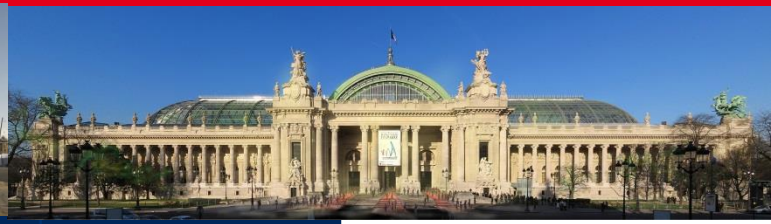
26th World Gas Conference

1 – 5 June 2015, Paris, France



SUBSEA TECHNOLOGIES FOR ULTRA-DEEPWATER ‘SUBSEA-TO-BEACH’ (STB) GAS FIELD DEVELOPMENT

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Introduction

- Development options: Subsea-to-Beach (STB) and FLNG
- Selected projects examples
- Technologies status and current challenges
- Today's achievements
- Future trends and tomorrow's technical challenges
- Conclusions

For more information and data, please see:

Beltrami, F. 2015, Subsea Technologies for Ultra-Deepwater 'Subsea-To-Beach' Gas Field Development: A Critical Review of Current Achievements and Future Challenges

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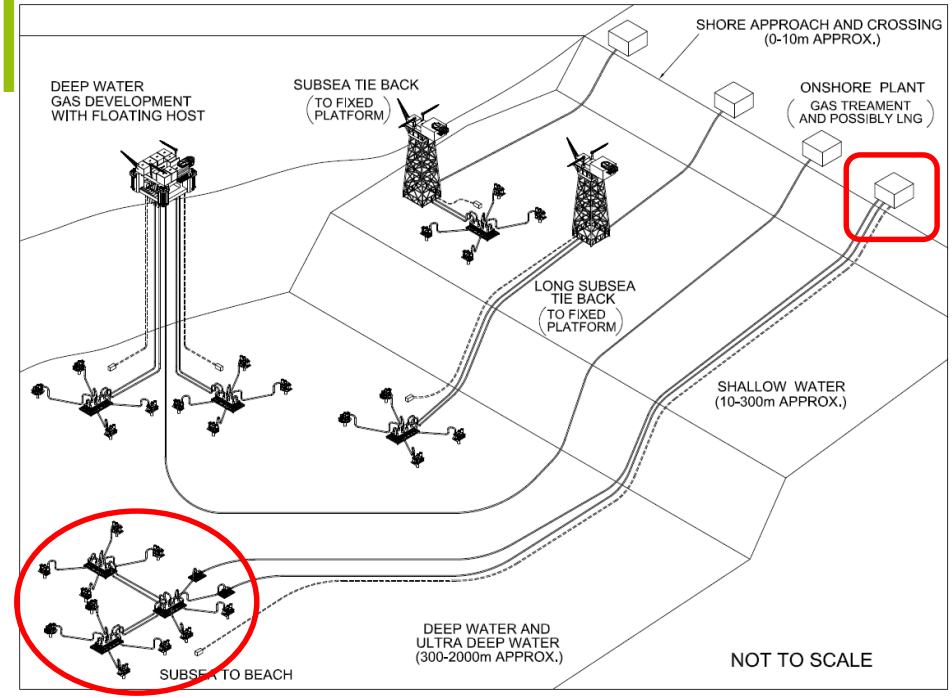
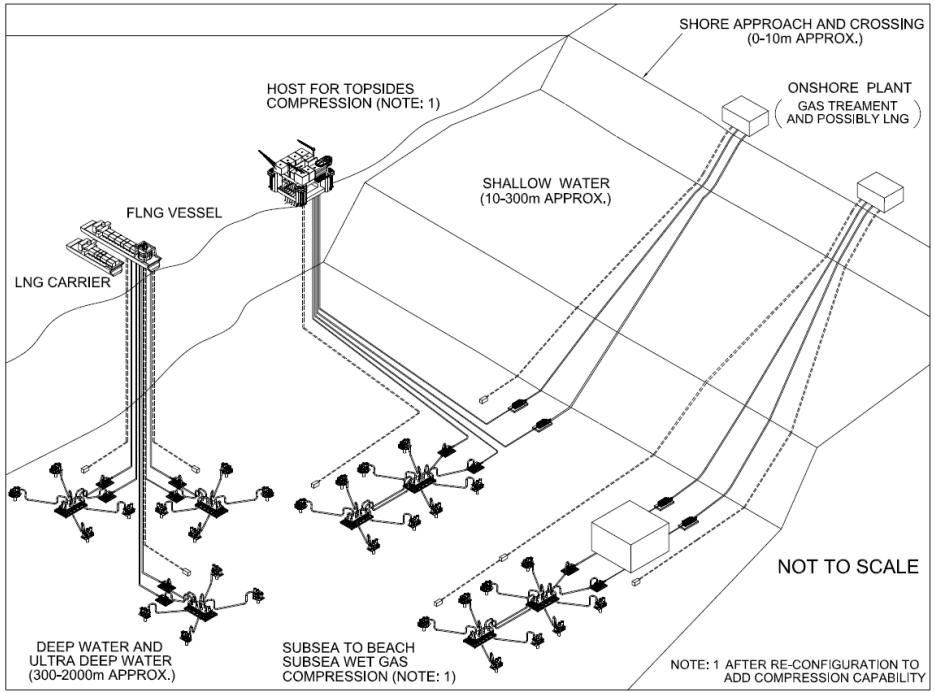
Field Development Options: STB and FLNG



Subsea-to-Beach (STB) and subsea tie-backs



STB and FLNG

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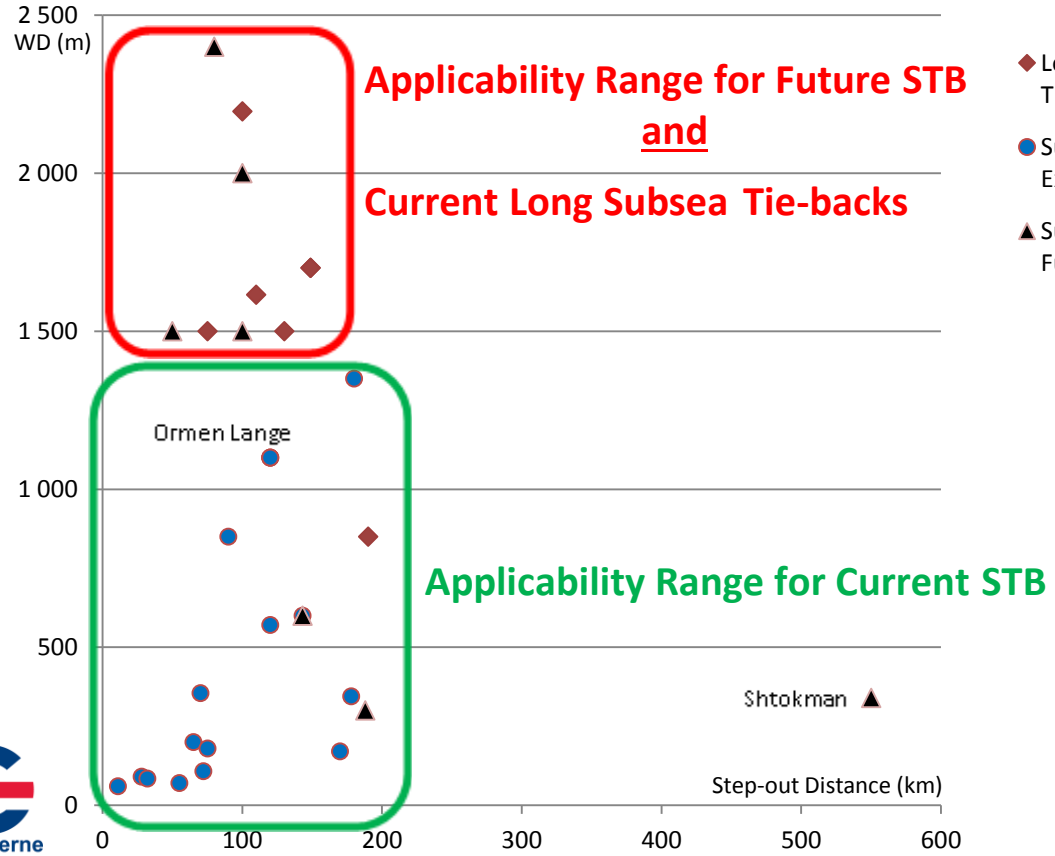
Selected Project Examples



Data from the 28-off projects reviewed in the paper:

- 7-off Long Subsea Tie-backs
- 14-off current and ongoing STB projects
- 7-off possible future STB projects

(information available in the public domain)

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Technologies Status and Current Challenges

- Flow Assurance aspects:
  - Avoidance of methane hydrates formation in pipelines
  - Mono-Ethylene-Glycol cleanliness for re-injection
- Long distance power and communications
- Electronic components obsolescence
- Manufacturing capability for control umbilicals
- Cost of control umbilicals
- Expensive alloys for subsea hardware and pipelines

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Today's Achievements

- Applicability range: 1,500m WD, 200km step-out distance
- Ongoing projects are reaching deeper waters
- Increased recovery of hydrocarbons is possible thanks to 'late field life' gas compression
- Environmentally acceptable shore approach and crossing
- Subsea HIPPS now adopted in deepwater STB projects
- Higher subsea reliability: longer design life is obtainable

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Future Trends and Tomorrow's Technical Challenges

- Increased step-out distance from the mainland?
- Need for 'late' gas compression, either subsea or topside
- High voltage power distribution over longer distances
- High voltage subsea electrical connectors
- Permanent subsea AUV's for inspection and repair activities
- Riser-less installation techniques for subsea well re-entry
- 'Smart Fields', virtual metering and data management

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Future Trends and Technical Challenges - continued

Subsea control umbilicals cost reduction:

- ‘All-Electric’ subsea controls
- Underwater storage and pumping of chemicals
- Subsea Hydraulic Power Unit

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Conclusions

- STB is a viable field development option - within its current applicability range
- New projects are moving to greater water depths
- STB may not move to longer step-out distances; other field development options could be preferable beyond 200km
- Creation of new, promising gas provinces is possible
- Project costs and schedule control is critical

Thanks for your attention…Questions?

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