

The Oil and Gas Industry

Overview and Trends

KEY MESSAGES

- Oil and gas are hydrocarbons formed from the compression of organic material over millions of years.
- The process of getting oil out of the ground and to end-users is divided between *upstream* operations, which include exploration and production, and *downstream* operations, which include refining, marketing, and distribution.
- Nationally owned oil companies are the largest players in the industry.
- New technology has made it profitable to extract oil and gas from new places when prices are high. One of the major new processes is hydraulic fracturing, or *fracking*, which allows companies to extract *shale oil and gas*.

WHAT ARE OIL AND GAS?

This reader covers basic information about oil and gas and the industry that extracts them. It is intended to give a basic understanding to those who aim to promote better use of revenues from oil and gas.

Oil and natural gas are *hydrocarbons*, strings of carbon and hydrogen formed from organic material compressed over millions of years. Generally, oil and natural gas are both referred to as *petroleum*. They are often found together. If a reservoir (area underground) has only gas and no oil, it is called *non-associated gas*. If a reservoir contains both oil and gas, the gas it contains is called *associated gas*.

The oil and gas found in the ground come in different *grades* or qualities. The primary way to describe the quality of oil is in terms of its *sweetness* and *heaviness*. The sweetness of oil refers to the amount of sulfur in the oil. Oil with less sulfur is sweeter and requires less processing before use, and is therefore more valuable. The heaviness of oil refers to its density. Lighter crude can be refined into higher value products, such as the gasoline (or petrol) used by car owners. Heavier crude flows more slowly and has more unwanted chemicals that must be refined out. The American Petroleum Institute (API) has created a degree-based gravity scale that compares the relative density of various crudes. Light crude is measured above 31.1° API while heavy crude measures below 22.3° API.

Refining

What comes out of the ground is not often a form of petroleum that can be used right away. For it to be the fuel that can go into a car or converted into plastics, it must go through a process of refining. Refining is a chemical process of heating and cooling that isolates the chemicals that are most useful in the end product.

This reader is intended for use in conjunction with the Natural Resource Charter.

Natural gas is mostly methane, with some other contaminants. It is also described as either *sweet* or *sour* depending on the amount of hydrogen sulfide in the reservoir. When gas is refined, leaving mostly methane, it is called *dry gas*. Often natural gas is condensed into natural gas liquids, such as propane and butane. The British thermal unit (BTU) is the measure for the energy output of gas. While gas burns cleaner and is considered to have less destructive environmental impact upon use than oil or coal, the challenges associated with storage and transport can make it more expensive.

Reserves of oil are generally measured in tons or barrels of oil. Production quantities are abbreviated using “bbl” (or barrels of oil per day, bbl/d or bpd). One ton is approximately between six and eight barrels of oil. Reserves and production quantities of gas are measured in cubic meters (m³) or standard cubic feet (scf).

HOW DO COMPANIES GET OIL AND GAS OUT OF THE GROUND?

The process of getting oil and gas out of the ground begins with *exploration and appraisal*. Oil and gas are found under the ground in reservoirs that are sealed but connected to other chambers of oil and gas underground. When a reserve of oil is found, the company will often produce a description of the quality of the oil and the estimated amount measured either by volume (barrels) or by weight (tons). The company may also classify some of the contents as *proven reserves*. Proven reserves are oil finds that are considered commercially viable—that is, the company is at least 90 percent certain that it would make money getting petroleum out of the ground and taking it to market. If oil is held in a *probable reserve*, then the company thinks there is at least a 50 percent chance of recovering the oil. *Unprovable* or *possible* reserves are those with a 10 percent to 50 percent probability of profitable extraction. The word *resource* is used to refer to all fields within a country, including those that may not be economically feasible to extract.

Upstream vs. downstream

Upstream and downstream are different parts of the process of getting petroleum from out of the ground and to the market. Upstream includes the exploration and extraction phases. Downstream includes refining, marketing, and end use. Transportation between upstream and downstream is often referred to as midstream.

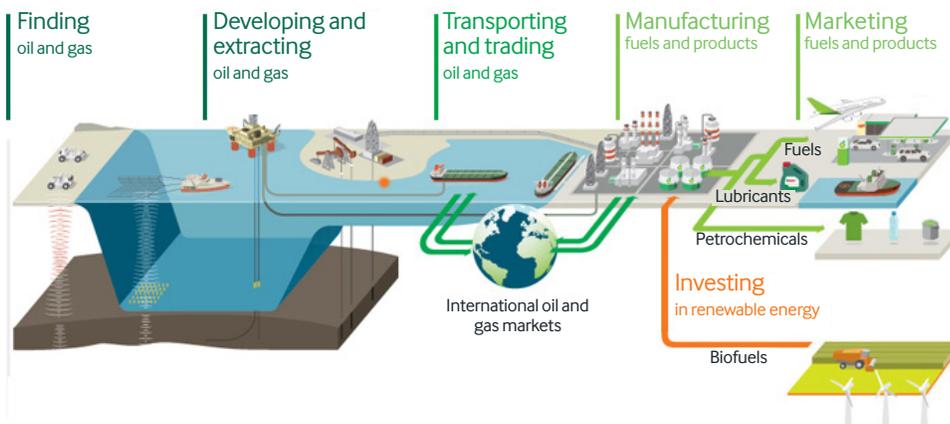


Figure 1. Oil value chain describing BP’s business model.

The oil and gas industry often refers to the concept of a value chain to describe the steps in the process get the oil out of the ground and purchased on the commercial market.

Source: BP value chain image, available at: <http://www.bp.com/en/global/corporate/about-bp/companyinformation/our-business-model.html>

Once the reservoir is deemed commercially viable and the company has been granted legal authorization to tap it, the company will often begin digging test wells. These wells will give more information about viability and can indicate what type of equipment is best for production. *Production*, the next phase after exploration and appraisal, is the process of getting the oil and gas out of the ground. This can occur in three different ways. *Primary* recovery efforts are when the oil will flow to the surface under its own pressure. When water or gas are injected into the reservoir to lift the oil, recovery is considered *secondary*. *Tertiary*, or enhanced, removal happens when chemicals are put

into the well. The production rates of wells vary greatly depending on the geology and technology used. Rates are usually measured in barrels per day. The lifecycle of a typical well will have a build-up period, peak, and then decline.

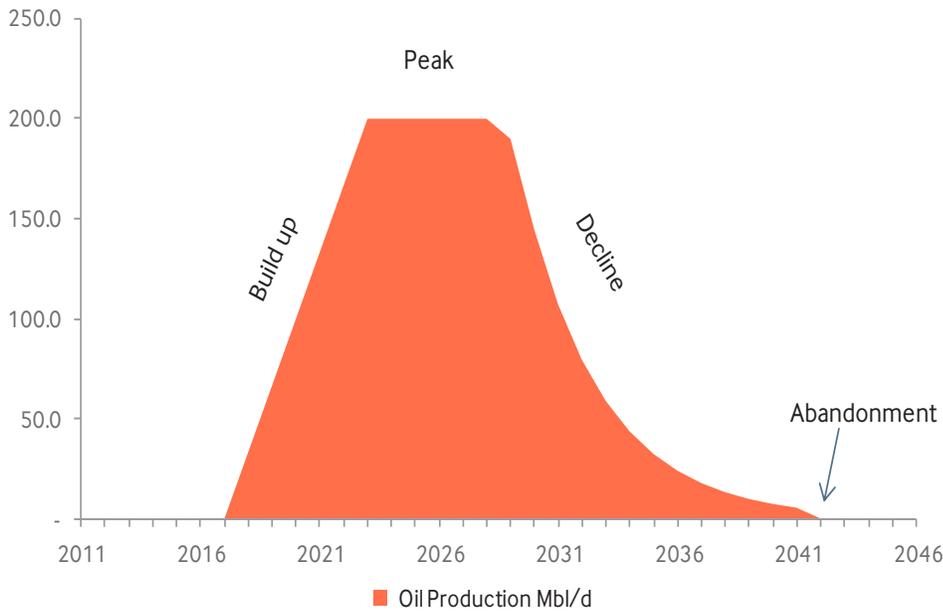


Figure 2: Production profile of a typical oil field

Source: NRGi

The final phase of an oil project is *decommissioning* and *abandonment*. This phase requires closing the reservoir, removing equipment, and restoring the environment to its previous state.

The cost of extraction varies greatly depending on the type of oil and its location. Generally offshore oil is much more costly to extract than onshore oil.

WHO ARE THE KEY PLAYERS IN THE INDUSTRY?

Countries with large reserves of oil and gas have always been very powerful players in the industry. The Organization of Petroleum Exporting Countries (OPEC) formed in 1960 as five countries collaborated to get the best price for their oil. Today, OPEC represents 12 countries, which together control 80 percent of the world’s proven reserves and one-third of production. Often countries make agreements, or contracts, with companies to help extract the oil and bring it to market.

National oil companies (NOCs), oil companies that are primarily or completely owned by the government, are some of the biggest players. Saudi Aramco, for example, is the largest oil company in the world. In addition to being involved in extraction, many national oil companies are also involved in regulation of the industry, commodity trading, and quasi-fiscal expenditures. For more on NOCs, please refer to reader on state participation and state-owned enterprises.

International oil companies are privately owned by shareholders, instead of governments. The six largest *supermajors* companies are ExxonMobil, BP, Royal Dutch Shell, ConocoPhillips, Chevron/Texaco, and Total. These large oil companies cover all aspects of the industry value chain from extraction through distribution. They tend to be risk averse, preferring to engage in projects where there are more established legal

Public energy data

There are a number of websites that publish data about energy. These often include rates of production on a country level. You can access some of these data at the following websites:

- www.eia.gov
- www.bp.com
- www.opec.org
- www.ieg.org

regimes and higher probability of successful extraction. Supermajors own a small share of reserves compared to NOCs, but their profits are still very large, often comparable to the GDPs of many medium-sized countries.

Smaller, multinational companies like Occidental Petroleum and Anadarko Petroleum still have billions of dollars in capital. These tend to be more innovative and develop a technical expertise in one area of extraction, such as deep-water drilling.

Another type of company involved is a *service provider*. These companies supply specialized services for the larger companies, such as rigs, pipes, seismic surveys, and rig operators. Examples include companies like Halliburton and Transocean. Though they are smaller than the supermajors, some are still very large companies. Halliburton, for example, had revenue of \$32.9 billion in 2014 and employs over 75,000 people.

“Supermajors own a small share of reserves compared to NOCs, but their profits are still very large, often comparable to the GDPs of many medium-sized countries.”

WHAT ARE THE MAJOR TRENDS IN THE INDUSTRY?

At the moment, in early 2015, the price of oil is dropping rapidly. Price fluctuations in oil and gas can impact the direction of the industry because costs are different at different extraction points. Shale oil, for example, can be very costly to produce and may become less commercially viable if prices continue to drop. Countries with large production fields and large companies can more easily ride price shocks without having to make drastic changes to their activities.

Shale gas

Shale gas refers to reservoirs of gas that are trapped in rock formations that are less permeable. Removing gas from these formation requires a process called hydraulic fracturing, or *fracking*. Fracking involves pumping a mixture of water, sand and chemicals into a well under high pressure. Shale gas production has become extremely controversial due to its potential social and environmental impacts.

Technological innovations during the years when oil prices were high made *shale oil and gas* more commercially viable to extract. The production of shale hydrocarbons has altered the market structure, and increased the production capacity of the United States, Canada, and Russia. However, the drop in oil prices in 2015 has already led to a downsizing of this industry, especially in the United States.

Amid fluctuating prices, the global demand for energy, including oil and gas, is increasing. While alternative forms of energy are becoming more popular, there are still strong indications that the use and production of oil and gas will continue. Though industrial energy efficiency is increasing, the demand for transportation and increasing population means there is an overall increasing need for energy.

Oil and gas are highly concentrated geographically. As of 2011, the Middle East held 48 percent of the world’s known oil reserves. Improvements in exploration technology and economic stability in Africa have prompted oil and gas companies to begin exploring where they have not looked previously. As a result, since the early 2000s there has been an increase of discoveries throughout Africa.

QUESTIONS TO ASK

- What types of oil and gas are found in my country? How much is available? How much is being produced? When will it be depleted at current production rates?
- Who are the key players in my country?
- How do changes in the price of oil impact production in my country?
- What type of extraction process is used in my country?

ADDITIONAL RESOURCES

Further reading

Christian O.H. Wolf, *Petroleum Sector Value Chain* (World Bank Group 2009), available at : http://siteresources.worldbank.org/INTOGMC/Resources/noc_chapter_1.pdf

Inkpen, Andrew, *The Global Oil & Gas Industry: Management, Strategy and Finance* (2011)

The Natural Resource Governance Institute, an independent, non-profit organization, helps people to realize the benefits of their countries' oil, gas and mineral wealth through applied research, and innovative approaches to capacity development, technical advice and advocacy.
Learn more at www.resourcegovernance.org