Subsea Gas Compression - Enabling optimal performance for long tie-back and deepwater

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“Subsea Gas Compression for a greenfield long distance tie-back to an onshore LNG facility”

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T.B.Irmann-Jacobsen, B.Hop, T.K.Awolola, FORSYS subsea & FMC Technologies
R.Ferrario, D.Vanzan, ENI Tecnomare
Early-Phase design
- taking into account all cost drivers

\[ NPV(i) = \sum_{i}^{N} \frac{\text{oil price}(i) \times \text{oil rate}(i) - \text{CAPEX}(i) - \text{OPEX}(i) - \text{TAX}(i)}{(1+r)^{i}} \]

- The opportunity to reduce cost is the greatest in Early-Phase
- Minimize risks by getting control over the uncertainties

CAPEX CONTROL
Design 1 of subsea gas compression

Design basis

- Inlet Pressure, Temperature
- Outlet Pressure, Temperature
- Fluid properties - gas condensate
- Deep water – 1600 m depth
- Long tie-in – 60km
- Expected production
  - LNG target rate
- Onshore arrival pressure 35/80 bara

8 parallel compressors
Power system design of 100MW

Conclusion
Not a business case
Design 2 of subsea gas compression

Design basis is whole system - linking input with disciplines

New design
• 2-4 parallel compressors
• Power system design of 25-50 MW
• 50-75% cost reduction

Conclusion
Good business case
Production and timing of compression

Plateau rate to LNG plant

Qg (Sm³/hr)

Time (Years)

Natural flow

- 2 compressors
- 4 compressors
- 6 compressors
- 8 compressors

Natural flow
Production and power consumption

Plateau rate to LNG plant

- Natural flow
- 2 compressors
- 4 compressors
- 6 compressors
- 8 compressors

Time (Years)

Qg (Sm3/hr)

Shaft Power (kW)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

85% 95%

25 MW 100 MW
Case study uncertainty

Model uncertainty from field experience is +/- 10%
Uncertainty in input parameters to be calculated
Case study uncertainty

Plateau rate to LNG plant

Time (Years)

Pressures (bar)

Q_g (Sm³/hr)

83%/87%

2 compressors

Benchmark case

Flowing Wellhead Pressure

Onshore Arrival Pressure

+/− 10 bars

+/− 1 year
Key-findings

Get a full system overview and understanding before freezing design requirements

Get control over uncertainty in the calculations

Find the most cost-efficient solution