

Drilling



Once subsurface formations are identified from exploration as potential areas for containing hydrocarbons, actual drilling of one or more wells is necessary to determine whether there are accumulations of oil and gas in commercial quantities.

An oil well is a term for any perforation through the earth's surface designed to find and release both petroleum oil and gas hydrocarbons.

Three types of drilling for oil and gas wells

1. **Exploration drilling** (often called Wildcat wells) - during the initial phases of exploration, drilling a well is completed to check whether the reservoir rocks contain any oil and/or gas.
2. **Appraisal drilling** - if hydrocarbons are discovered, more drilling is done to test if the region is commercially viable (i.e. that there is a sufficient amount of oil and gas to justify investing money in infrastructure to recover oil/gas to sales).
3. **Development (or) Production drilling** - this drilling is done to create a flowpath from the reservoir to the surface and then through the production facility.



Rotary drilling is by far the most commonly used method of drilling today. In rotary operations, the hole is drilled by rotating a drill bit downward through the earth's rock formations.

The well is created by drilling a hole that is 13 to 76 cm in diameter into the earth with an oil rig which rotates a drill bit. After the hole is drilled to a predetermined depth, a steel pipe (casing) slightly smaller

than the hole is placed inside and secured with cement.

The casing provides structural integrity to the newly drilled wellbore, in addition to isolating potentially dangerous high pressure zones from each other and from the surface.

With these upper zones safely isolated and the formation protected by the casing, the well can be drilled deeper with a smaller drill bit and

also cased with a smaller casing. By drilling smaller and smaller holes, the well can reach the target formation.

Modern wells often have two to five sets of subsequently smaller hole sizes drilled inside one another, each cemented with casing.



Drilling



To drill the well:

- ▶ The drill bit breaks up the earth
- ▶ Drilling fluid (commonly known as “drilling mud”) is pumped down the inside of the drill pipe and exits at the drill bit and aids to break up the rock, keeping pressure on top of the bit, as well as cleaning, cooling and lubricating the bit.
- ▶ The generated rock “cuttings” are swept up by the drilling fluid as it circulates back to surface outside the drill pipe (in the annulus). Then go over “shakers” which shakes out the cuttings over screens allowing the good fluid to return back into the pits. Watching for abnormalities in the returning cuttings and volume of returning fluid is imperative to catch “kicks” early (“kick”: when the formation (rock) pressure below the bit is more than the pressure due to mud resulting in gas and mud to come back to surface uncontrollably).

- ▶ The pipe or “drill string” to which the bit is attached is gradually lengthened as the well gets deeper by screwing in several 10 m joints of pipe at surface. Usually joints are combined into three joints equalling one stand. Some smaller rigs only use two joints and newer rigs can handle stands of four joints.

How to drill

This process is all facilitated by a **drilling rig** which contains all necessary equipment to circulate the drilling fluid, hoist and turn the pipe, control downhole pressures, remove cuttings from the drilling fluid, and generate onsite power for these operations.

Onshore drilling is done by a standard drilling rig. For offshore drilling there are two categories:

1. Bottom (sea floor supported)

- ▶ Submersibles
- ▶ Jack-ups

2. Floating Vessels

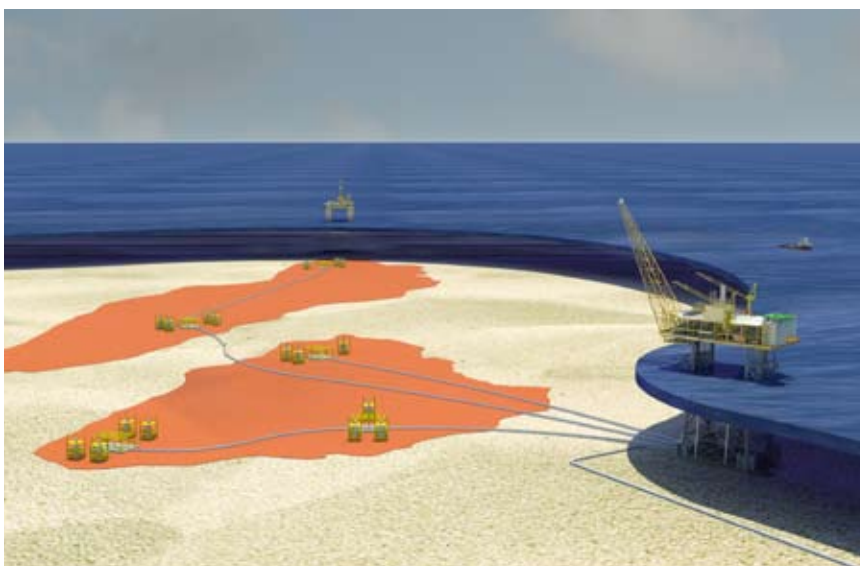
- ▶ Semi-submersibles
- ▶ Drill ship (FPSO)

Wireline logging is the process used to test any discoveries of hydrocarbons in the wellbore that is made through drilling. Logging is carried out by sending various ‘tools’ downhole where data is recorded then analysed onsite and in the office.

Once exploration drilling has discovered an oil and gas accumulation, appraisal drilling is done to determine whether or not it is large enough to be commercially viable.

As the drilling results come in, the geological / reservoir engineering team makes an evaluation of the discovery and an estimate of the reserves. The more well data collected, the more confidence can be placed in the recovery estimate.

Not every well that is drilled encounters hydrocarbons. This is referred to as a ‘dry hole’.



Safety & Environment during drilling.

During drilling, health, safety and the environment are very important. Any oil spills must be reported. Oil spills are uncommon and generally very small. In some circumstances, drilling cuttings may need to be sent to a landfill for disposal. In other cases, cuttings can be released into the ocean. All waste is either recycled or shipped back to shore.

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