University of Oklahoma College of Law Graduate School.

Midstream Oil & Gas Procedure

OIL AND GAS EXPLORATION AND PRODUCTION PROCEDURES; AN OVERVIEW AND THE EVOLUTION OF THE STAGES INVOLVED IN THE OIL AND GAS INDUSTRY.

By

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1.0 INTRODUCTION

The oil and Gas industry is one of the largest and most important global industry, there are various activities that must take place to transform inputs of raw materials, knowledge, labor and capital into end products purchased by customers. A value chain is a device that helps identify the independent, economically viable segments of an industry. Value refers to what customers are willing to pay for, and so the value chain helps to identify the specific activities that create value throughout the chain the Oil and Gas industry.

The oil and gas industry is divided into three major sectors: **upstream, midstream and downstream**.

In this project the segment to be discussed is the Upstream segment of the Oil and Gas Industry.

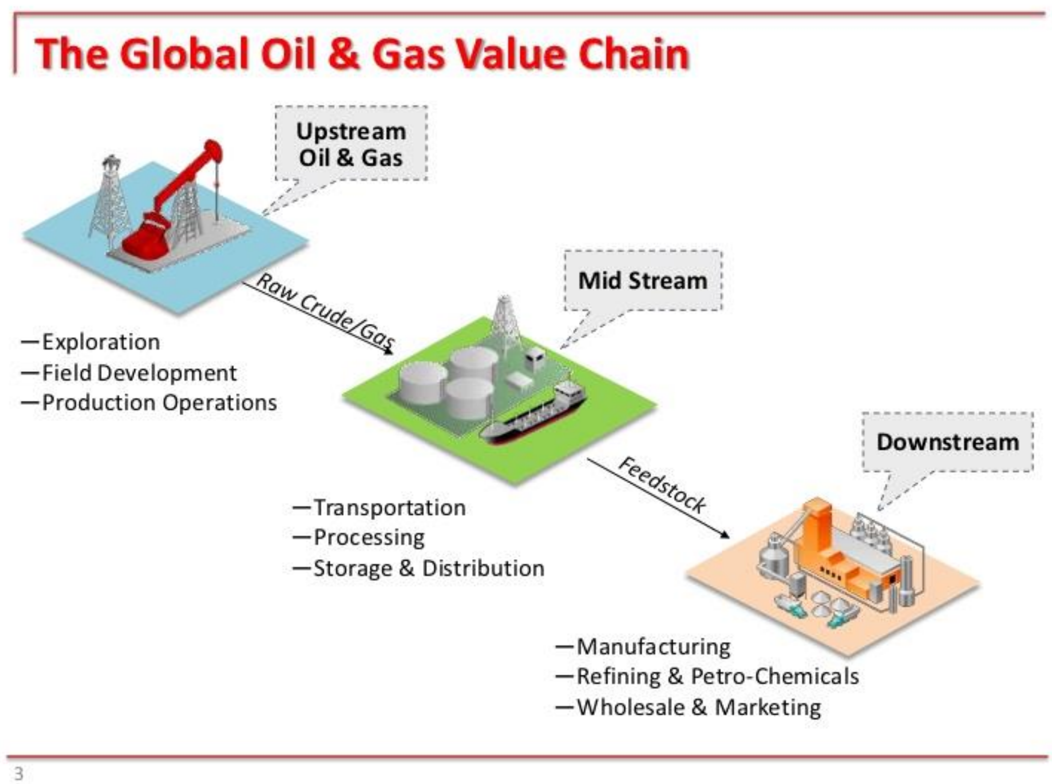

Fig 1

The upstream oil sector is also commonly known as the exploration and production (E&P). The upstream sector includes the searching for potential underground or underwater crude oil and natural gas fields, drilling of exploratory wells, and subsequently drilling and operating the wells that recover and bring the crude oil and raw natural gas to the surface.

People did not start drilling for buried petroleum until the middle of the 19th Century. However its presence had been known for quite a long time. In the mid-nineteenth century, a lack of whale oil matched with the development of procedures for refining "rock oil" into lamp oil. Demand for oil and gas has occasionally surged and slumped, as have prices and exploration activity. Regardless of the market for petroleum, however, both the exploration and production of oil are expensive endeavors. Even with the most sophisticated technology, finding hidden petroleum deposits involves creative interpretation of the land.

1.1 PURPOSE STATEMENT

Tend to explain What Oil and Gas Exploration and Production involve and, how the stages run. **An explanation of the overview of the stages and the evolution of procedures and technology involved have evolved, are detailed in this work.**

2.0 Exploration

The only way to prove what lies in buried rocks is to drill a well. Even with current geology and geophysical procedures, drilling stays hazardous. An exploratory or "wildcat" well in a region that has not been drilled before faces high chances against success: approximately one of seven to 10 exploratory wells finds commercial accumulations of oil or gas. To be commercially feasible, a well must be able to produce enough oil or gas to reach the costs of drilling and placing it on production. In wildcat areas the first exploratory wells are often drilled as tests. Produce valuable information about the nature of the rocks, and their oil and gas potential through the analysis of core samples, rock cuttings and data gathered from surveys.

A financial analysis is a determining factor in the classification of a well into:

1- Oil Well

2- Natural Gas Well

3- Dry Hole

In the event that the well can sufficiently deliver oil or gas to take care of the expense of consummation and generation, it will be put to production, If not classified as dry hole even if oil or gas is found.

If exploratory wells establish the presence of producible quantities of oil or gas, "development" wells are drilled to define the size and extent of the field. In development drilling the odds for success are higher: about six or seven successful wells for every 10 drilled. But the element of risk is still present. There may not be enough oil or gas to make the site commercially feasible or the technology required to produce oil or gas may be too expensive.

The exploration industry in Canada has gone through ups and downs that have little to do with the amount of oil or gas left to be found and more to do with the balance between supply and demand. For example, the Norman Wells oil field in the Northwest Territories was first discovered in 1920, but it was then considered too remote to be of interest to southern Canada. A modest amount of oil was refined there to meet regional demands. It was not until the mid-1970s that decreasing supplies and increasing oil values made large-scale development at Norman Wells worthwhile.

Technology also can have an impact on exploration activity, extensive exploitation of the large volumes of heavy oil in the Lloyd Minster area was dependent on the development of enhanced recovery techniques.

2.1 Exploration methods

Visible surface features such as oil seeps, natural gas seeps, pockmarks (underwater craters caused by escaping gas) provide basic evidence of hydrocarbon generation (be it shallow or deep in the Earth). However, most exploration depends on highly sophisticated technology to detect and determine the extent of these deposits using exploration geophysics. Areas thought to contain hydrocarbons are initially subjected to a gravity survey, magnetic survey, passive seismic or regional seismic reflection surveys to detect large-scale features of the sub-surface geology. Features of interest (known as leads) are subjected to more detailed seismic surveys which work on the principle of the time it takes for reflected sound waves to travel through matter (rock) of varying densities and using the process of depth conversion to create a profile of the substructure. When a prospect has been identified and evaluated and passes the oil company's selection criteria, an exploration well is drilled in an attempt to conclusively determine the presence or absence of oil or gas.

2.2 Exploration risk

Hydrocarbon exploration is a high risk investment and risk assessment is paramount for successful exploration portfolio management. Exploration risk is a difficult concept and is usually defined by assigning confidence to the presence of five imperative geological factors. This confidence is based on data and/or models and is usually mapped on Common Risk

Segment Maps (CRS Maps). High confidence in the presence of imperative geological factors is usually Colored green and low confidence colored red. Therefore these maps are also called Traffic Light Maps, while the full procedure is often referred to as Play Fairway Analysis. The aim of such procedures is to force the geologist to objectively assess all different geological factors. Furthermore it results in simple maps that can be understood by non-geologists and managers to base exploration decisions on.

2.3 Elements of a petroleum prospect

Fig 2 :Mud log in process, a common way to study the rock types when drilling oil wells.

A prospect is a potential trap which geologists believe may contain hydrocarbons. A significant amount of geological, structural and seismic investigation must first be completed to redefine the potential hydrocarbon drill location from a lead to a prospect. Five geological factors have to be present for a prospect to work and if any of them fail, neither oil nor gas will be present.

2.4 Terms used in petroleum evaluation

Bright spot - On a seismic section, coda that have high amplitudes due to a formation containing hydrocarbons.

Chance of success - An estimate of the chance of all the elements (see above) within a prospect working, described as a probability.

Dry hole - A boring that does not contain commercially viable hydrocarbons.

Flat spot - Possibly an oil-water, gas-water or gas-oil contact on a seismic section; flat due to gravity.

Hydrocarbon in place - amount of hydrocarbon likely to be contained in the prospect. This is calculated using the volumetric equation - GRV x N/G x Porosity x Sh / FVF

GRV - Gross rock volume - amount of rock in the trap above the hydrocarbon water contact

N/G - net/gross ratio - proportion of the GRV formed by the reservoir rock (range is 0 to 1)

FVF - formation volume factor - oil shrinks and gas expands when brought to the surface. The FVF converts volumes at reservoir conditions (high pressure and high temperature) to storage and sale conditions

Prospect - a lead which has been more fully evaluated.

Recoverable hydrocarbons - amount of hydrocarbon likely to be recovered during production. This is typically 10-50% in an oil field and 50-80% in a gas field.

2.5 Drilling

In the early years of petroleum industry, wells were not drilled but were punched with cable tools. On a cable tool rig, a heavy bit with a chiseled edge was suspended on a line of rope or wire cable. The hole was made through the constant raising, lowering and pounding of the bit into the earth. By the late 1920s, most operations used rotary drilling equipment, which was more efficient, drilling deeper and faster.

To a large extent, drilling still involves turning a drill bit at the end of lengths of steel pipe. Each piece of pipe is about 9 m long and is added, a length at a time, by threading onto the next piece of pipe. The bit, drill collars (which add weight to the bit) and lengths of pipe are called the drilling "string." The whole string is turned by a rotating platform, the rotary table. The revolving bit cuts and grinds through rock formations, lubricated and cooled by drilling fluid commonly called drilling "mud," a mixture of water or oil, clay and chemicals.

A deep-rated drilling rig, which might be used to drill holes 5,000 m deep, is composed of much heavier, larger and stronger equipment than one used to drill shallow wells.

For offshore drilling, rigs generally are permanently mounted on barges or platforms so that they can be towed from well site to well site. Some offshore drilling rigs are mounted on specially designed ships which move under their own power.

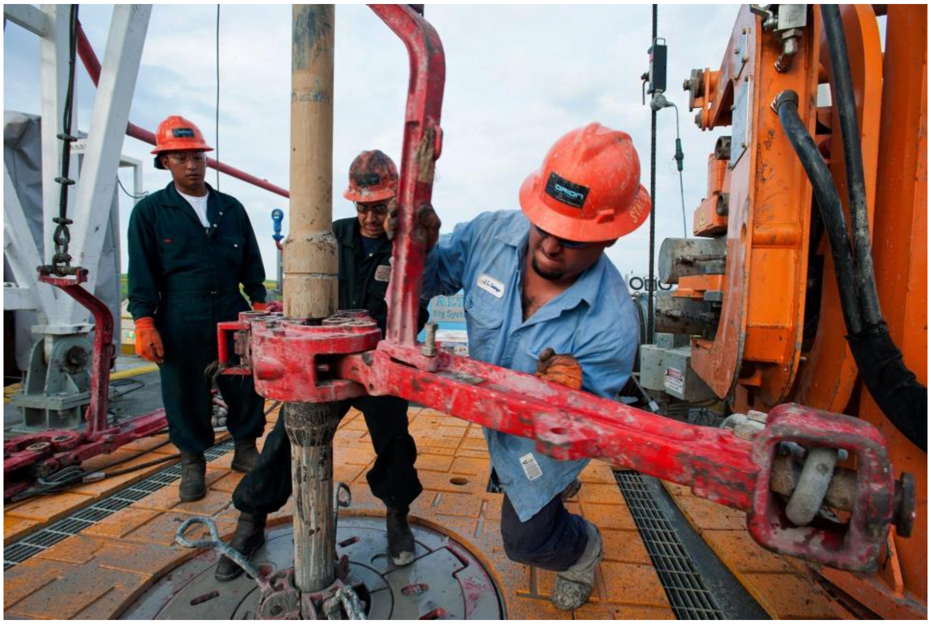

Fig (3)

Fig 4 (Drilling ship)

2.6 Down hole Technologies

During recent decades the technologies used to find and produce oil have gone through a revolution. In particular, horizontal drilling and the ability to drill several horizontal laterals from a single wellbore have transformed the drilling sector. Horizontal drilling is possible because of improvements in bit design, better down hole motors and bigger rigs.

Geo-steering is one of a number of revolutionary down hole technologies developed since the 1990s. In recent years, it has been given a lift by high-impact, measurement while drilling tools and techniques. More importantly, the industry can now isolate many completion zones (areas from which oil and gas are produced) in horizontal wellbores. This makes reservoir fracturing (and therefore production) possible from horizontal wells that reach out for several kilometers underground.

It took rapid innovation in down hole tools to turn hydrocarbon-bearing shales and other low-permeability rocks into producing reservoirs. Coil ("coiled") tubing is the workhorse of underground technologies. A tool that began to make inroads into industry operations around 1990, coil tubing has transformed many aspects of underground drilling and work-over operations. It refers to metal piping spooled on a large reel and used for down hole operations in wells. Coiled tubing is often used to carry out operations previously done by wire lining, which involves lowering tools into a wellbore by an electrical cable. Wire line tools transmit data about the conditions of the wellbore to the surface. The main benefit of coil tubing over wire line is that you can pump chemicals through the coil. With coil tubing you are able to push tools and chemicals into the hole, whereas wire lining relies on gravity.

The tool string at the bottom of the coil can range from something as simple as a jetting nozzle, for jobs involving pumping chemicals or cement through the coil, to a larger string of logging tools, depending on the operations. Coil tubing is also used for relatively inexpensive work-over operations. It is also used to perform open-hole drilling operations.

As these technologies increased in sophistication and declined in relative cost, they led to a fundamental change in field economics. Producers are now investing more money underground than above ground.

2.7 Completion

Drilling operators constantly monitor the progress of a well so they can quickly make decisions about whether to "complete" the well so it can be used for production or "abandon" it as a dry hole. Throughout the drilling operation, rock cuttings are examined for traces of hydrocarbons, and other evaluations and analyses are made. If the well is judged a dry hole, it will be plugged with cement and abandoned. However, if the tests show promise, the well will be completed.

The first step in completion is the installation of production casing, a tubular steel pipe that is cemented in place down the length of the wellbore. After this process, the drilling rig is usually removed from the well and a truck-mounted service rig is moved into place. The production casing is perforated to allow entry of fluids and gases into the wellbore. The perforations also provide access to the producing formation for other completion activities that may be undertaken.

For example, fracturing, or "fracking," is a common completion technique. In this process, materials are pumped down the well under high pressure to pop open cracks in the reservoir rock so that the oil or gas can move more freely through the formation.

3.0 PRODUCTION

Production is the long-term process of drilling and extracting oil and gas. Most countries grant oil and gas development rights to private companies through a process of either negotiation or bidding. Because crude oil and natural gas are non-renewable resources, optimizing recovery is critical. Only about 25 per cent of the oil can be recovered from a typical reservoir by natural means or primary recovery techniques. Enhanced-recovery techniques permit production of more oil from many reservoirs. The most common enhanced-recovery method, water injection, involves injecting water into the oil-bearing formation, and the water then forces the oil toward the producing well bore. Such techniques can result in recovery rates that can exceed 80 per cent of the oil in place.

Natural gas generally flows to the surface through its own pressure; thus, a natural gas wellhead is usually composed of only a series of chokes and valves to control flow. This wellhead structure is called a "Christmas tree." Crude oil, which typically contains some natural gas or solution gases, is sometimes produced through its natural pressure, but most crude oil wells in Canada require some method of lifting or pumping the oil to the surface. Pumping equipment is known by various names, including "pump jack," "horse head pump" and “walking beam” pump.

4.0 Conclusion

There is what is termed as offshore and onshore production, and development is after the exploration which comprises the installation of facilities to become a platform for production of Oil and Gas. After the Exploration and Production, if crude oil is produced must be sold and transported from the wellhead to a refinery, and If natural gas is produced must be moved into markets via pipeline or ship, Crude oil has little or no value until is refined into products such as gasoline and diesel.

The marketing of crude oil, natural gas, their products and by-products is complex. Various regulations, both federal and provincial, govern all aspects of production and sales. Although the provinces have jurisdiction over the oil and gas produced within their boundaries, the federal government has the ultimate jurisdiction over oil and gas pricing, transmission and sales, both domestic and export. Governments share the revenues of producing companies through federal and provincial taxes, and provincial royalties.

The ownership of oil and gas, particularly in offshore areas, and the right to revenue sharing and regulation often have been topics of dispute among federal and provincial governments regulates interprovincial movements of oil and gas and export allocations of gas and electricity.

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LL.M. Energy, Natural Resources (Oil & Gas) Law (2016).

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January 2016.

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