Offshore Oil & Gas Exploration & Production

An Overview from a Technical Perspective

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Presentation Overview

- **Background**
  - Why Oil & Gas Exploration and Production?
  - Benefits of Oil & Gas E&P
  - Oil & Gas Value Chain
  - Crude Oil Products

- **Technical Basis of Oil & Gas Exploration and Production**
  - Engineering and Technical Standards
  - Technical Challenges and Areas of Expertise

- **Oil & Gas Lifecycle**

- **Offshore Production Facilities, options and considerations**

- **What can go wrong?**
Why Oil & Gas Exploration & Production?
Why Oil & Gas Exploration & Production?

Benefits

- Total expenditures
- Gross Product
- Revenues
- Employment/Jobs
- Income
Why Oil & Gas Exploration & Production?

Benefits

- Total expenditures
- Gross Product
- Revenues
- Employment/Jobs
- Income
1. Resources
• Offshore, Onshore
• Oil & Gas reservoir

2. Upstream
• Exploration & production
• Offshore, Onshore
• Rigs, platforms, FPSOs, Submersible pumps
• Onshore Terminals

3. Downstream
• Refineries
• Petrochemical Plants

4. Demand
• Petrol Stations
• Power Generation
• Transportation
• Domestic, Commercial, Industrial
Crude Oil Products

- Diesel
- Other Distillates
- Jet Fuel
- Other Products
- Heavy Fuel Oil (Residual)
- Liquified Petroleum Gases (LPG)
- Gasoline

Fractionating column

- Petrochemistry
- Gasoline
- Kerosene
- Diesel
- Heavy fuel oils
- Bitumen

370 °C

Furnace
Oil & Gas Exploration & Production

Technical Basis

Offshore Oil & Gas exploration and production is a technically challenging and complex industrial sector.

Achieving a balance between:

A. Managing commercial and technical risks & opportunities, and
B. Ensuring sustainable & profitable production, whilst
C. Protecting people and the environment from harm

requires:

- Technical Standards & Guidance
- Technical Governance & Compliance
- Technical Expertise & Competence
- Technical Integrity & Assurance
- Technical Procedures & Management systems
Engineering standards are documents that specify characteristics and technical details that must be met by the products, systems and processes that the standards cover.

The purpose of developing and adhering to standards is to ensure minimum performance, meet safety requirements, make sure that the product / system / process is consistent and repeatable, and provide for interfacing with other standard-compliant equipment (ensure compatibility).

Industry uses standards to enhance technical integrity, improve safety, enable cost reductions and reduce the environmental impact of operations worldwide.
Technical Challenges of Offshore Oil & Gas

**MARINE ENVIRONMENT**
- Offshore
- Deepwater
- Sensitive - Marine organisms and wildlife
- Sea/salt-water
- Waves, tides, storms
- Shipping, fishing activities
- Atmospheric Temperatures

**OIL & GAS PRODUCTION**
- Pressurized fluids
- High temperature fluids
- Flammable, volatile fluids
- Corrosive fluids
- Toxic fluids

**OFFSHORE FACILITIES**
- Electricity
- Utilities
- Accommodation/lodging
- Telecommunications
- Catering & provisions
- Health & Safety
- Lifting & Hoisting
Areas of Engineering & Technical Expertise

**SUB-SURFACE (Exploration, Drilling)**
- Geology, Geophysics, Petrophysics
- Reservoir Engineering
- Drilling Engineering
- Well Engineering
- Production Engineering

**SURFACE (Operations, Production, Maintenance)**
- Process Engineering
- Mechanical Engineering
- Production Chemistry
- Materials Engineering
- Pipeline Engineering
- Subsea Engineering
- Electrical Engineering
- Rotating Equipment Engineering
- Control, Automation and Instrumentation

**CONSTRUCTION (Installation)**
- Metocean Engineering
- Marine Engineering
- Naval Architecture
- Civil/Structural Engineering
Oil & Gas Lifecycle

Creating value

Stage 1: Identify

Adding value

Stage 2: Explore

Stage 3: Appraise

Stage 4: Develop

Stage 5: Produce

Stage 6: Return and re-invest

Realising value

Stage 7: Abandon

Identify exploration opportunities

Find new reserves

Determine reserve size and estimate costs

Build the offshore production facility

Oil and gas production, and cash flow

Stimulate, add to production, extend field life

Depleted reserve
Offshore Oil & Gas Lifecycle

- **Exploration**
  - Seismic and other surveys to determine geological structure
  - First exploratory wells
  - Time frame: 2-4 years

- **Appraisal**
  - Additional drilling
  - Determines economic feasibility
  - Time frame: 1-2 years

- **Development**
  - Drilling of production wells
  - Pipe laying between wells, production platform and shore
  - Time frame: 4-7 years

- **Production**
  - Extraction of mixed hydrocarbons
  - Separation of produced fluids and gases
  - Time frame: 35-50 years

- **Abandonment**
  - Well plugging with cement
  - Structure cut below water’s surface and left in place or installations are demolished
  - Restoration of habitat
Offshore Oil & Gas Lifecycle

- Locating Oil reservoir
- Determining size of reserves
Offshore Oil & Gas Lifecycle

Development

- Drilling & completing production well(s)

SUB-SURFACE (Drilling)
- Drilling Engineering
- Well Engineering
• Installing surface production facility*
• Laying subsea pipelines and flowlines

* Type of facility is dependent on water depth and economics of field
Types of Offshore Production Facilities

- **TLP** – Tension Leg Platform
- **FPSO** – Floating Production Storage & Offloading
- **DVA** – Direct Vertical Access

**SURFACE / TOPSIDES**

**SUBSEA / SUB-SURFACE**

Water depth

- **Fixed Leg**
- **Jack-up**
- **Semi-Submersible**
- **FPSO**
- **TLP**

- **DVA Wells**
- **Subsea Wells**
Types of Offshore Production Facilities

Feasibility

- Fixed platform
- Compliant tower
- TLP
- SPAR
- FPSO
- Subsea completion

Water depth, m:

- 0
- 500
- 1,000
- 1,500
- 2,000
- 2,500

1400 ft
1800 ft
4500 – 5000 ft
5600 – 8000 ft
4500 – 10000 ft
Offshore Production Facilities

Height Perspective
Offshore Production Facilities

Height Perspective

- **Olympus TLP, GoM**
  - 124 m Tall (406 ft)
  - (1.5 times height of New Orleans Superdome)

- **Perdido Spar, GoM**
  - 267 m Tall (876 ft)
  - (Almost as tall as the Eiffel Tower)

- **TROLL PLATFORM**
  - Offshore Norway
  - 472 m

- **Q1 TOWER**
  - Australia
  - 322.5 m

- **PETRONAS TOWER**
  - KL, Malaysia
  - 452 m
Offshore Production Facilities

Depth Perspective

Stones FPSO, GoM
2900 m depth (9500 ft)
(Deeper than height of 6 Empire State Buildings)

Malikai TLP, Malaysia
500 m depth (1640 ft)
(Deeper than height of Petronas Twin Towers)
DVA vs. Subsea Wells & Production

- **DVA** (Direct Vertical Access) wells/production
- **SS** (Subsea wells/production)
DVA vs. Subsea Wells & Production
Subsea Wells & Production
Subsea Flowlines & Pipelines
Subsea Flowlines & Pipelines
Topsides Production Facilities
Civil/Structural Components and Modules
Topsides Production Facilities
Utilities, Process Modules & Systems
Offshore Oil & Gas Production
Surface & Subsurface Overview
Offshore Oil & Gas Production
Surface & Subsurface Overview
What can go wrong?

If technical aspects are not sufficiently robust, properly implemented or suitably managed.
What can go wrong?

Materials / Equipment degradation & failures
What can go wrong?
Subsea equipment leaks & loss of containment
What can go wrong?

Platform buckling & collapse
What can go wrong?

Oil Spills & Environmental Contamination
Summary

Offshore Oil & Gas exploration and production is a complex and challenging industrial sector that requires wide-ranging technical expertise, competence and systems in order to maximize the venture/opportunity, whilst operating in a safe and responsible manner that does no harm to people or the environment.
Thank You!

Q&A