Upstream Oil & Gas Overview

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What is Needed to Have an Oilfield?

**Source Rock**
(to Create the Oil)

**Structure and Seal**
(to Trap the Oil)

**Good Reservoir Rock**
(to Allow us to Produce)
Source Rock

- Preservation of Organic matter
- Needs Burial / Heat
  - Oil – 110-130 C  2.5 – 3.5km
  - Gas - >150 C  >4 km
- Common Source Rocks Coal, limestone and shale
Types of Rocks

What Are Rocks?
A rock is defined as an aggregate of mineral grains, which means that rocks are a bunch of mineral grains all stuck together.

The Three Rock Types:

Igneous

Igneous rock is any of various crystalline or glassy, noncrystalline rocks formed by the cooling and solidification of molten earth material (magma).
Examples: Basalt, Granite and Pumice

Sedimentary

Sedimentary rock is a type of rock that is formed by sedimentation of material at the Earth's surface and within bodies of water.
Examples: Sandstones, Limestone and Shale
[main rock type for oilfields]

Metamorphic

Metamorphic rock is the result of the transformation of an existing rock type, when subjected to heat and pressure.
Examples: Marble, Quartzite and Slate
Seal (Cap Rock)
- Very Small Pores
- Strength
- Mud Stones / Evaporites

Reservoir
- Porosity
- Permeability
- Sandstone or Limestone are Most Common
How Do We Find Oilfields?

**Oil Source**
- Find Natural Seeps
- Study Other Wells
- Understand the Geology [Geological Time = millions of years]

**Seal**
- Seismic Surveys

**Reservoir**
- Drill a Well

PLATE 24.2  G. B. Reynolds (left) and two of his assistants, Williams and Crush, near Masjid-i-Sulaiman in 1908.
Seismic Surveying - Offshore

Seismic Data Recorded
[Shows rock structure Underground]
Seismic Surveys – Transition Zone/Onshore

Transition Zone Seismic
[Between Offshore and Onshore
- very difficult]

Onshore Seismic
Types of Wells

**Exploration**
- sometimes called a wildcat well, are drilled to probe the earth to determine whether oil or gas are present

**Appraisal**
- are drilled to determine the extent of a field or the amount of area it covers, once that field has been discovered

**Development wells/Production**
- are drilled in a discovered and appraised field to exploit the hydrocarbons.
Parts of a Drilling Rig
The Mud System

Mud is important as it is used to:
- Control the well pressure
- Cool the drill bit
- Carry cuttings out of the hole
Types of Rigs – Offshore Mobile Rigs (1)

Drilling Barge
[10-30 ft water]

Jack-up Rig
[30-200 ft water]
Types of Rigs – Offshore Mobile Rigs (2)

Semi-submersible
[200-5000 ft water]

Drillship
[1000-8000 ft water]
Types of Rigs – Offshore Fixed Rigs

Offshore Platform Rig
Types of Rigs – Land rigs

- Truck Mounted
- Modular / Containerised
- Hydraulic Hoist
**Hole Section Types and Casing**

**Conductor**: structural loads

**Surface Casing**: isolation of surface formations, section typically drilled with diverter on platform

**Intermediate Casing**: Isolation of pressure/problem zones above reservoir

**Production Casing**: Will see production loads; completion will be run inside this string

**Completion**: Run across reservoir, typically lower and upper sections to carry hydrocarbons to surface
Cementing
Well Control

Blow Out Preventer
BOP stack

Accumulator Bank

Pressure Ratings
5,000 psi
10,000 psi
15,000 psi
No Well Control – Blow Out

10th August 2004 - GSF Adriatic IV Jack-Up – ENI Operated - Temsah Gas field, Mediterranean Sea, Egypt
Evaluation

Mud Logging and LWD/MWD

Electric logging

Coring

Drill Stem Testing (DST)
Oilfield Development

First - Some Terms
Oil in Place (million barrels) - How much oil is in the ground and where it is
Recovery Factor (%) - How much of the oil in the ground we expect to recover
Production Rate (Barrels per day) - How much oil we produce on any given day
Reserves (million barrels) – How much oil we expect to recover over fieldlife

Field Development

-Development wells

-Production facilities

-Pipelines

-Oil Storage Terminals and Tanker Shipment
Different Types of Field Development

Land Rig  Fixed Platform  Jack-up  Semi-Submersible  FPSO  Tension Leg
Directional Drilling

• **On Land:**
  – Surface constraint due to land owner, natural event, topography
  – Horizontal

• **Offshore:**
  – Save development cost
  – Horizontal
  – Extended Reach
  – Multi-Lateral
Completions – Xmas Trees

Onshore / Platform Tree

Subsea Tree
Onshore Production
Offshore Production

Floating Production Storage Offloading Vessel (FPSO)

Floating Production Unit (FPU)

Fixed Platform Production
Offshore Production - Subsea Systems
Oilfield Production Profiles

Offshore profile has a rapid build up as wells are often pre-drilled and a plateau of several years to optimise the usage of the facilities capacity.

Onshore profile has a slower build up as wells are drilled and put on production immediately. It also has a higher peak and a shorter plateau period as onshore facilities cost less and are more flexible.
Oilfield Economics - Cashflow

+ Revenue
  • Oil Sales
- Operating Costs
  • Field Operating Costs
  • Transportation Costs
- Capital Expenditure
- Government Take (Royalty and Taxes)
= Cashflow
Oilfield Economics – Government Take

Different Tax Structures:
- Tax and Royalty
- Production Sharing
- Service Agreement
- Government Participation

Extract from an Article "Higher Prices Lower Government Take?" by Daniel Johnston
Oil Environmental Impact

• Seismic Surveys:
  - Loud Noises / Explosions / Air guns: Potential Damage to Animals, Fish, Marine Mammals and Scuba Divers

• Exploration Well Drilling:
  - Risk of Contamination of Acquifers Underground
  - Risk of Loss of Well Control and Oil Spills
  - Industrial Discharges to Land or Sea
  - Drilling Mud and Cuttings Disposal

• Oil Development and Production:
  - Dredging Pipelines
  - Building Facilities
  - Well Drilling (with Risks as Above)
  - Long Term Industrial Discharges
  - Pipeline Leaks
  - Tanker Oil Spills
Oilfield Employment Impact

**Skilled Positions**
- Petroleum Engineer
- Geologist
- Geophysicist
- Chemist
- Mudlogger
- Electric Logger
- Seismic Acquisition Specialist
- Surveyor
- Tool pusher
- Marine Superintendent
- Driller
- Derrickman
- Roustabout
- Consultant
- Accountant & Bookkeeper
- Land Agent
- Managers & Supervisors
- Computer Programmer & Technician
- HSE Engineer
- Electrical, Instrumentation and Mechanical Engineer
- Project Engineer
- Pipeline Fabricator / Welder

**Semi-Skilled Positions**
- Roughneck
- Crane Operator
- Wireline Operator
- Well Test Operator
- Production Operator
- Driver
- Seismic Operator
- Welder
- Draftspeople
- Logistics Coordinator
- Catering and housekeeping staff
- Storeman and Materials Coordinator
- Medics / nurses
- Firecrew and Emergency Response Personnel
- Security Guards
Thank You for Listening........................................Any Questions?