Report 14 - Protocol about the visit of an Oilfield on the Interdisciplinary Study Tour to Oman at the 6th of March 2007

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1. What is Oil e.g. Petroleum:

Petroleum or crude oil is a naturally occurring in a liquid form in porous rock formations in the upper strata of some areas of the Earth's crust.
It is usually black or dark brown (although it may be yellowish or even greenish) but varies greatly in appearance, depending on its composition. In its naturally occurring form, it may contain other non-metallic elements such as sulphur, oxygen, and nitrogen.
It consists of a complex mixture of hydrocarbons of various lengths.
Due to its high energy density and relative abundance, it has become the world's most important source of energy since the mid-1950s.
84% of the hydrocarbons present in petroleum are converted by distillation at an oil refinery to produce energy-rich fuels (petroleum-based fuels), including gasoline, diesel, jet, heating, and other fuel oils and liquefied petroleum gas.
Petroleum is also the raw material for many chemical products. The 16 % not used for energy production are converted into solvents, fertilizers, pesticides, and plastics.
(wikipedia.org)

2. Biogenic theory of oil

Most geologists view crude oil and natural gas as the product of compression and heating of ancient organic materials over geological time. According to this theory, oil is formed from the preserved remains of prehistoric zooplankton and algae which have been settled to the sea bottom in large quantities under anoxic conditions. Over geological time this with mud mixed organic matter, is buried under heavy layers of sediment. The resulting high levels of heat and pressure cause the remains to metamorphose, first into a waxy material known as kerogen which is found in various oil shales around the world, and then with more heat into liquid and gaseous hydrocarbons in a process known as catagenesis. Because most hydrocarbons are lighter than rock or water, these sometimes migrate upward through neighbouring rock layers until they become trapped beneath impermeable rocks, within porous rocks called reservoirs or Oilfields. (wikipedia.org)

3. Locating an oil field

Geologists use seismic surveys to search for geological structures that may form oil reservoirs. For the "classic" method an explosion in the nearby underground is needed to observe the seismic response that provides information about the geological structures beneath the ground. Another "passive" method extracts information from naturally-occurring seismic waves. Other instruments such as gravimeters and magnetometers are also sometimes used in the search for petroleum. (wikipedia.org)

4. What is an oil field

An oil field is a region with a large quantity of oil wells extracting petroleum (oil) from beneath the ground. Because the oil reservoirs typically extend over a large area (possibly several hundred kilometres across) full exploitation requires multiple wells scattered across the area. In addition, there may be exploratory wells probing the edges, pipelines to transport the oil elsewhere, and support facilities.

Because an oil field may be remote from civilization, establishing a field is often an extremely complicated exercise in logistics. For instance, workers have to work there for months or years and require housing. In turn, housing and equipment require electricity and water. Excess natural gas needs to be burned off if there is no way to make use of it, requiring a heater and stacks, and pipes to carry it from well to furnace.

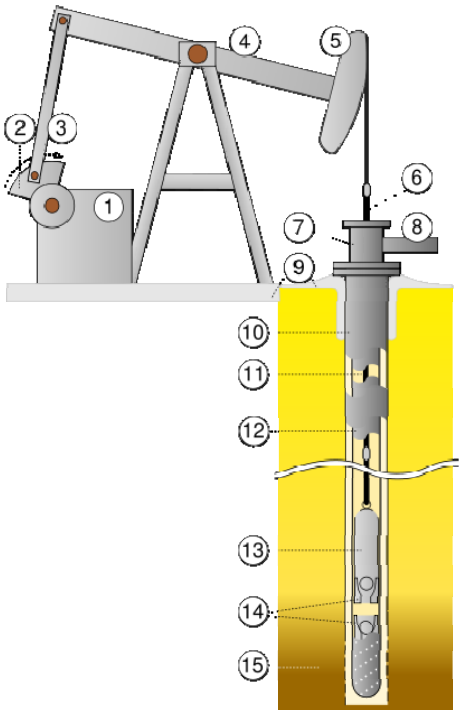
The typical oil field looks like a small self-contained city in the centre of a landscape dotted with drilling rigs or in Oman because of the oil’s high viscosity pump jacks known as "nodding donkeys" because of their bobbing arm. (wikipedia.org)

5. "Horsehead" Pump jacks

"Horsehead" Pump jacks convert turning power, which is provided by an internal combustion or electric motor to reciprocating power. This power is delivered to the downhole production pump through the "rocking horse" and a string of sucker rods.

Oil is collected in a perforated nipple at the lower end of the pump. The plunger, which is attached to the sucker rod, moves up in the barrel forcing the upper check valve into its seat. This movement creates a vacuum in the pumping chamber unseating the lower check valve and drawing oil in. When the action reverses, pressure is created in the chamber when the lower check valve is seated as the plunger moves down. This pressure opens the upper check

valve releasing the oil into the tubing and the action repeats. The stroke rate of the pump is set to suit the flow character of the well. (lloydminsterheavyoil.com)



1. Driving motor
2. Counterweight
3. Connecting rod
4. Balancer
5. Horse head
6. Plunger
7. Seal par of Christmas tree
8. Pipe
9. Concrete backfill of borehole
10. Outer borehole piping
11. Pump rods
12. Inner borehole piping
13. Deep pump
14. Pump outlets (perforated nipple)
15. Oil containing rock formation

Figure 1: Sketch of Pump jack (www.wikipedia.org)

6. Oil extraction in Oman

In 2006 Oman conveyed about 740,000 barrels per day. (CIA –World Fact book – Oman) Oman's oil is of medium quality, because it contains sulphur and is contaminated with aromatic hydrocarbonates, such as Benzpirins and Benzols.

The oil is located in extreme depths, around 500 meters. It is highly viscous and water comes up with the oil. The water is heated and pumped down again to dissolve the viscose oil. It cannot be used for irrigation purposes because it is polluted.

7. The Future of Oil

The known reserves of petroleum are typically estimated at around 1.2 trillion barrels with at least one estimate as high as 3.74 trillion barrels. Consumption is currently around 84 million barrels per day, or 31 billion barrels per year. Because of pumping difficulties, usable oil reserves are only about 1/3 of total reserves. At current consumption levels the world oil supply would be gone in about 32 years. (wikipedia.org)