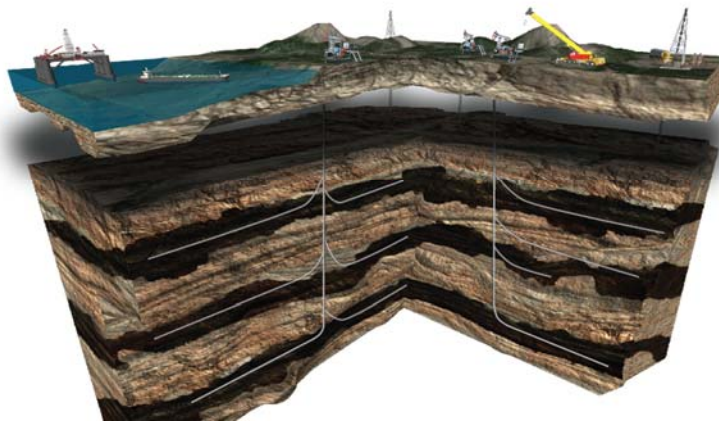


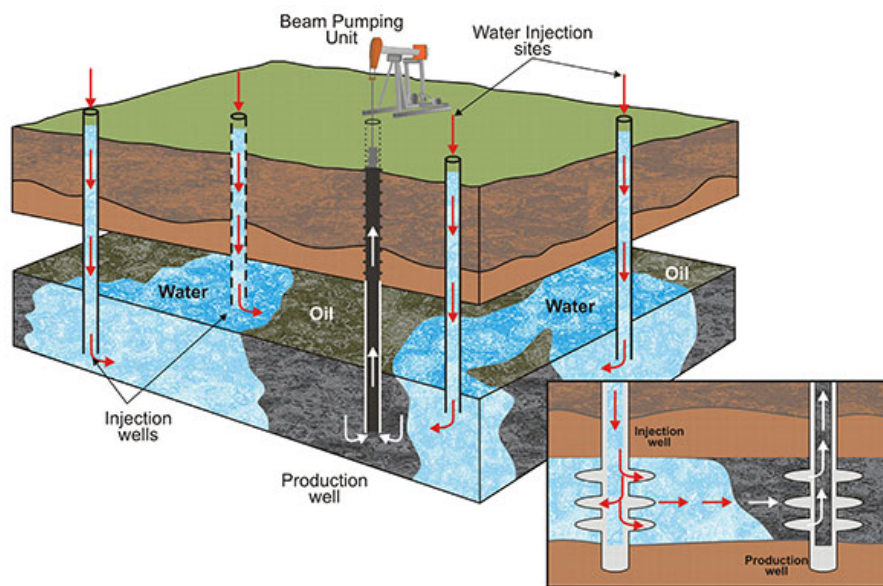
Oil Industry Basics

- The industry is really divided into three parts: Exploration, Production and Managing Oil Fields
- Exploration is high risk and expensive. Some offshore deep North Atlantic exploration wells can cost over \$1 billion. Horizontal wells in shale can cost \$5-10 million each. Wells on conventional oil fields can cost anywhere from \$300,000 for shallow reservoirs to over \$1 million depending on depth and other factors.
- Production Drilling and Completion (making drill holes into producing wells) is capital intensive and scheduled after an economic amount of oil is discovered. Dozens of new wells can be scheduled to be completed after an oil reservoir discovery.
- Managing oil fields is the less risky and if done right becomes a mundane and long lasting aspect of the industry. 90% of the work on these fields on a daily basis is done by workers who are not engineers. These are called pumpers. They are important people. Field engineers do the office work, planning and do get their hands dirty but most of the running of the field is very basic. The oil wells need to be cared for but it is not rocket science, but diligence and good management is important.
- Oil Exploration is high risk especially offshore. The low risk side of the industry is mature fields with established production and known proven reserves.
- All oil fields after 2-3 years of completion start losing pressure and oil production starts to decline.
- This initial production is called Primary Production. This is the most profitable production as Mother Nature forces oil to the surface. Primary Production usually recovers only 15% of the oil in the reservoir.
- An oil reservoir is not a lake or a pool or river. An oil reservoir is solid rock (sandstone for instance) that is more dense than the wall in your home or office. The oil is actually found in between the microscopic grains of sand. These tiny spaces between the sand grains are called pore spaces. The oil is found in these pore spaces. Water is also in the spaces as well.



- The oil reservoir is a layer of rock saturated with oil. Think of a chocolate layer cake with ten layers and the 4th layer is saturated with rum. That would be what the lithology (the layers of rock, sand, silt and clay that are found beneath the earth) of an oil field resembles.
- These billion-year old layers of material can go down for miles. There could be hundreds of different rock types, layer upon layer. Certain layers or strata contain oil and that is what is called an oil reservoir.

- If you took a glass and filled the glass with crushed beach sand and then poured olive oil into the glass, the oil in the spaces between the sand particles would be a good picture of what pore spaces are in an oil reservoir.
- Many times the sand or rock particles have been crushed and ground to microscopic sizes.
- The entire oil industry is focused on getting the oil in these microscopic pore spaces to come to the surface. It is in essence a microscopic industry.
- How microscopic? If you took some sandstone from an oil reservoir that was the size of a basketball, there would be more than 200 million spaces between the sand grains. In those spaces would be oil. That's how tightly packed and crushed the sand particles are.
- After a certain time, the natural pressure from the oil reservoir is depleted and approximately 15% of the oil is recovered. The industry must now try to put pressure back into the oil reservoir in an attempt to recover more oil.
- After Primary production the oil industry needs to add pressure back into the oil bearing strata in order to force more oil to the surface.
- This next phase is called Secondary Production
- This new production phase and new pressure can be accomplished by taking some of the production wells and reversing the flow and injecting water or gas back into the reservoir. A common method is pushing water down some wells towards the production wells nearby. These wells are now called injection wells.
- Injection wells push water back into the reservoir and force oil to be pushed up at surrounding production wells. This is called waterflooding.



Mature fields can have 500 production wells and 200-300 injection wells pushing water into the reservoir.

- The most common form of Secondary production is waterflooding.
- 50% of the world's oil fields become waterflooded fields. The Titan Process works best on waterflooded fields.
- Every day millions of gallons of water are pumped into the pipes which take the water down to the reservoir (rock strata) and push the water through the rock. The water is usually production water that originally was produced with the oil.
- The water pushes oil that is in between the minute rock particles towards the production wells

- The water comes up the production wells with oil.
- The oil is separated in tanks and sold
- The water is sent back down the injection wells. This can go on for 10-30 years or more.
- The water is usually salt water buried thousands of feet below oil country areas like Texas or any state. It is actually an ancient seabed where plant matter and algae and plankton were once collected and compressed over millions of years of geological time and because of the heat, pressure and the biology this organic material became oil.
- After Secondary Recovery the oil industry recovers another 15-20% of the oil in the reservoir.
- The global recovery rate for all the world's oil fields is 35%.
- Only 35% on average ever gets to the surface.
- 65% of the discovered world's oil resource does not get produced. It is forever trapped in the oil reservoirs. The oil is like a golf ball stuck inside a coke bottle – it can't get out.
- This unrecoverable oil is trapped in the pore spaces between the sand grains. It cannot escape.
- Until the Titan Process there has been no technology that could economically and efficiently recover this trapped oil at a low cost and with no capital expense.

Note:

There is also oil in shale rock and what is called carbonate reservoirs which are basically old coral reefs that have been buried thousands of feet below the earth or sea bottom. For simplicity sake I have used the sandstone reservoirs for illustrative purposes.

The Titan Process takes the oil that is trapped in the pore spaces and makes the oil into micro droplets that can escape and be pushed thru the sand matrix. Titan makes the "golf ball" into tiny bbs.

Until now, there has never been a technology that can do this. Create micro droplets and allow oil to escape from the microscopic pore spaces in an oil reservoir.

Titan does this with biodegradable materials that make simple changes in the biological environment that exists in these oil fields. It is a breakthrough science and technology.
