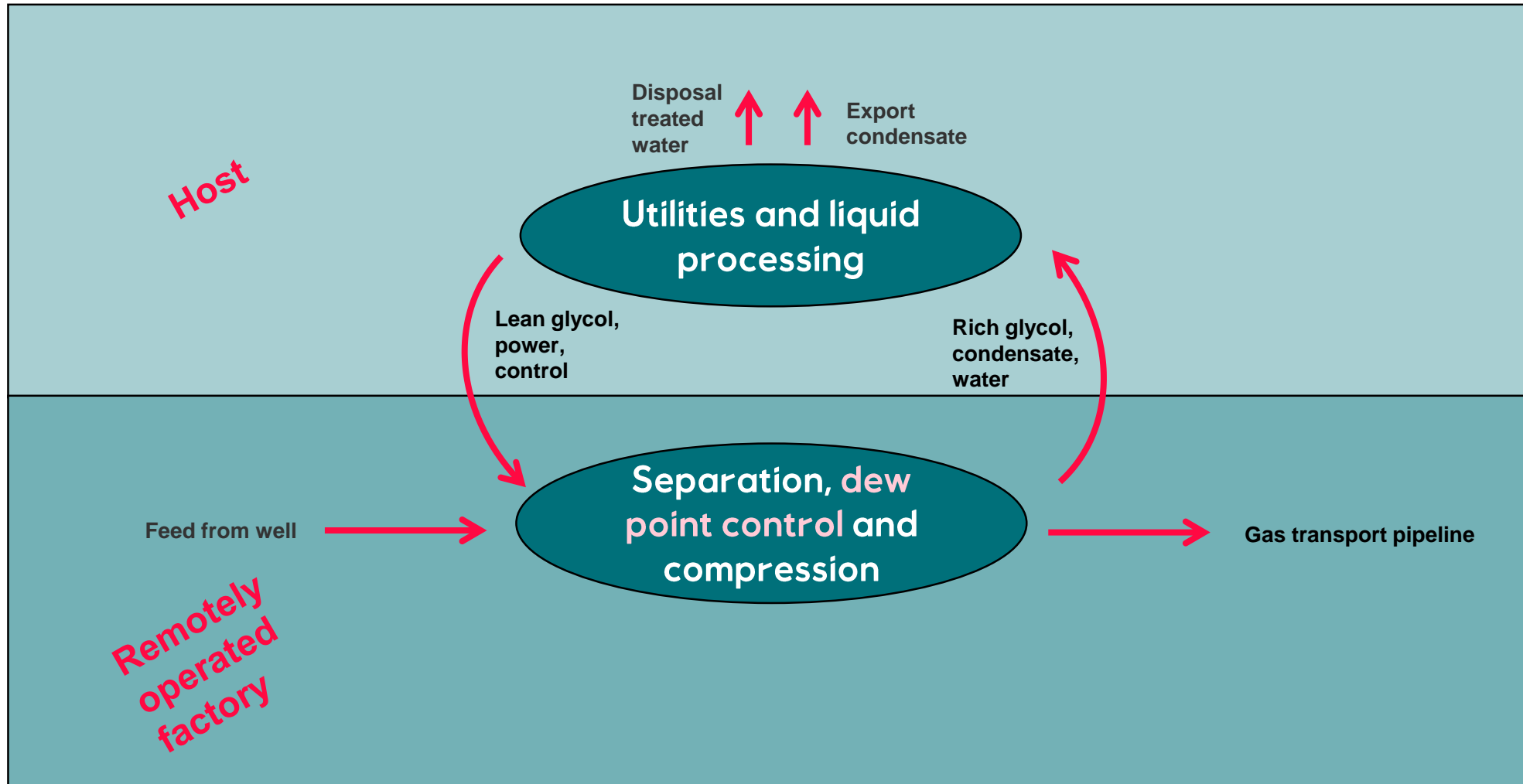


Ultra deep water Upp™

# Unmanned production

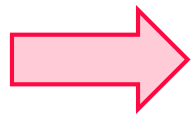


# The Gas-2-Pipe™ concept

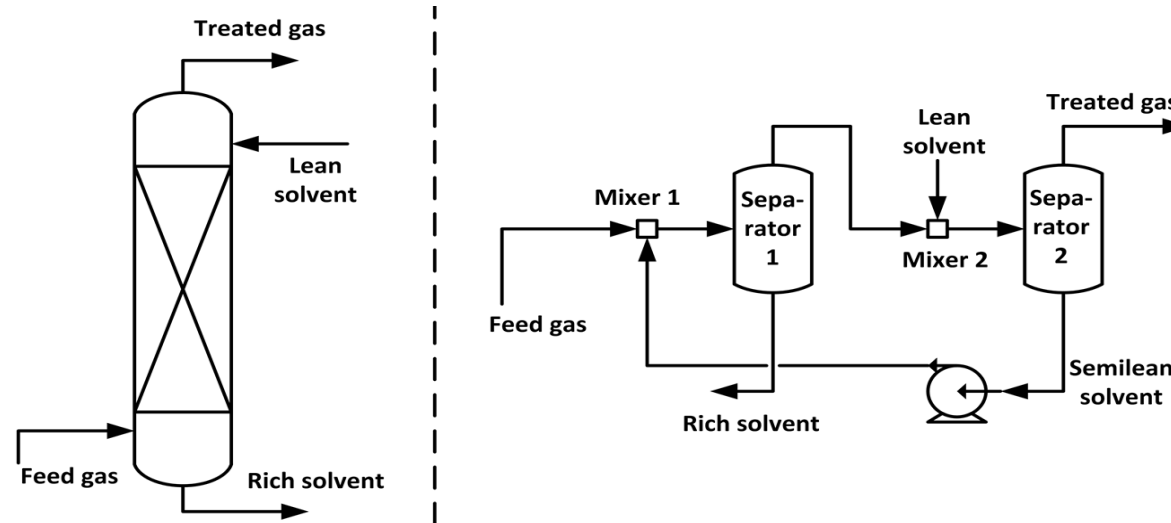


# Technology needs

- Simpler processes with less maintenance needs
- Fundamental understanding of the efficiency of the water removal process
- Ability to predict solubility of glycols in natural gas



**Improved thermodynamics for hydrocarbon/glycol/water systems to be used in simulations for design and monitoring**



## Filling the gaps

- Sponsored project with DTU: «Chemicals for Gas Processing»
  - CERE Thermo
- Equinor internal thermodynamic models – NeqSim
  - Java source code, IKVM compilation to .NET
  - Thermodynamics including PVT characterization
  - Physical properties: interfacial tension, viscosity, conductivity
- CAPE-OPEN implementation ~5 years ago – still ongoing
  - Implemented in C#

	Feed	Phase 1	Phase 2
	total	gas	aqueous
methane	2.5E-1	3.32227E-1	2.73602E-8
ethane	2.5E-1	3.32227E-1	8.9029E-10
propane	2.5E-1	3.32227E-1	7.40861E-13
water	2.5E-1	3.32026E-3	1E0

# CAPE-OPEN in Equinor

## Simulators

- UniSim (previously HYSYS)
- ProMax
- Pro/II

## Flash algorithms

- UniSim embedded flash (eThermo) in use
- Internal implementation lack speed and stability

## CAPE-OPEN implementations

- Thermodynamics and Physical Properties (v1.1)
- Unit Operations

## Tools for debugging

- COLTT for logging
- COFE for testing and debugging

# Challenges

- Speed of simulations
  - Simulation of oil and gas processes requires large fluid packages (~70 components)
- Stability and speed of flash algorithms
- Difficult interpretation of warnings and errors
- Limited knowledge and time available for development

## Oil&gas process simulation in UniSim with 40 components

Model	Time [seconds]
UniSim SRK	13
NeqSim SRK with CAPE-OPEN	90

Factors:

- SRK implementation
- Flash algorithm
- Communication through CAPE-OPEN



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