Offshore Oil Drilling
The Conventional Method

INTRODUCTION. Conventional offshore drilling is a type of oil excavation in which the well is drilled vertically from the surface down to the pay zone (reservoir where the oil is). Conventional drilling is the oldest, and still the most common method. The other two main types of offshore oil drilling are horizontal and slant. Horizontal drilling is a precise process in which drillers make a sharp turn and drill horizontally along the oil reservoir. Slant drilling is when the drilling is done at an angle. In this method, many wells can be drilled from one site, which is less harmful on the environment than the conventional method.

Offshore drilling provides another means of discovering oil reserves that have been previously inaccessible. This increases the supply of oil and lowers its price. In the late 1800s and early 1900s, the first attempts at drilling for oil in the ocean were made. Due to limited technology in those times, most of the attempts were unsuccessful. The mid 1900s marked modern and successful offshore drilling operations.

Many laws and regulations govern where wells can be drilled. Offshore blocks (an offshore space where drilling is legally permitted) are under control of the national government. Typically, a drilling permit is required in which the operator will have to demonstrate that drilling is within rules and laws of the country to gain approval. Aside from legal barriers, there are also social issues concerning offshore oil drilling. The primary concerns are the possibility of oil spills, the effects of drilling on aquatic life, and pollution it will cause in the ocean.

There are many resources, tools, and materials used for offshore oil drilling: a seismic survey vessel, ocean surveyor, geologist, metal tubing called casing, drill pipe, giant hammers to pound casing into the ground, drill bit, high pressure drilling fluids called mud, cement, pipe nozzles, blow out preventer, sound wave tools, electrical wave tools, and radiation measurement instruments.

The major steps in offshore oil drilling are finding the drilling site, making the hole and inserting casing, drilling into the casing and then into the ground, cementing the casing sections into place, connecting the blowout preventer and marine riser on top of the well head, drilling the rest of the well, and determining if the well will produce oil.

1 FINDING THE SITE. The first step in the oil drilling process is deciding exactly where to begin drilling. The oil company will hire an ocean surveyor who takes a seismic survey vessel out to sea. This boat scans underneath the ocean floor and examines the rock and sediment formations. This is an important process because it allows the drilling to be precise and prevents wasting time drilling where there is not a significant amount of oil.

The surveyor sends sounds waves out into the ocean. The waves reflect off of the layers of the ocean floor and echo back to the boat. The computers on the boat are capable of showing the features of the earth using these sound waves.

A geologist is then consulted to study the images for areas that may contain oil. The increase in technology has made this process much simpler as it is able to show 3-D images of the land and potential oil deposits.
2 MAKING THE HOLE. After the drilling site is found, the actual drilling process can begin. Metal tubing with a 36” diameter, called casing, is forced 300-400 feet into the ground. This will serve as the main support system for the well. A drill pipe is used to push the casing to the ocean floor.

The drill pipes are stored in the derrick (set of machines used for lifting, drilling, and turning the drill bit) and are connected in groups of twos and three to save time on putting the pipes together at sea. Each pipe is called a joint. All of the joints together are called a stand.

As the pipes are pushed into the ground, giant hammers can be used to push them into the ocean floor. After the pipes reach the correct depth, the drill pipe is disconnected and pulled out of the water.

3 DRILLING INTO CASING. The drill bit is lowered inside 36” casing into the seafloor. Once entered, the bit drills 2000-30000” into the ground. The drill bit is connected to the drill pipe which runs to the surface of the water to the drill ship. As the bit rotates in the well bore (hole that is cut into the ground), high pressure drilling fluids (or mud) is pumped down the center of the drill pipe and out through nozzles in the drilling bit. As the drill bit cuts at the rock formations, the drilling fluid carries the chipped rock pieces out of the hole to prevent them from building on the bottom of the well. Once the hole has reached its designated depth, the drill bit and the drill pipe is brought back to the surface.

4 CEMENTING CASING. The 22” casing needs to be set inside the 36” casing. This is accomplished by cementing the two in place. Cement is pumped down the drill pipe and out through a special nozzle on the end of the pipe. Cement must be mixed very carefully and it is imperative that the nozzle is lowered to the correct position inside the casing. Once the cement has been pumped down the drill pipe and back up around the sides of the casing, 4-12 hours are needed for the cement to harden.
 CONNECTING THE BLOWOUT PREVENTER AND MARINE RISER. A Blowout Preventer (BOP) is a large underwater control valve that prevents high pressure from the water and oil from escaping the well while drilling. The release of this pressure is called a “blowout” and can result in a violent explosion. If there is not a BOP present, oil and gas would be released directly into the sea causing large scale damage to the environment. If a blowout were to occur with a BOP in place, giant valves inside it seal off the well, containing any excessive pressure and putting it back into the ground. Maintaining the BOP and continually testing it is a very high priority of both the oil company involved and the drilling contractor.

The BOP is placed on top of the wellhead (the top of the well), which is why it is important to make sure the casing is properly cemented in place. It is connected to the drilling rig by a marine riser. A marine riser is a type of offshore drilling tool that is used as a temporary extension connecting the oil well to the rig.

As drill pipe is lowered down through the marine riser, through the BOP, into the wellhead, and then further down into the well, drill fluid or mud (fluid that helps clear the rock bits or “cuttings” that are being chipped away when drilled) is pumped back up through the pipe and out through the drill bit. The mud eventually circulates around up through the marine riser and back to the surface of the oil rig. The marine riser brings these cuttings to the surface in order to be disposed of. Properly disposing of the cuttings is important so that potentially contaminated cuttings will not affect the local marine life.

DRILLING THE REST. The rest of the well sections are drilled the same as the 22” casing was drilled in step 3, only now the cuttings are sent back up to the drillship to be processed instead of being disposed of.

As the drill bit gets closer to the oil, the drilling crew closely watches the amount of fluid in the storage tanks. They also make sure that the pressure of the formation is at a good level to ensure that the well is not experiencing a blowout.

If the well experiences a blowout after more than just the initial drilling is down, the BOP control valves are closed off. The drill crew must then try to stabilize the well by pumping heavier drilling fluids into the well, therefore creating enough force the pressure back into the ocean floor.
WILL THERE BE OIL? After the well is established tests called logs are done to see how much oil is present. The information is put into a database. Finding the oil is done by using high tech measuring instruments. They are sent into the hole and detect whether or not there is oil. Geologists use sound wave tools, radiation measurement tools, and electrical wave tools to help decide if there is oil or not.

After the geologist determines that there is oil, the oil company has to analyze the amount of oil and see if it is worth pumping to a refinery.

Environmental Effects

While Drilling

While oil is being extracted from the ocean floor, other chemicals and toxic substances come up with the oil as well. Chemicals and toxins such as mercury, lead and arsenic are often released back into the ocean. Also, the seismic waves that the geologists use to locate oil can harm sea mammals and disorient whales. There was a case near Madagascar where 100 whales beached themselves because of these waves.

The infrastructure necessary to drill wells and transport offshore oil can be just as devastating. In Louisiana, a series of canals that were built across the wetlands to transport oil has led to erosion. Not only did the drilling efforts cause destruction of their marshland, the canals have removed an important storm buffer, which could possibly have contributed to the damage caused by Hurricane Katrina.

After Drilling

The main concern for offshore oil drilling is oil spills after the actual drilling is complete. If oil spills, it can wash up onto the shore causing pollution and contamination. An immediate effect is the mass mortality and contamination of fish and other food species. Mammals, reptiles, amphibians, and birds are also poisoned. A large oil spill can put a halt to recreational activities such as fishing, boating, snorkeling and scuba diving, and swimming.
CONCLUSION. Conventional offshore drilling is an important process because it provides access to more of the earth’s oil reserves. There are several stages in the conventional offshore oil drilling process. First, an area in a body of water is surveyed for drilling. Once an area is deemed suitable, the equipment is brought and setup in that area by an operating crew. Once the drilling rig is in place the drill bit assembly is put together. The area where the well will be drilled must be cased. The casing is hammered into the desired depth and drilling begins. The drill bit is lowered into the seafloor until a hole is deep enough to run the smaller casing. The casing is lowered inside the larger casing and cemented together. Once cemented, the blowout preventer and marine riser is connected on top of the well head. Drilling commences in the expectation of the well producing oil.
Offshore Oil Drilling

Search for oil using a seismic survey vessel

Is this a good site for oil?

NO

Keep searching

YES

Make the hole

Drill into casing

Cement casing

Blowout preventer and marine riser

Drill the rest

Check for oil