



## Verification / validation of sub sea multiphase meters

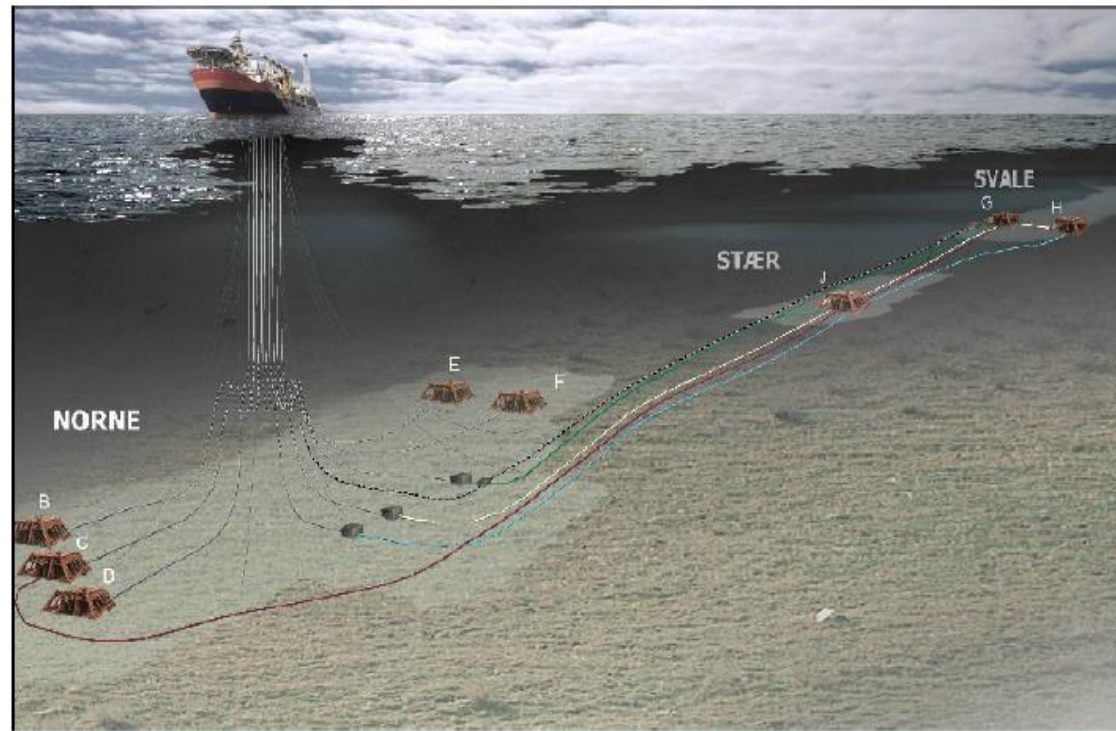
NFOGM Temadag 19. mars 2015  
Eirik Åbro and Eivind Lyng Soldal

# Outline

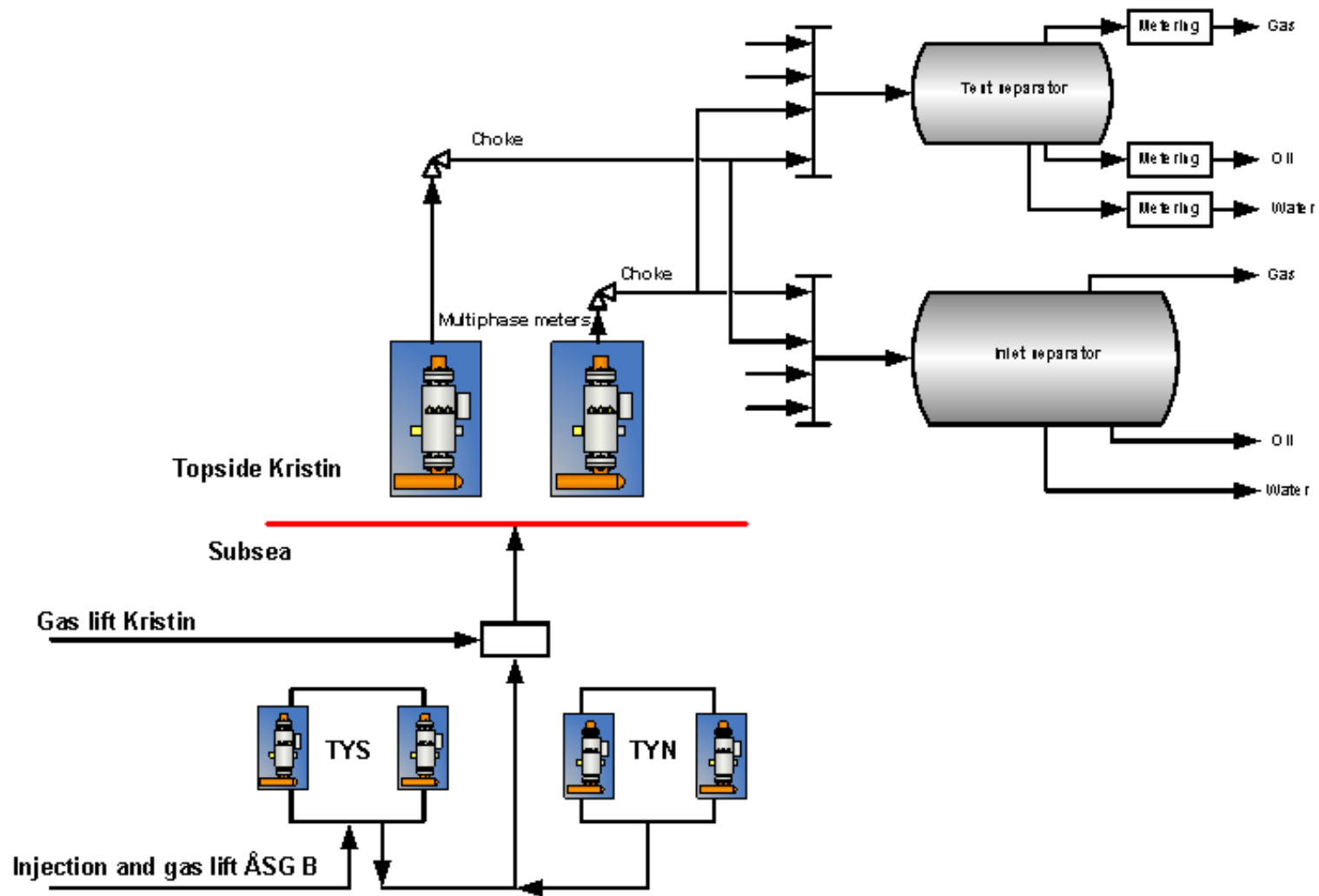
- Introduction: Online well data and allocation
- Base case subsea tie-ins metering concept
- Lessons learned
- Multiphase metering technology needs
- Subsea – subsea tie-ins
  - Example from Yttergryta tie-in to Midgard
- Challenges for subsea – subsea tie-ins
- Subsea factorying concept
  - Åsgard subsea compression
- Summary

# Online well data and allocation

- Reduced need for traditional well testing and well shut in during testing
- More active control of the wells, optimise production on daily basis
- Better reservoir management for more accurate input data during planning of infill wells
- Monitoring of formation water breakthrough and salinity
- Ownership allocation measurement



# Base case – Example Tyrihans tie-in to Kristin



# Lessons learned from Base case

20 yrs of operational experiences of multiphase and wet gas meters  
250 multiphase meters in operation, approx 50% subsea  
Subsea multiphase are installed in retrievable modules

Flow loop testing at real conditions and real fluids needed to document performance and functionality

Verifications of multiphase meters needed to document performance over time

- Test separator
- Subsea meters against topside meter

Robustness and reliability of multiphase meters linked to production strategies (GI, GL, WI) and access to PVT samples

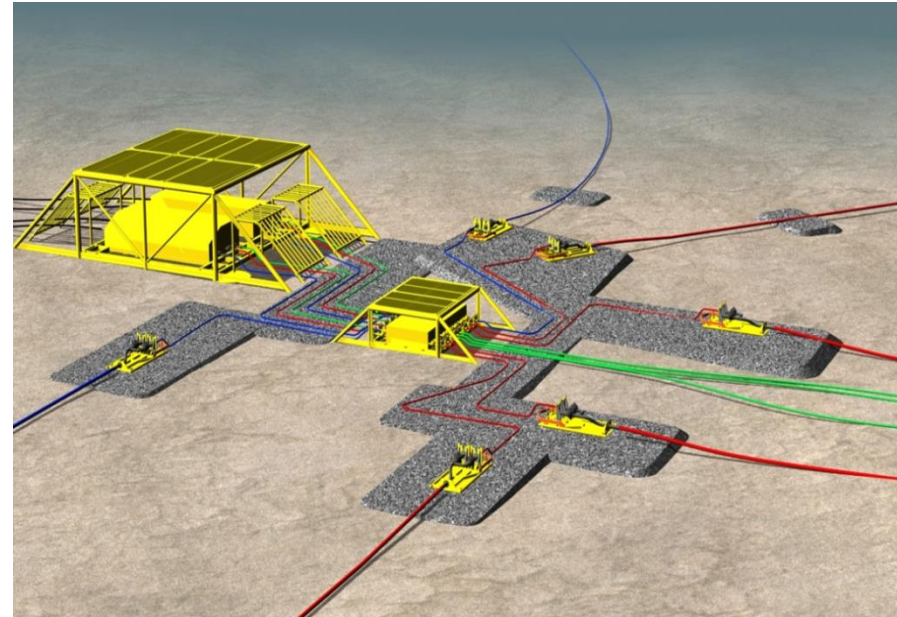
Remote access to multiphase meters, topside and subsea is needed.

High capacity in the communication (bandwidth) to subsea meters needed for proper follow-ups

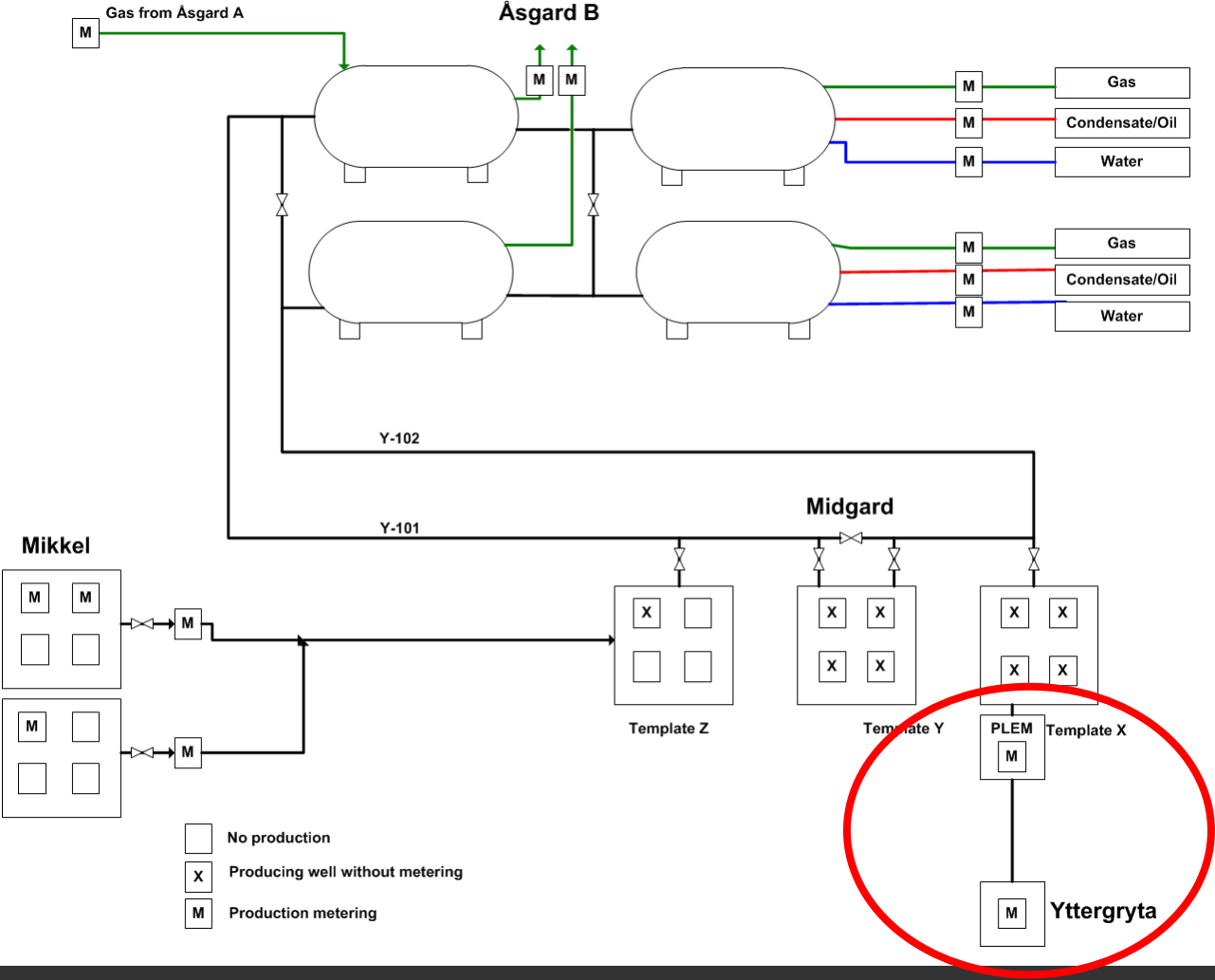
Close follow-up needed

# Multiphase metering technology needs

- Long distance multiphase transport
- Subsea – subsea tie-ins
- Subsea compression and processing
- Other fluids, heavy oil, high viscous oil
- IOR
- Ultra high GVF
- Formation water detection
- MEG/Water capacity limitation
- Multi zone production and production from multilateral wells

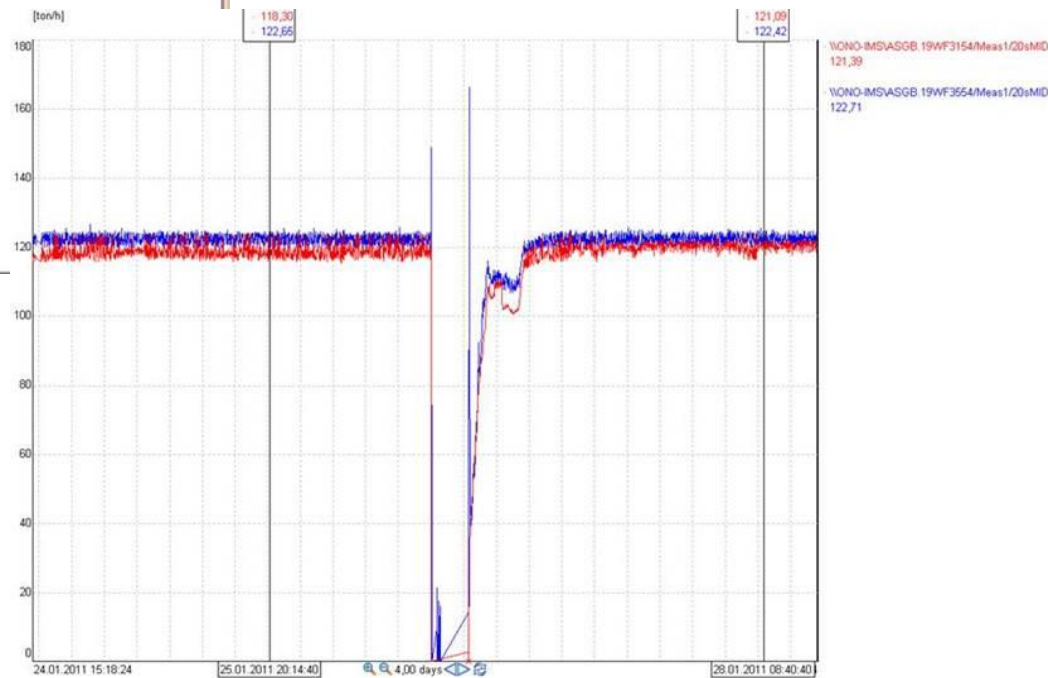
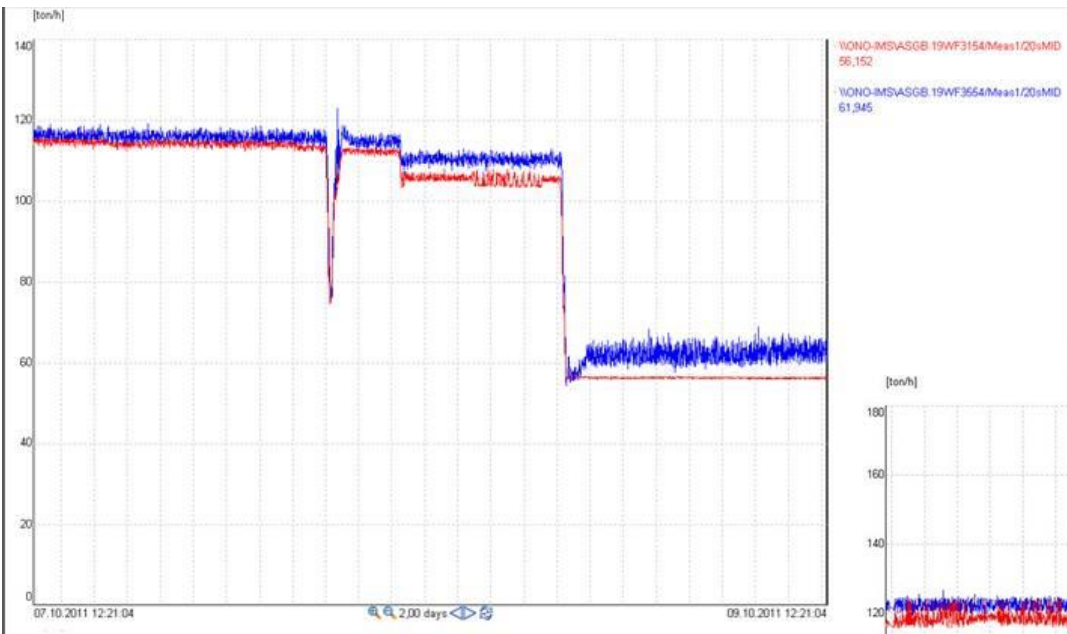


# Subsea – subsea tie-in



# Field experiences from Yttergryta

- Hydro carbon mass rate measurement
- Two different technologies
- Typical 2% in difference





# Challenges for subsea – subsea tie-ins

With tie-in to older subsea field, limited power and bandwidth capacity

Lack of verification of multiphase meters to references (test separator)

- Need for additional subsea meters for verification
- Additional subsea meters need modules to be installed in
  - ✓ Umbilical
  - ✓ CAPEX

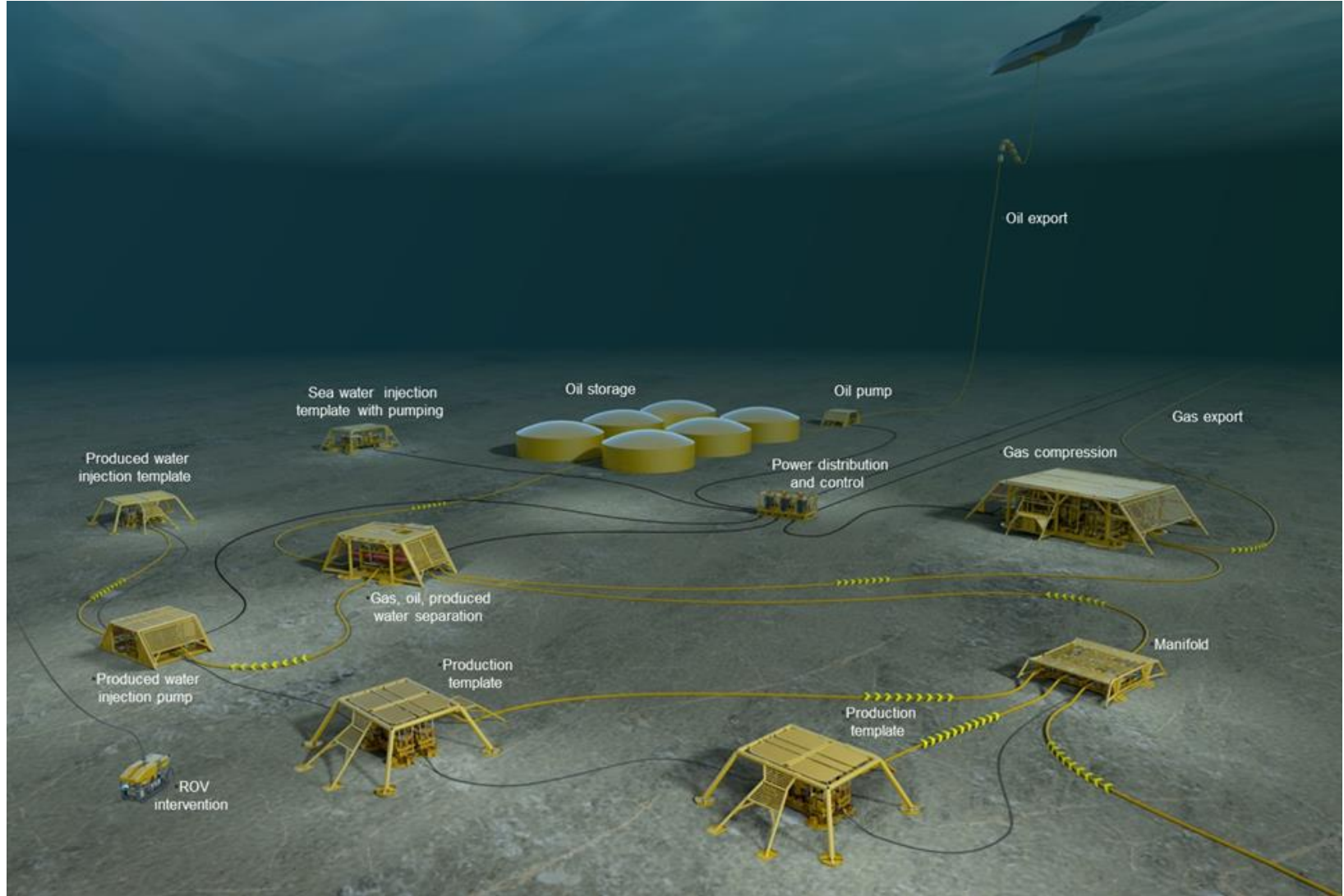
More testing of meters and system is needed prior to installation

Limited access to multiphase meters subsea, long time to fix a problem

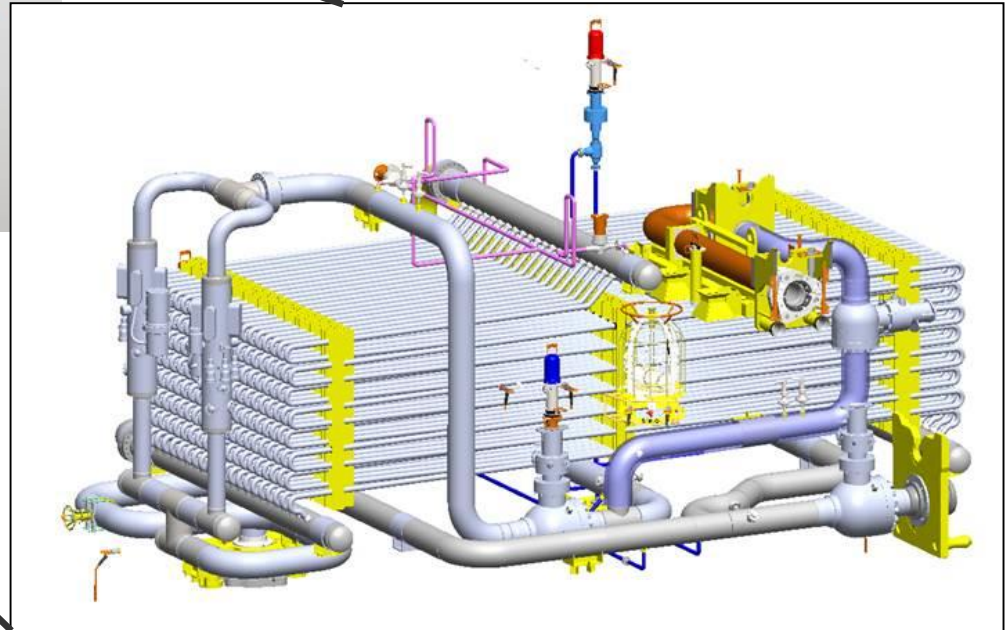
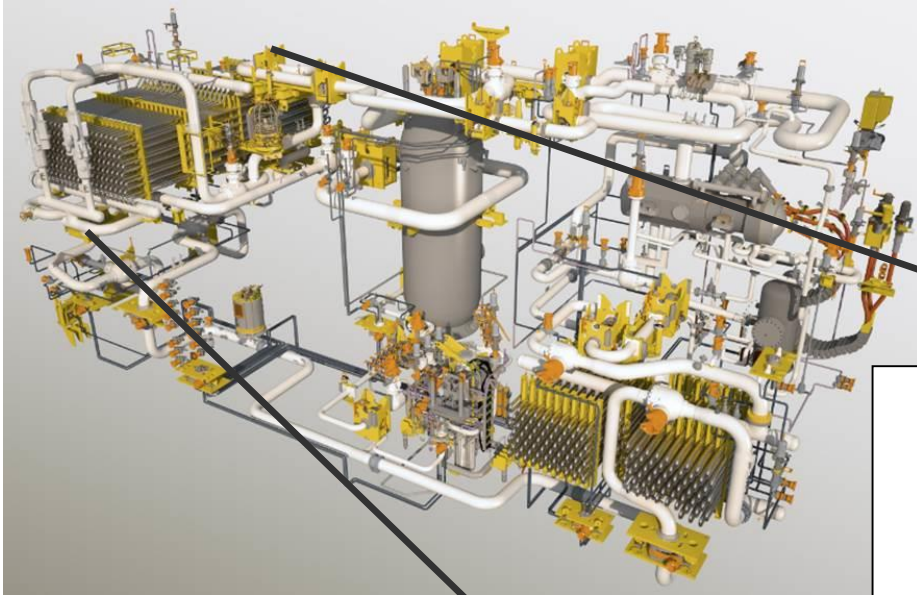
Lack of PVT samples and sampling possibilities

- ✓ More robust meters to better handle changes are required
  - ✓ Less dependent on verification against external measurements and sampling
- ✓ Smarter and internal self checks
- ✓ Multiphase meters with improved specification required

# Subsea factorying



# Åsgard subsea compression



# Summary

- More complex field developments require more robust multiphase metering technologies
  - ✓ Long distance multiphase transport
  - ✓ Subsea – subsea tie-ins
- Gaps identified from multiphase meter experienced from more traditional subsea tie-in need to be closed
  - ✓ Robustness and reliability during changing conditions
  - ✓ Operational range (turndown, multiphase/wet gas)
  - ✓ Improved uncertainty specifications and functionalities
  - ✓ Formation water detection level
- Verification of individual multiphase meters may not be possible
  - ✓ Smarter and internal diagnostics are required

There's never been a better  
time for **good ideas**



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