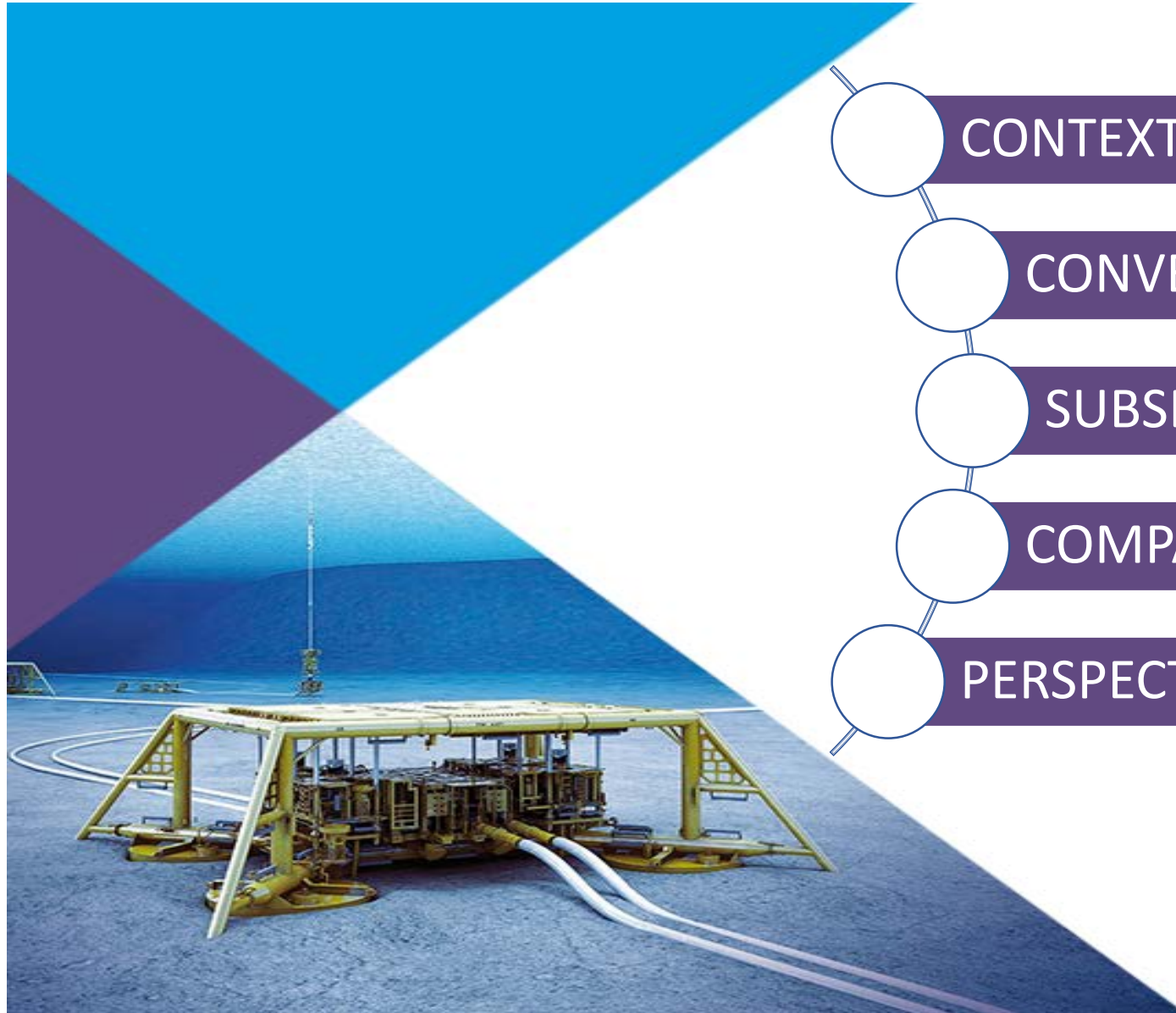


Subsea to Shore Development : Incentives Compared to a Conventional Approach

Ghassen Neji, Luc Hême de Lacotte, Audrey Lopez – TechnipFMC
Luc Rivière - TOTAL





CONTEXT

CONVENTIONAL APPROACH

SUBSEA TO SHORE

COMPARISON

PERSPECTIVES

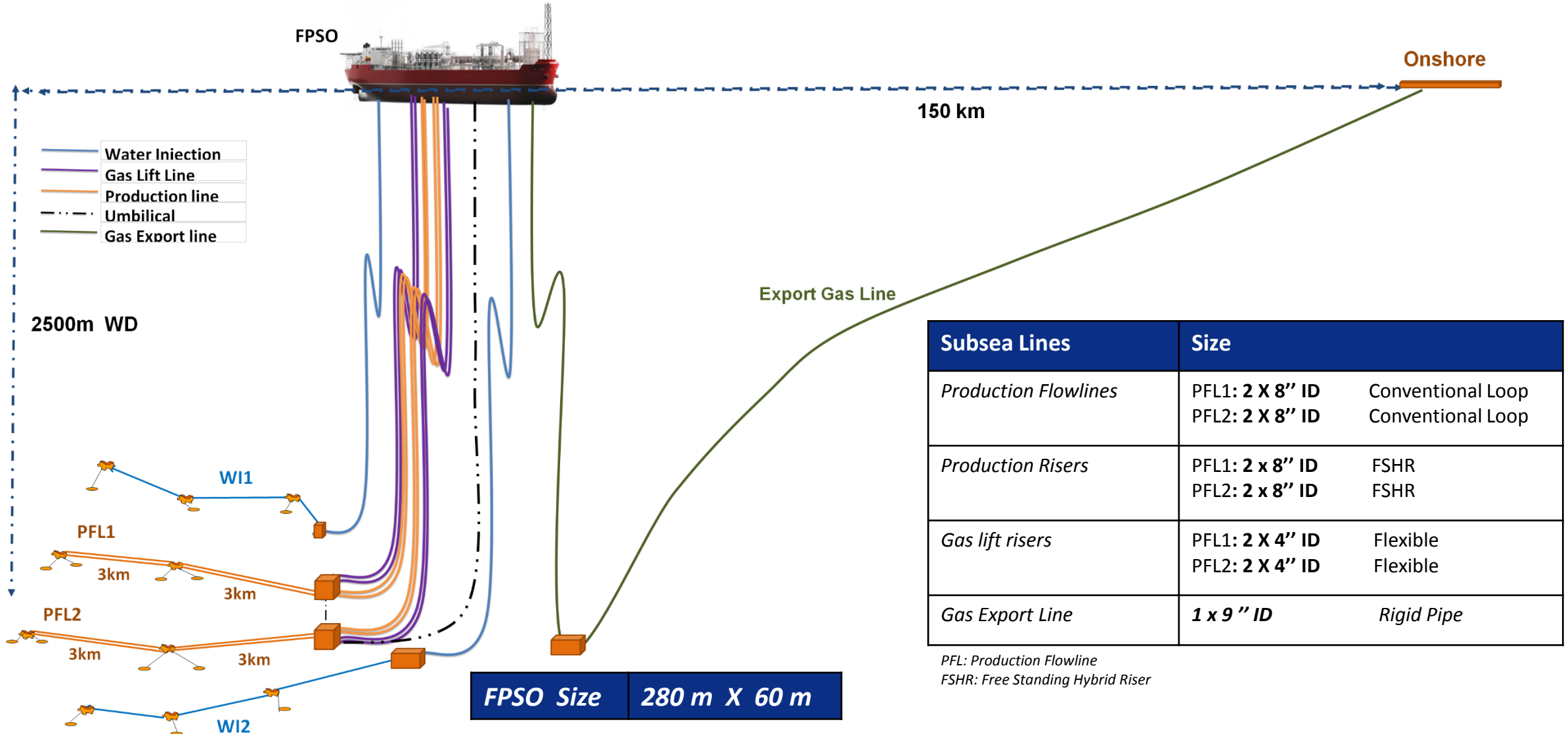


CONTEXT

- Water Depth: **2500 m**
- Distance from Shore: **150 km**
- Production Rate: **70 kbopd**
- Production Wells: **8 wells**
- Water Injection Wells: **6 wells**
- Location: **West Africa**

kbopd: Thousand Barrels of Oil Per Day

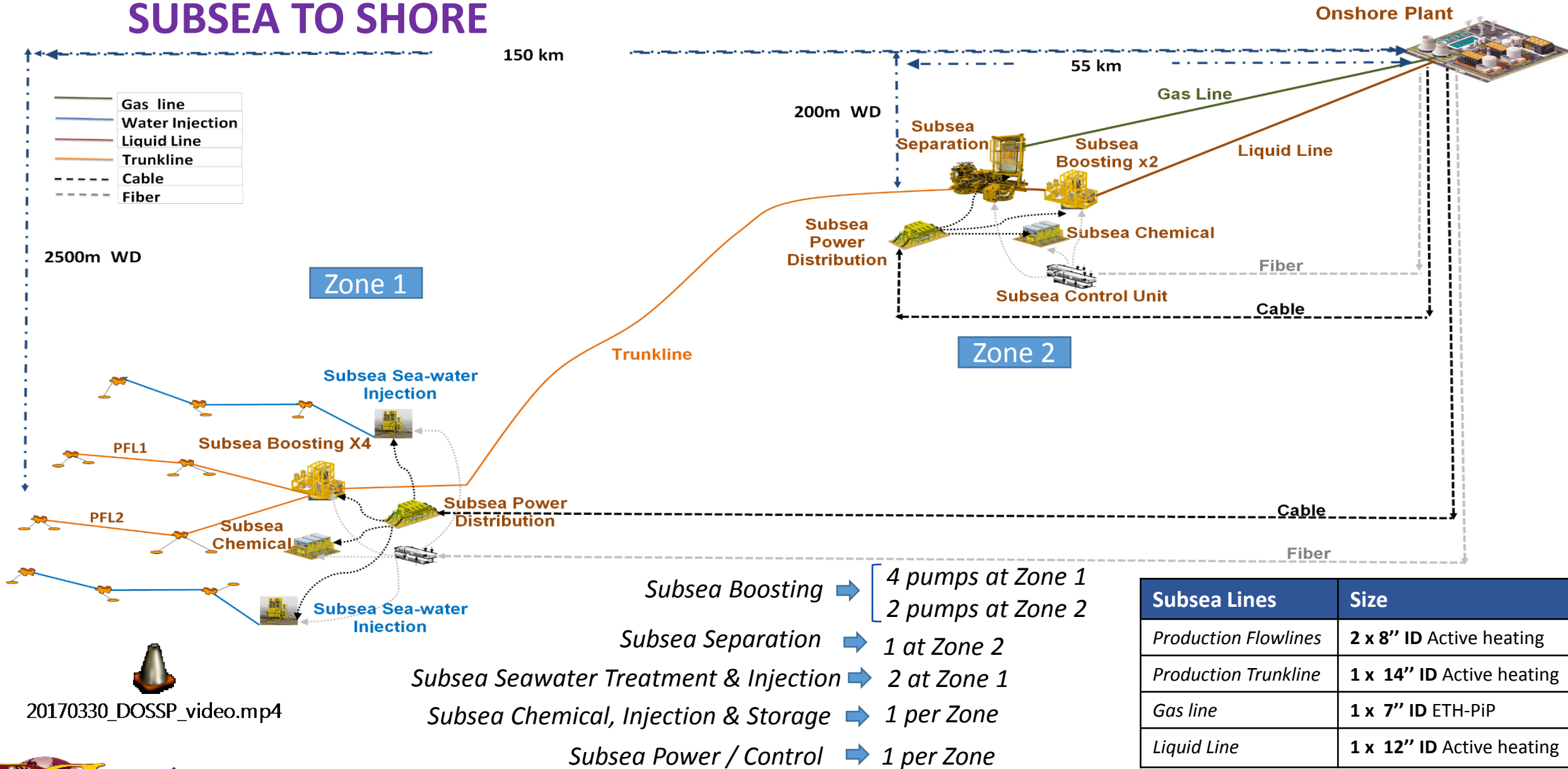
CONVENTIONAL APPROACH



> Conventional Approach : Production Loop + FPSO + Gas lift



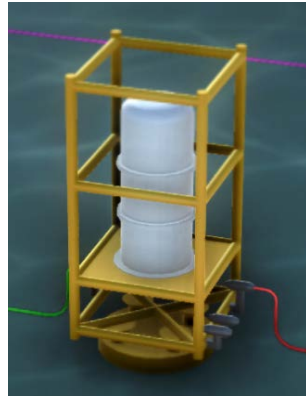
SUBSEA TO SHORE



20170330_DOSSP_video.mp4

Subsea to Shore Approach: Subsea Processing + Active heated singles lines + Plant onshore

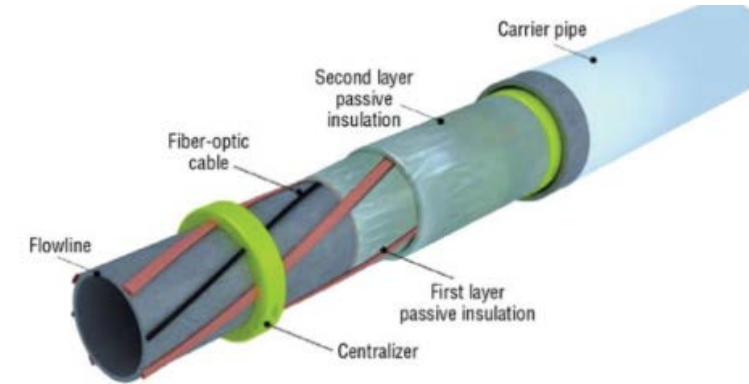
SUBSEA TO SHORE – Focus on Technologies



Subsea Separator

11.9 m x 3.1 m

- ➡ Flow assurance issues drive location
- ➡ Gas Free flow drive separation pressure



Active Heating Technology

- ➡ Technology allows single pipe architecture



Subsea Boosting

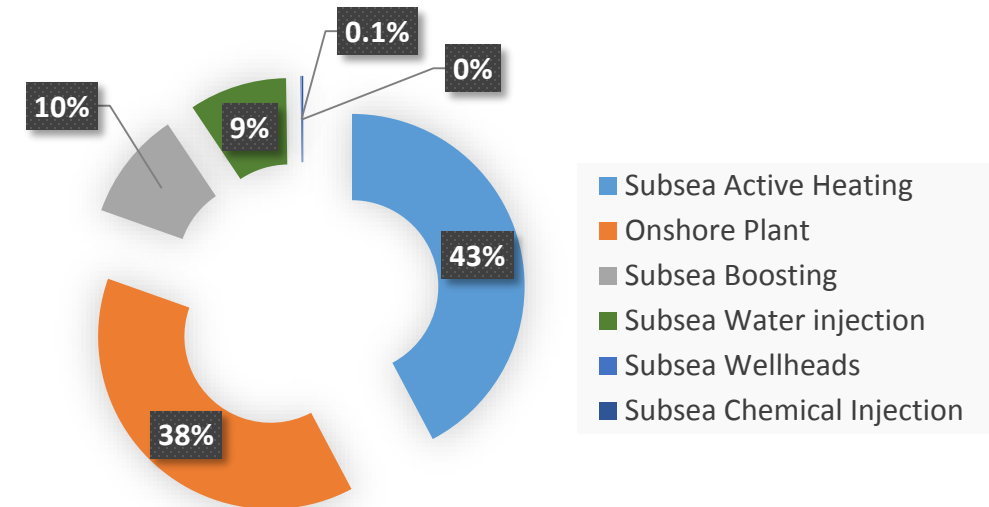
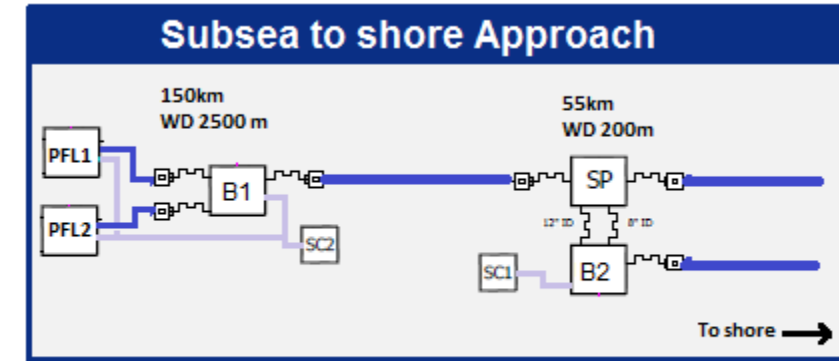
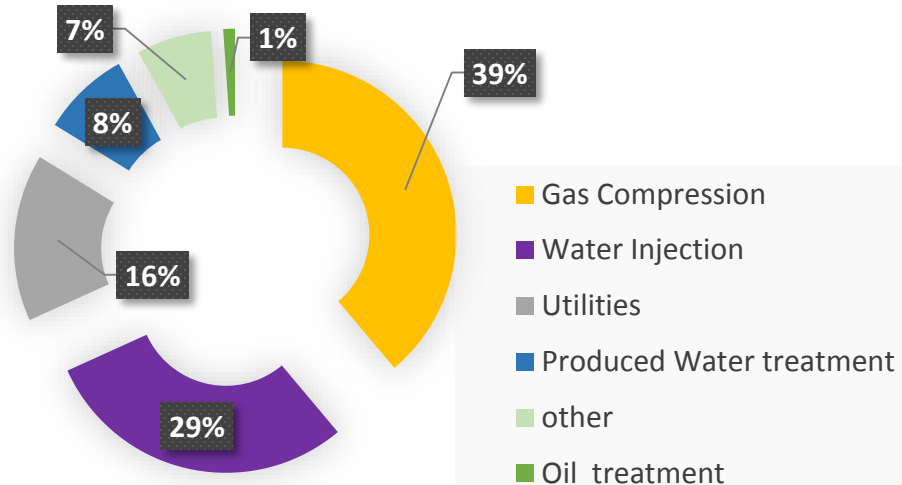
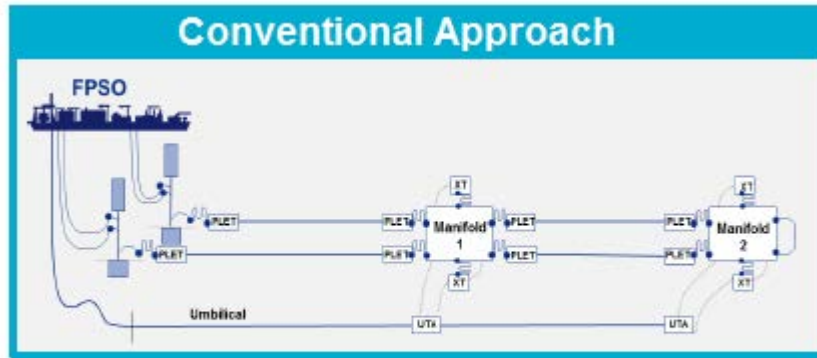
Subsea Boosting	Pressure Boost (bar)	GVF %	Technology
Zone 1	Up to 245	Up to 7%	Multiphase Pumps
Zone 2	Up to 106	0	Hybrid pumps

GVF: Gas Volume Fraction

- ➡ Max Pressure Boosting and GVF drive the choice of pump technology

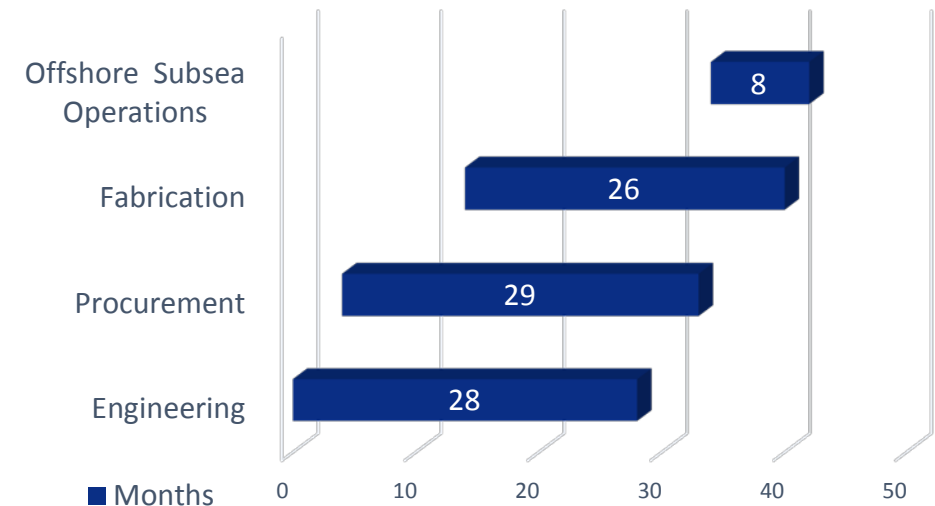
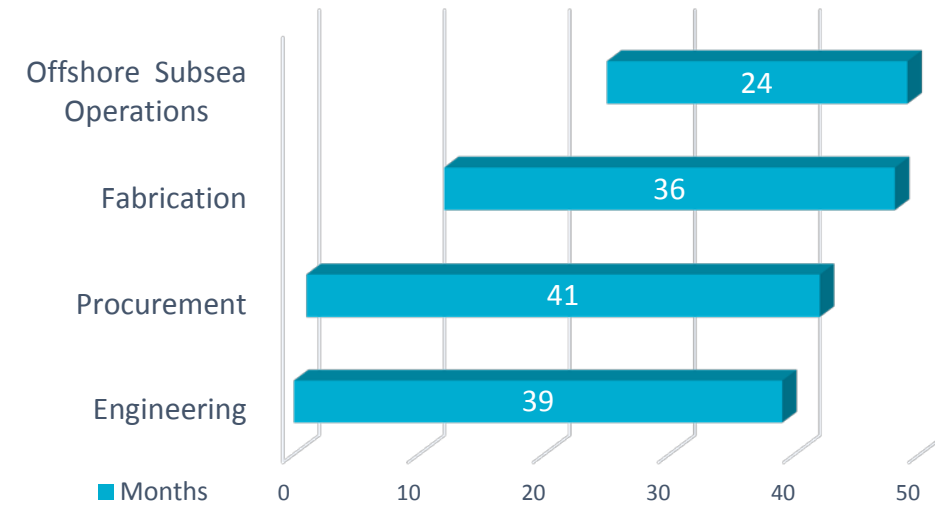
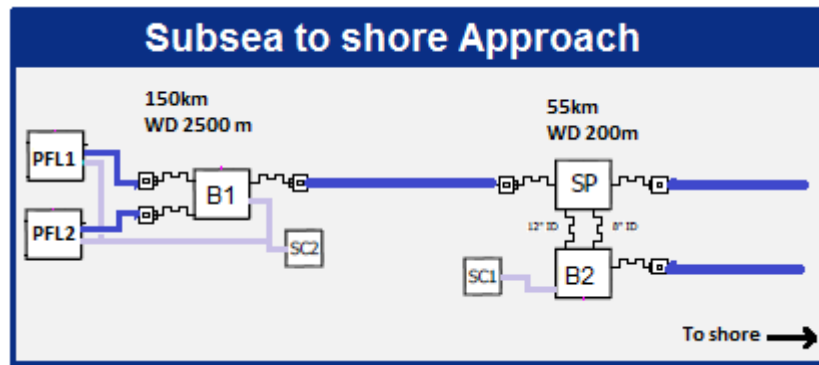
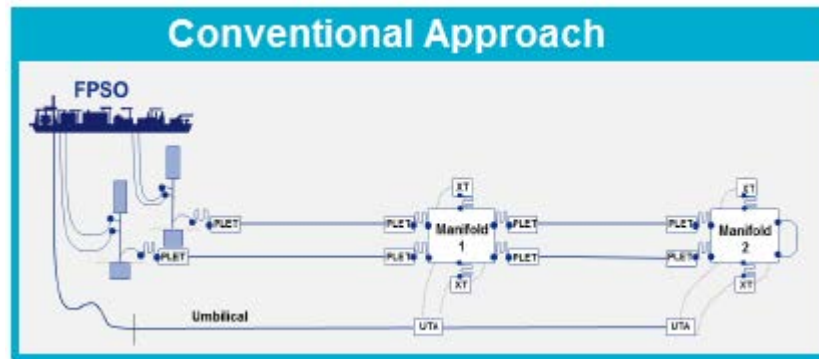
➤ Subsea to Shore Approach allowed thanks to Subsea Processing and Active heated singles lines

COMPARISON – Electrical Power



Required electrical power for the two concepts ~ 42 MW

COMPARISON – Planning

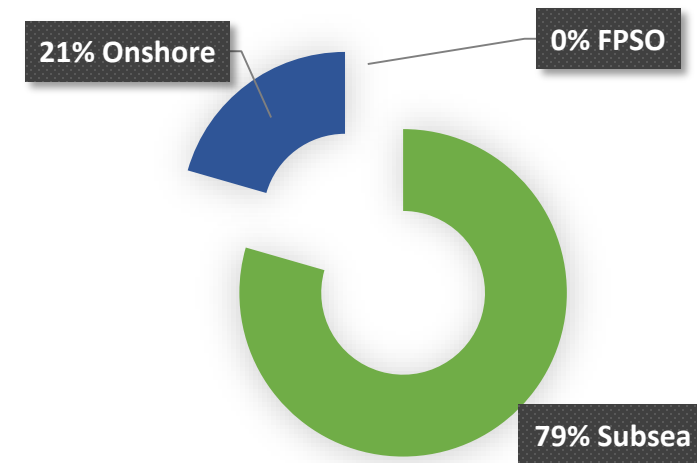
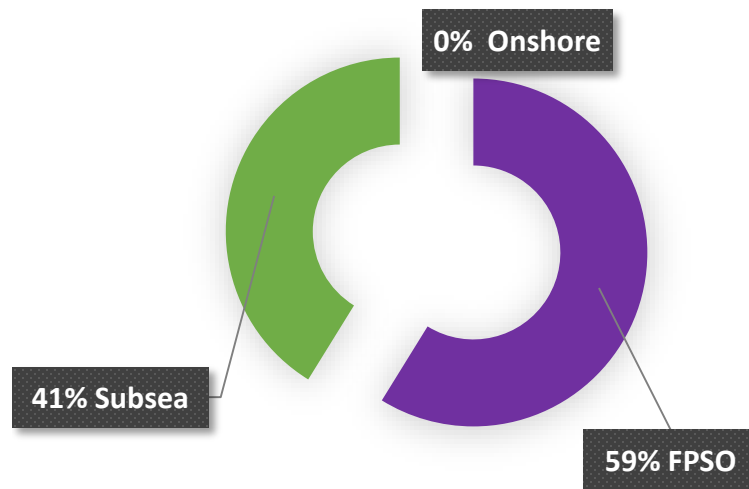
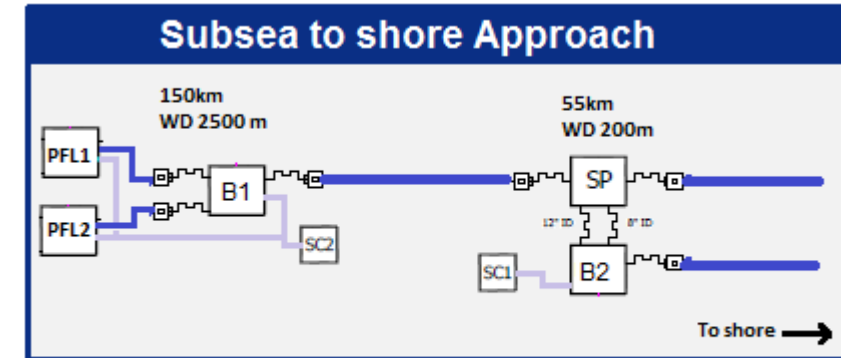
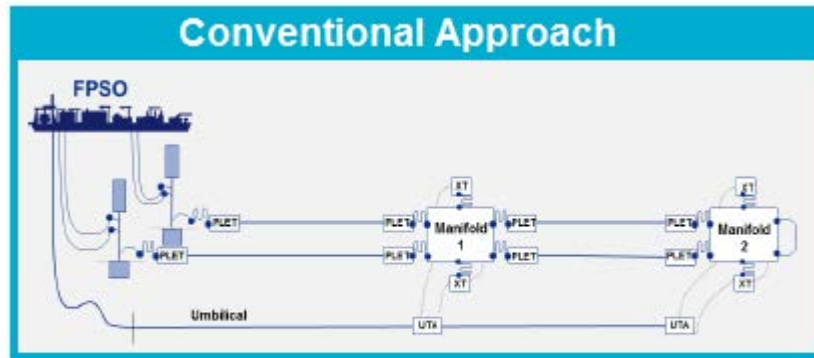


Execution Planning



49 Months (Conventional Approach)
42 Months (Subsea to Shore Approach)

COMPARISON – Cost

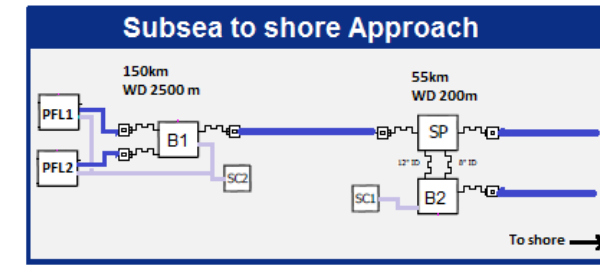
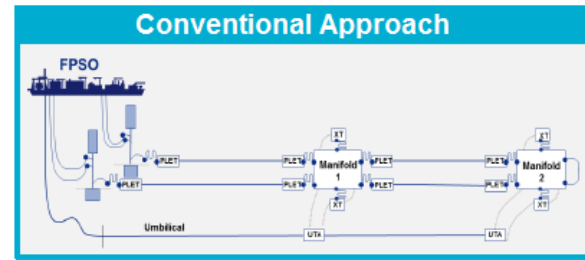


> Equivalent Global Cost estimation

Onshore Installation
Maintenance Technology HSE Risers Safety Power
Offshore Operation
Flow assurance Availability CAPEX Processing
FPSO Subsea Construction Separation
Planning Pumps Process Performance Flowlines



COMPARISON – Overall (1/2)



Process and FA



Proven Operations



Long distances challenges

Safety



Exposure to personnel



Remote Operation

Layout



FPSO congested modules



Subsea Modularization

Rotating /
Separation



Proven Technologies



Subsea Pumping /
Separation Maturity

Instrumentation



Offshore control system



Technology challenges
Subsea Controllers

Planning



49 Months

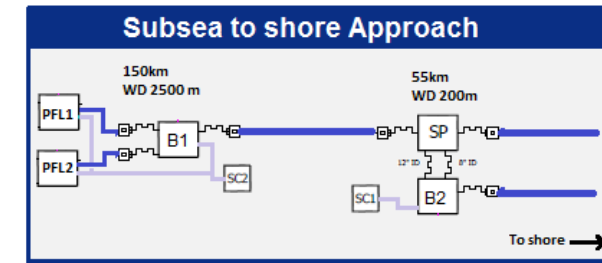
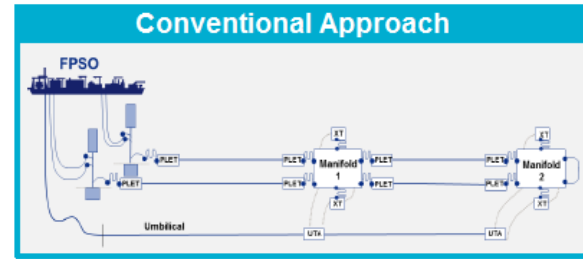


42 Months



-  Advantages/Improvements
-  Drawbacks/Constraints

COMPARISON – Overall (2/2)



Electrical



Power Generation FPSO



Subsea Power Cable and Electrical components

Subsea Lines



Flowlines and Risers



Reduced Number

Availability



Equipment Sparing



Less Equipment

Construction



Worldwide Yards Dependency



Qualification Program

Installation



Proven Performance



Proven Performance

Manpower



Personnel onboard FPSO

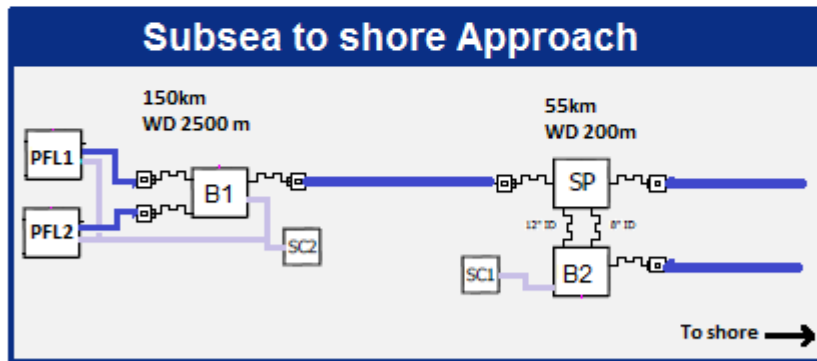
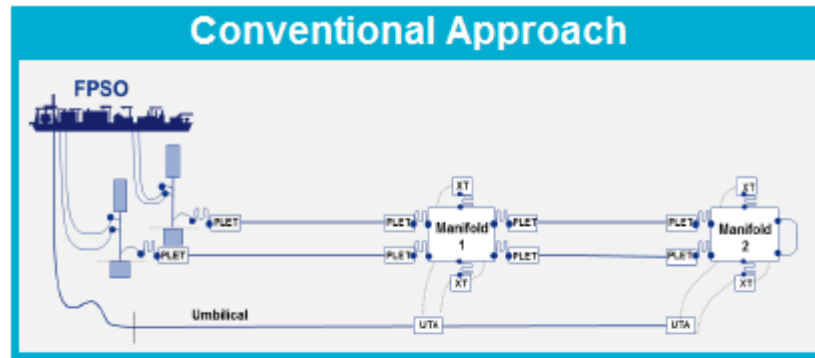


Onshore Personnel Support



-  Advantages/Improvements
-  Drawbacks/Constraints




COMPARISON – Conclusion



- ▶ Decrease the personnel offshore
- ▶ Less risers and flowlines
- ▶ Less PLETS end at flowlines
- ▶ Fast first Oil
- ▶ Decrease the duration of offshore installation
- ▶ Less execution interfaces and risks



> Perspectives

-  **Global integration in the Subsea and Topsides Facility is paramount for a project's success**
-  **Subsea Processing and Active Heating Technologies are key elements for future deepwater projects success**
-  **Across subsea, onshore/offshore and surface, TechnipFMC will enhance the performance of the future projects**