Coca-Cola and Petroleum Reservoirs

Have you ever opened a can of Coca-Cola that’s been shaken up? After spewing all over, it stops flowing within a few seconds, leaving behind messy floors and, often, drenched clothes. There is usually still some soda left in the can, and to retrieve it, you can stick a straw in and suck it out. Over time, oil and gas reservoirs, like exploding cans of soda, become depleted to levels at which the fizz in the soda, or the natural pressure in the reservoir, is insufficient to drive oil and gas to the surface. This process of recovering the remaining soda is effectively artificial lift.

When we suck on a straw, we’re actually reducing the pressure at the bottom of the straw, allowing soda to flow up. This reduces the pressure of the soda in the straw relative to the surrounding sugary goodness. As a result, there is now a pressure difference between the soda in your can and the straw; this difference forces more liquid into the straw, and up to your mouth. All methods of artificial lift function to reduce the pressure at the bottom of the straw, or wellbore, thereby increasing the pressure differential between the fluids in the reservoir and the wellbore. This mechanism allows more reservoir fluid to flow to the surface. Just like we would like more soda in our mouths, more oil and gas to the surface is also desirable. Without artificial lift systems, a lot of valuable petroleum fluids will be left behind.

*Figure 1 - Can of Coca-Cola (petroleum reservoir) (BsnSCB, 2015)*
According to an article by Rigzone in 2009, sucker-rod pumps are the most common form of artificial lift in the United States. The rhythmic back and forth motion of pumping jacks can be thought of as repeatedly shaking your can of Coca-Cola, increasing the pressure within, and subsequently opening the top. The stroking mechanism uses pressure to lift a volume of produced fluid from the reservoir to the surface. Gas lift is another form of artificial lift in which gas is injected at the bottom of our straw, or wellbore. This injected gas makes the petroleum fluids lighter, or less dense, allowing them to easily flow up the well and to the surface. Electric submersible pumps (ESPs) are yet another type of lift system which employ a different technique of reducing the pressure at the bottom of our straw. They operate very much like ceiling fans placed at the bottom of the wellbore, sucking fluids from the reservoir into the well, and finally forcing them to the surface. These fans, or pumps, can be made larger and more powerful by increasing the number of blades; this allows it to be adapted to different types of reservoirs.

As we’ve seen, reservoirs operate in a similar manner to cans of soda. After a can has been shaken up, it is initially at high pressure which allows the soda to flow out on its own accord. Over time however, the pressure decreases, and a straw must be inserted to retrieve the remaining soda. Methods of artificial lift employ different mechanisms to reduce the pressure at the bottom of the wellbore, effectively creating a larger pressure differential that drives fluids to the surface. Petroleum is integrated into many aspects of our daily lives, therefore getting more oil and gas to the surface is beneficial to us all. Artificial lift systems are necessary to efficiently extract valuable petroleum reserves that, like soda, will otherwise be left behind.
References
