



150 Years of Plenitude: The Story of Oil

Posted by [Gail the Actuary](#) on August 27, 2009 - 10:34am

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This post is a guest post by [Morgan Downey](#). Morgan is author of the book 'Oil 101'.

Exactly one hundred and fifty years ago, on August 27, 1859, the [first commercial oil well](#) in the US began producing. The subsequent petroleum bounty has enabled and defined modern civilization.

This post is a status update in honor of the day--on how far we have come and our immediate challenges.

Lighting Fuel	Self Serve
Sunlight	0
Candles	Costly
Whale Oil	Luxury

Graphic by author, based on prices of illuminants in the mid 1850s from 'Artificial Light' by Matthew Luckiesh.

A Brief History of Oil

People have used oil obtained from the ground since at least 4,000BC. In the Middle East, crude oil that seeped to the surface was used to waterproof boats and as an adhesive in the construction of buildings and roads. Crude oil was also refined in minor quantities for lamp and heating oil in ancient China, though this technology never made it directly to modern times. By 600AD, the Byzantines used crude oil to produce a flame-throwing weapon known as Greek fire.

The modern oil industry began as a result of the search for inexpensive lighting. Until 1859, most people obtained artificial light by burning animal fats in the form of beeswax candles or whale oil. Whale oil shed the purest light of all available fuels, and became a luxury product. Overfishing led to a decline in the whale population ([click here](#) to see a cool whale video today) and a sharp

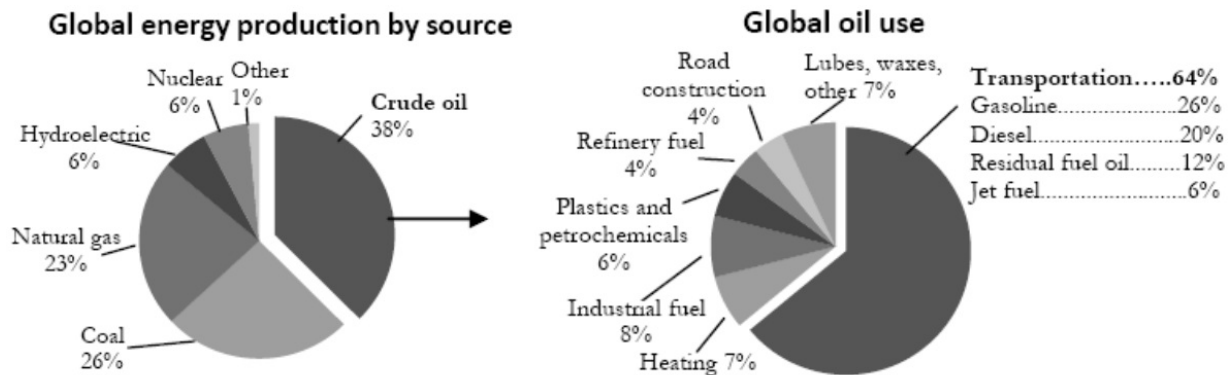
[increase](#) in whale oil prices.

In order to take advantage of the high prices of illumination, a group of investors hired a railroad conductor named Edwin Drake to head to a location close to where traces of crude oil had been observed on the surface. After a nervous few weeks in rural Pennsylvania, Drake struck oil on August 27, 1859. The 69 foot deep well on a salt dome rock formation yielded around 15 barrels a day. Others quickly followed Drake and drilling soon spread across the region.

The petroleum that flowed from this well in what became known as Oil Creek, near Titusville, Pennsylvania, started the modern oil industry we know today (oil had been produced in other parts of the world, but the Titusville well kicked off industry on a large scale).

The new industry was gradually consolidated and monopolized by one man, John D. Rockefeller, and his Standard Oil Company. In 1911, Standard Oil was split by anti-monopoly legislation into several competing firms. [Esso](#) ("S. O." for Standard Oil), which later became Exxon, remains the most well known of the Standard Oil children.

Up until the early 1900s, although economically important for lighting, oil was not used for much else. This quickly changed with the development of mass produced automobiles and aircraft such that by the 1950s oil had almost completely transitioned to being a transportation fuel. Today (see charts below), two-thirds of oil is used for transportation with the remaining third used for heating oil, plastics and road surfacing. A very small amount of oil is used for electricity generation as oil is generally more expensive than coal or natural gas.



Charts are based on 2007 data. Chart source: Page 7 of Oil 101. Data from EIA and IEA.

The success of the oil industry in finding oil has always been its greatest challenge. Oil prices remained low during long periods of unforeseen oversupply while demand steadily caught up.

Standard Oil managed excess production capacity initially. Then, in the early 1930s, the Texas Railroad Commission (TRC) and similar but smaller organizations in other oil producing US states were given a government mandate to impose production restrictions to ration the amount of crude produced in each state. The US was a very large crude oil producer at that time and the government sought to prevent the bankruptcy of the industry during the Great Depression.

The global pricing ability of the TRC disappeared in 1970 when US oil production began to steadily decline. OPEC (the Organization of Petroleum Exporting Countries) was formed in 1960 in Baghdad. This new organization took over the role of managing excess production capacity in 1971. Today, OPEC members control just over 40% of global crude oil production. While non-OPEC producers generally pump as fast as they can, OPEC members occasionally restrain oil supply in order to support prices.

In the late 1970s and 1980s, oil began to be traded on futures exchanges. Heating oil futures first traded on the New York Mercantile Exchange (NYMEX) in 1978, followed by gasoline futures in 1981, and crude oil futures in 1983. This created price transparency between producers and consumers never witnessed before and finally removed oil price determination from the shady smoke-filled rooms where prices had been set previously.

What is crude oil?

Organic materials such as plankton and algae that have been deposited in sedimentary layers over many years on ocean and floors are believed to account for most crude oil. Contrary to popular perception, dinosaurs and other large animals are not thought to account for much oil.

All living creatures are composed of the elements carbon, hydrogen, oxygen, nitrogen, sulfur, phosphorus, along with minor amounts of other elements. Crude oil is composed of these same elements in addition to small amounts of inorganic materials picked up from the surrounding area. If buried deep enough and long enough the heat and pressure closer to the earth's core combines the hydrogen and carbon over time to produce hydrocarbon molecules.

The primary factor which makes oil so valuable is that these liquid hydrocarbon molecules quickly release a large amount of energy as heat when combined with oxygen in a process called oxidization, more commonly referred to as combustion or burning.

Being lighter than surrounding rock, newly formed crude oil tends to head to the surface where it evaporates or is eaten by bacteria. If it is to be found today, the oil needs have been trapped under a suitable cap rock on its way to the surface.

A crude oil reservoir does not resemble an underground lake; instead, an accumulation of crude oil is contained between grains of sand or within tiny pores inside an otherwise solid rock matrix, like a rigid finely perforated sponge.

The hundreds of different grades of crude oil produced today are literally crude. To be used, they must be boiled in a refinery to separate out individual finished products including gasoline, diesel, heating oil, jet, and residual fuel. Each product has a different boiling temperature range.

The two factors which are most important for refineries to know about crude oil are its density and sulfur content.

In general, less dense, or lighter, crude is more valuable--it will more easily yield high value light products such as gasoline. Heavy crude oils can be processed to yield light products also, but only with the use of expensive and energy intensive processes which crack the heavier molecules.

Crude oil can be referred to as being sweet--low in sulfur, or sour--high in sulfur. Sulfur corrodes metal piping and tanks in producer and refining facilities. It also becomes a pollutant when burned, and sulfur in tailpipe exhaust damages catalytic converters. Refineries have to use costly methods to remove the sulfur from products such as gasoline and diesel, so the less sulfur in the crude to begin with, the better.

The Future

Global oil discoveries have declined steadily since the early 1960s despite periods of high prices and advances in exploration and production technology. The deficit has grown such that around

the world we are now consuming roughly three times the amount of oil we are discovering each year.

The current rate of daily oil supply (around 85 million barrels per day) is becoming increasingly difficult and more expensive to maintain. Between September 2005 ([see story](#)) and July 2008 the global oil market ran out of spare production capacity. With all the taps fully open, supply could not meet demand. Oil consumers were shocked by this rare event.

Oil prices rose to a peak of US\$147 per barrel in 2008, in order to slow down demand growth. The first annual fall in oil demand since the early 1980s began to take place ([see story](#)).

Many, including the OECD's International Energy Agency (IEA), forecast another supply "[crunch](#)" between late 2010 and 2012, depending on how quickly global demand recovers.

Looking forward a little further, the discovery deficit is now so large that the IEA estimates an equivalent of six additional Saudi Arabias need to be found and developed, requiring [cumulative investments of US\\$26 trillion](#), to meet expected 2030 global oil demand.

Just like Edwin Drake and his driller "Uncle Billy" on the morning of August 27, 1859, unless consumer behavior changes, the oil industry has a lot of work to do.



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