Azərbaycan Dövlət Neft və Sənaye Universiteti

Fakultə: "İqtisadiyyat və Menecment Fakültəsi"

Kafedra: "Neft Mühəndisliyi"

Qrup: 799.3

"İstehsalın texniki əsasları" fənnindən

Sərbəst iş

Mövzu: Quyuların qazliftli üsulla istismarı (Gas Lift Method)

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Bakı -2016

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Introduction

The petroleum industry includes the global processes of exploration, extraction, refining, transporting (often by oil tankers and pipelines), and marketing petroleum products. The largest volume products of the industry are fuel oil and gasoline (petrol). Petroleum (oil) is also the raw material for many chemical products, including pharmaceuticals, solvents, fertilizers, pesticides, and plastics. The industry is usually divided into three major components: upstream, midstreamand downstream. Midstream operations are usually included in the downstream category.

Petroleum is vital to many industries, and is of importance to the maintenance of industrialcivilization in its current configuration, and thus is a critical concern for many nations. Oil accounts for a large percentage of the world's energy consumption, ranging from a low of 32% for Europe and Asia, to a high of 53% for the Middle East.

Other geographic regions' consumption patterns are as follows: South and Central America(44%), Africa (41%), and North America (40%). The world consumes 30 billion barrels (4.8 km^3) of oil per year, with developed nations being the largest consumers. The United Statesconsumed 25% of the oil produced in 2007. The production, distribution, refining, and retailing of petroleum taken as a whole represents the world's largest industry in terms of dollar value.

Governments such as the United States government provide a heavy public subsidy to petroleum companies, with major tax breaks at virtually every stage of oil exploration and extraction, including the costs of oil field leases and drilling equipment.

Petroleum is a naturally occurring liquid found in rock formations. It consists of a complex mixture of hydrocarbons of various molecular weights, plus other organic compounds. It is generally accepted that oil is formed mostly from the carbon rich remains of ancient plankton after exposure to heat and pressure in the Earth's crust

over hundreds of millions of years. Over time, the decayed residue was covered by layers of mud and silt, sinking further down into the Earth's crust and preserved there between hot and pressured layers, gradually transforming into oil reservoirs.

Imperial Russia produced 3,500 tons of oil in 1825 and doubled its output by mid-century. After oil drilling began in what is now Azerbaijan in 1846 in Baku, two large pipelines were built in the Russian Empire: the 833 km long pipeline to transport oil from the Caspian to the Black Sea port of Batum (Baku-Batum pipeline), completed in 1906, and the 162 km long pipeline to carry oil from Chechnya to the Caspian. Batum is renamed to Batumi in 1936.

At the turn of the 20th century, Imperial Russia's output of oil, almost entirely from the Apsheron Peninsula, accounted for half of the world's production and dominated international markets. Nearly 200 small refineries operated in the suburbs of Baku by 1884. As a side effect of these early developments, the Apsheron Peninsula emerged as the world's "oldest legacy of oil pollution and environmental negligence." In 1846, Baku the first ever well drilled with percussion tools to a depth of 21 meters for oil exploration. In 1878, Ludvig Nobel and his Branobel company "revolutionized oil transport" by commissioning the first oil tanker and launching it on the Caspian Sea.

The first modern oil refineries were built by Ignacy Łukasiewicz near Jasło (then in the dependent Kingdom of Galicia and Lodomeria in Central European Galicia), Poland in 1854–56. These were initially small as demand for refined fuel was limited. The refined products were used in artificial asphalt, machine oil and lubricants, in addition to Łukasiewicz's kerosene lamp. As kerosene lamps gained popularity, the refining industry grew in the area.

The first commercial oil well in Canada became operational in 1858 at Oil Springs, Ontario (then Canada West). Businessman James Miller Williams dug several wells between 1855 and 1858 before discovering a rich reserve of oil four metres below ground. Williams extracted 1.5 million litres of crude oil by 1860, refining much of it into kerosene lamp oil. Some historians challenge Canada's claim to

North America's first oil field, arguing that Pennsylvania's famous Drake Well was the continent's first. But there is evidence to support Williams, not least of which is that the Drake well did not come into production until August 28, 1859. The controversial point might be that Williams found oil above bedrock while Edwin Drake's well located oil within a bedrock reservoir. The discovery at Oil Springs touched off an oil boom which brought hundreds of speculators and workers to the area. Canada's first gusher (flowing well) erupted on January 16, 1862, when local oil man John Shaw struck oil at 158 feet (48 m). For a week the oil gushed unchecked at levels reported as high as 3,000 barrels per day.

The first modern oil drilling in the United States began in West Virginia and Pennsylvania in the 1850s. Edwin Drake's 1859 well near Titusville, Pennsylvania, is typically considered the first true modern oil well, and touched off a major boom. In the first quarter of the 20th century, the United States overtook Russia as the world's largest oil producer. By the 1920s, oil fields had been established in many countries including Canada, Poland, Sweden, Ukraine, the United States, Peru and Venezuela.

The first successful oil tanker, the *Zoroaster*, was built in 1878 in Sweden, designed by Ludvig Nobel. It operated from Bakuto Astrakhan. A number of new tanker designs were developed in the 1880s.

In the early 1930s the Texas Company developed the first mobile steel barges for drilling in the brackish coastal areas of theGulf of Mexico. In 1937 Pure Oil Company (now part of Chevron Corporation) and its partner Superior Oil Company (now part of ExxonMobil Corporation) used a fixed platform to develop a field in 14 feet (4.3 m) of water, one mile (1.6 km) offshore of Calcasieu Parish, Louisiana. In early 1947 Superior Oil erected a drilling/production oil platform in 20 ft (6.1 m) of water some 18 miles off Vermilion Parish, Louisiana. It was Kerr-McGee Oil Industries (now Anadarko Petroleum Corporation), as operator for partners Phillips Petroleum (ConocoPhillips) and Stanolind Oil & Gas (BP), that completed its historic Ship Shoal Block 32 well in November 1947, months before

Superior actually drilled a discovery from their Vermilion platform farther offshore. In any case, that made Kerr-McGee's Gulf of Mexico well, Kermac No. 16, the first oil discovery drilled out of sight of land. Forty-four Gulf of Mexico exploratory wells discovered 11 oil and natural gas fields by the end of 1949. During World War II (1939-1945) - control of oil supply from Baku and Middle East played a huge role in the events of the war and the ultimate victory of the allies. Cutting off the oil supply considerably weakened Japan in the latter part of the war. AfterWorld War II ended, the countries of the Middle East took the lead in oil production from the United States. Important developments since World War II include deep-water drilling, the introduction of the Drillship, and the growth of a global shipping network for petroleum relying upon oil tankers and pipelines. In 1949, first offshore oil drilling at Oil Rocks (Neft Dashlari) in the Caspian Sea off Azerbaijan eventually resulted in a city built on pylons. In the 1960s and 1970s, multi-governmental organizations of oil–producing nations OPEC and OAPEC played a major role in setting petroleum prices and policy. Oil spills and their cleanup have become an issue of increasing political, environmental, and economic importance.

What is Artificial Lift

Artificial lift is a process used on oil wells to increase pressure within the reservoir and encourage oil to the surface. When the natural drive energy of the reservoir is not strong enough to push the oil to the surface, artificial lift is employed to recover more production.

While some wells contain enough pressure for oil to rise to the surface without stimulation, most don't, requiring artificial lift. In fact, 96% of the oil wells in the US require artificial lift from the very beginning.

Even those wells that initially posses natural flow to the surface, that pressure depletes over time, and artificial lift is then required. Therefore, artificial lift is generally performed on all wells at some time during their production life.

Although there are several methods to achieve artificial lift, the two main categories of artificial lift include pumping systems and gas lifts.

Methods of Artificial Lift

The most common type of artificial lift pump system applied is **beam pumping**, which engages equipment on and below the surface to increase pressure and push oil to the surface. Consisting of a sucker rod string and a sucker rod pump, beam pumps are the familiar jack pumps seen on onshore oil wells.

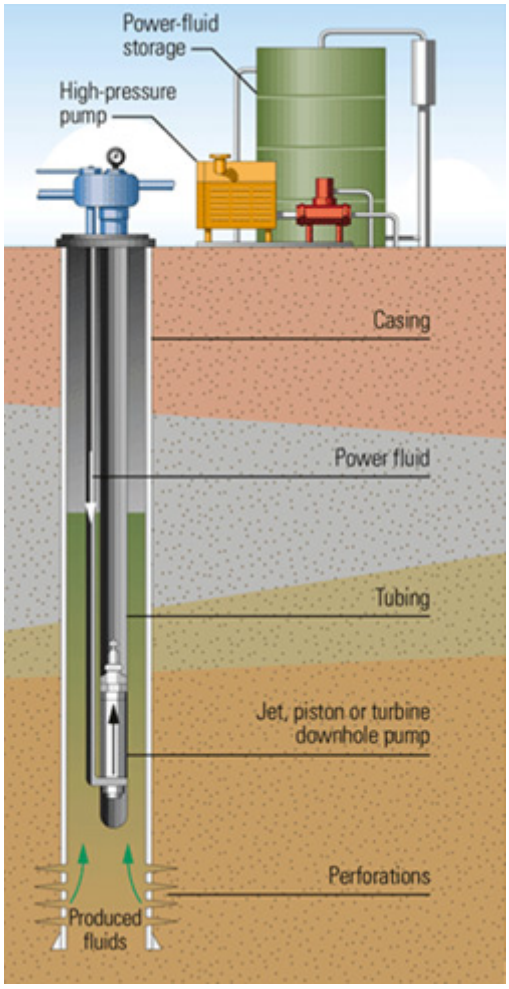
Beam Pump

Above the surface, the beam pumping system rocks back and forth. This is connected to a string of rods called the sucker rods, which plunge down into the wellbore. The sucker rods are connected to the sucker rod pump, which is installed as a part of the tubing string near the bottom of the well. As the beam pumping system rocks back and forth, this operates the rod string, sucker rod and sucker rod pump, which works similarly to pistons inside a cylinder. The sucker rod pump lifts the oil from the reservoir through the well to the surface.

Usually pumping about 20 times a minute, the pumping units are powered electronically or via gas engine, called a prime mover. In order for the beam system to work properly, a speed reducer is employed to ensure the pump unit moves steadily, despite the 600 revolutions per minute the engine achieves.

Another artificial lift pumping system, **hydraulic pumping** equipment applies a downhole hydraulic pump, rather than sucker rods, which lift oil to the surface. Here, the production is forced against the pistons, causing pressure and the pistons

to lift the fluids to the surface. Similar to the physics applied in waterwheels powering old-fashion gristmills, the natural energy within the well is put to work to raise the production to the surface.



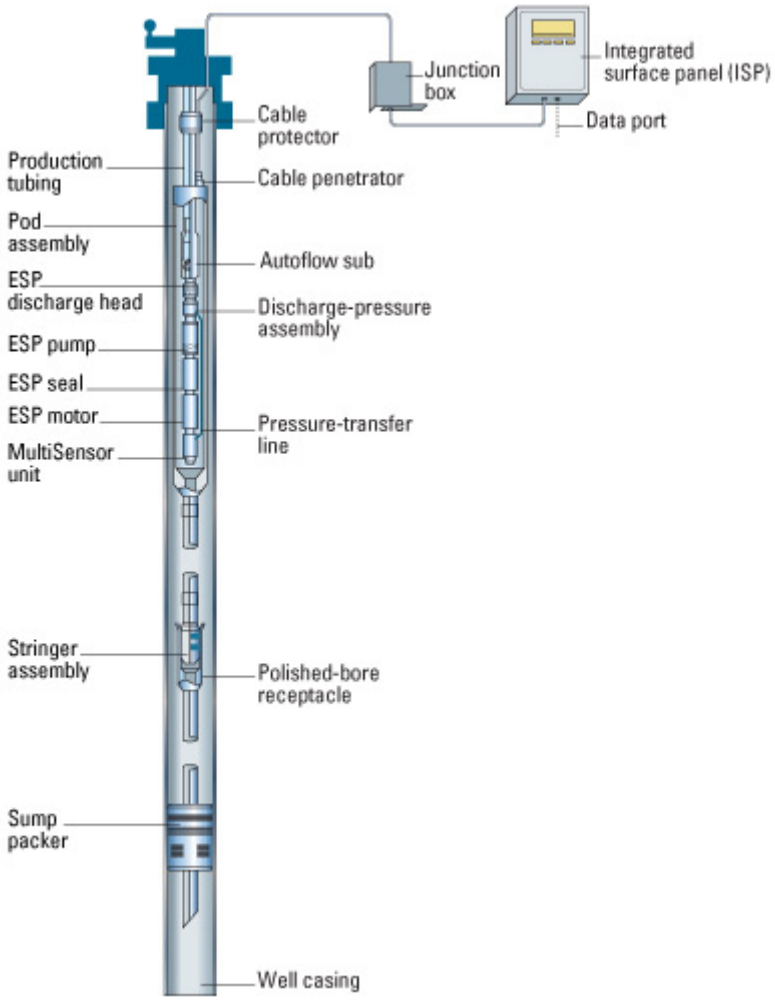
Hydraulic Pump

Hydraulic pumps are generally composed of two pistons, one above the other, which are connected by a rod that moves up and down within the pump. Both the surface hydraulic pumps and subsurface hydraulic pumps are powered by power oil, or clean oil that has been previously lifted from the well. The surface pump sends the power oil through the tubing string to the subsurface hydraulic pump installed at the bottom of the tubing string, the reservoir fluids are then sent up a second parallel tubing string to the surface.

Electric submersible pump systems employ a centrifugal pump below the level of the reservoir fluids. Connected to a long electric motor, the pump is composed of

several impellers, or blades, that move the fluids within the well. The whole system is installed at the bottom of the tubing string. An electric cable runs the length of the well, connecting the pump to a surface source of electricity.

The electric submersible pump applies artificial lift by spinning the impellers on the pump shaft, putting pressure on the surrounding fluids and forcing them to the surface. A mass producer, electric submersible pumps can lift more than 25,000 barrels of fluids per day.



Electric Submersible Pump

Gas Lift Method

Gas lift or **Bubble pumps** use the artificial lift technique of raising a fluid such as water or oil by introducing bubbles of compressed air, water vapor or other vaporous bubbles into the outlet tube. This has the effect of reducing the hydrostatic pressure in the outlet tube vs. the hydrostatic pressure at the inlet side of the tube.

Devices using this type of lift mechanism:

- Coffee percolators use vaporized water to lift hot water
- Airlift pumps uses compressed air to lift water
- Pulser pumps use a subterranean chamber of air for an airlift pump
- Suction dredges use an airlift pump to vacuum mud, sand and debris
- Mist lift pumps uses vaporized water to lift seawater in Ocean thermal energy conversion

Petroleum industry uses

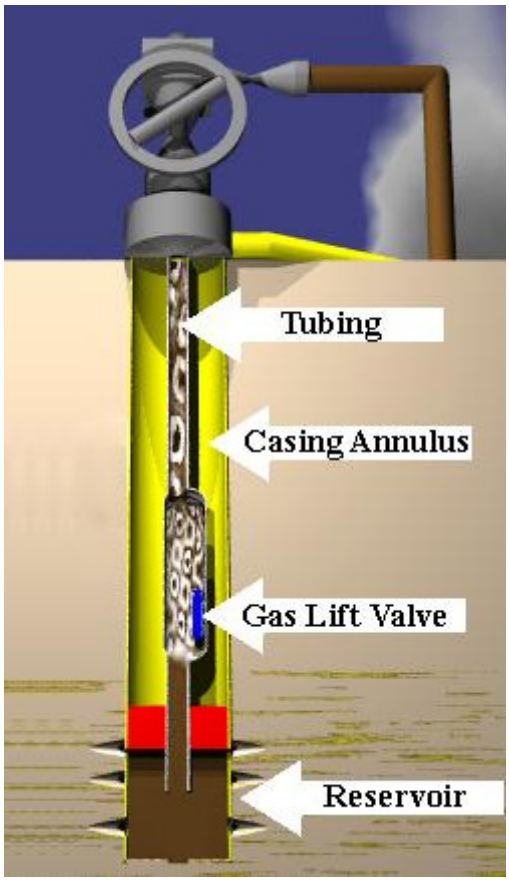
In the United States, gas lift is used in 10% of the oil wells that have insufficient reservoir pressure to produce the well.T In the petroleum industry, the process involves injecting gas through the tubing-casing annulus. Injected gas aerates the fluid to reduce its density; the formation pressure is then able to lift the oil column and forces the fluid out of the wellbore. Gas may be injected continuously or intermittently, depending on the producing characteristics of the well and the arrangement of the gas-lift equipment.

The amount of gas to be injected to maximize oil production varies based on well conditions and geometries. Generally, the optimal amount of injected gas is determined by well tests, where the rate of injection is varied and liquid production (oil and perhaps water) is measured. Although the gas is recovered from the oil at a later separation stage, the process requires energy to drive a compressor to raise the pressure of the gas to a level where it can be re-injected.

How Does Gas Lift Method Work

An emerging method of artificial lift, **gas lift** injects compressed gas into the well to reestablish pressure, making it produce. Even when a well is flowing without artificial lift, it many times is using a natural form of gas lift.

The injected gas reduces the pressure on the bottom of the well by decreasing the viscosity of the fluids in the well. This, in turn, encourages the fluids to flow more easily to the surface. Typically, the gas that is injected is recycled gas produced from the well.



Gas Lift

The amount of gas to be injected to maximize oil production varies based on well conditions and geometries. Too much or too little injected gas will result in less than maximum production. Generally, the optimal amount of injected gas is determined by well tests, where the rate of injection is varied and liquid production (oil and perhaps water) is measured.

Although the gas is recovered from the oil at a later separation stage, the process requires energy to drive a compressor to raise the pressure of the gas to a level where it can be re-injected.

The gas-lift mandrel is a device installed in the tubing string of a gas-lift well onto which or into which a gas-lift valve is fitted. There are two common types of mandrels. In a conventional gas-lift mandrel, a gas-lift valve is installed as the tubing is placed in the well. Thus, to replace or repair the valve, the tubing string must be pulled. In the side-pocket mandrel, however, the valve is installed and removed by wireline while the mandrel is still in the well, eliminating the need to pull the tubing to repair or replace the valve.

A gas-lift valve is a device installed on (or in) a gas-lift mandrel, which in turn is put on the production tubing of a gas-lift well. Tubing and casing pressures cause the valve to open and close, thus allowing gas to be injected into the fluid in the tubing to cause the fluid to rise to the surface. In the lexicon of the industry, gas-lift mandrels are said to be "tubing retrievable" wherein they are deployed and retrieved attached to the production tubing. See gas-lift mandrel.

Gas lift operation can be optimized in different ways.The newest way is using risk-optimization which considers all aspects for gas lift allocation.

With very few surface units, gas lift is the optimal choice for offshore applications. Occurring downhole, the compressed gas is injected down the casing tubing annulus, entering the well at numerous entry points called gas-lift valves. As the gas enters the tubing at these different stages, it forms bubbles, lightens the fluids and lowers the pressure.

In the US, the majority of wells, 82%, employ a beam pump. Ten percent use gas lift, 4% use electric submersible pumps, and 2% use hydraulic pumps.

List of Used Literature

1. Andrew Inkpen, 'The Global Oil & Gas Industry: Management, Strategy and Finance'
2. 'Drilling Technology in Nontechnical Language', 2nd Edition
3. Dr. J. J. Azar and Dr. G. Robello Samuel, 'Drilling Engineering'
4. Gabor Takacs , 'Gas Lift Manual'
5. W.E. Gilbert, 'Flowing and Gas Lift Well Performance' Drill and Prod. Prac., API, Dallas, 1954
6. H.Duns, Jr. and N.CJ.Ros, 'Vertical Flow of Gas and Liquid Mixtures in Wells', Proc., Sixth World Pet, Cong., 1963, 451page
7. K.Aziz, G.W. Govies, and M. Forgararasi, 'Pressure Drop in Wells Producing Oil and Gas' J.Pet. Tech., Jul-Sept, 1972, pp 38-51
8. En.wikipedia.org
9. Google.com
10. Petrowiki.org