The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Tech Talk - American Stripper Well Production

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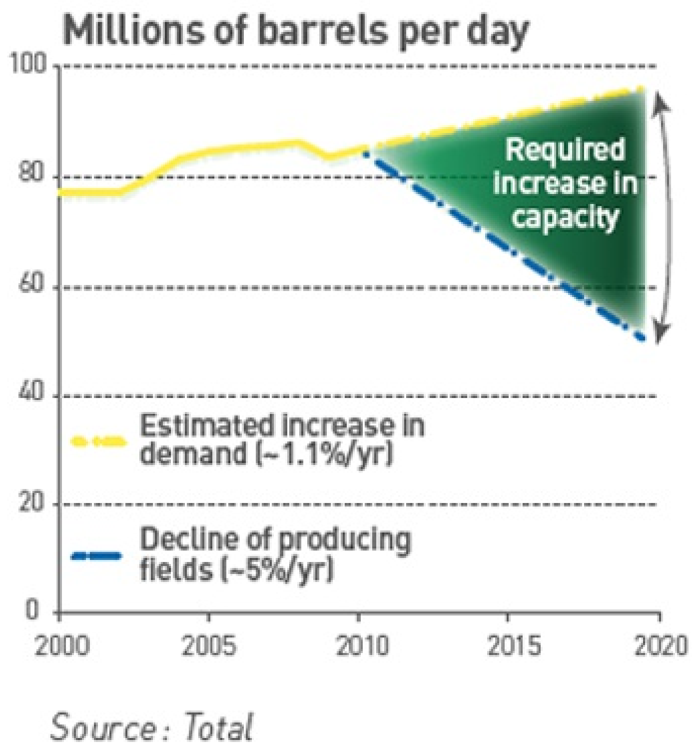
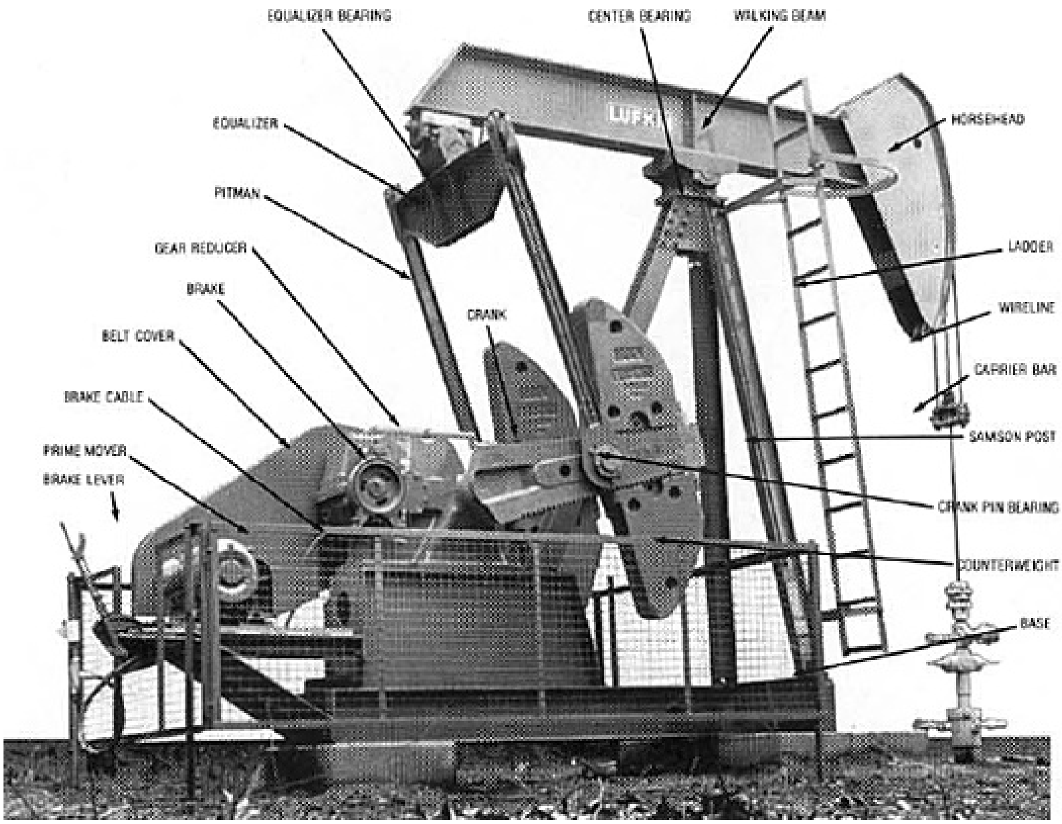
The Total (oil company) discussion on Enhanced Oil Recovery has an illustrative graph to explain why there is a growing need to get as much of the oil in a reservoir as can be economically recovered.



When the large flows of oil that I have written about previously stopped flowing from the major production fields in the on-shore United States, that did not mean that the wells from which they issued were immediately shut-in. Rather, in many cases, although the driving pressure to move the oil to the ground surface had largely disappeared, there was still a sufficient imbalance within the reservoir that oil would flow to the well. And so, before moving on to discuss other fields, I thought I would spend this space covering the pump jacks or "nodding donkeys" that dot the landscape over many of the older oilfields of the United States (and elsewhere).

These "stripper" wells that remove the final volumes of oil from a reservoir make up by far the largest number of wells, by category, that produce within the USA. The EIA reported that there were 363,459 producing oil wells in the USA in 2009. Of these, 35.1% produced 1 bbl/day (bd) or less, and 78.7% (a total of 286,109) produced less than 10 bd. For Texas alone, the EIA reports that there are 141,582 wells, and 79.4% of these produce less than 10 bd. (H/t Joules Burn).

So when oil production gets this low, and intermittent, how does the owner get the oil out? The short and simple answer is that the oil is pumped out. And if the well is running slowly, then the pump won't run all the time, but rather intermittently depending on how fast the pump fills. The original pumpjack design was put together in 1925 by Walter C. Trout, and provided the basic design for the units still dotting the American landscape.



Parts of a pumpjack (Lufkin catalog).

That basic design has largely remained the same, but the instrumentation and controls have grown more sophisticated over the years. A baseline estimate of the power requirement is that it needs around 0.2 kwh/bbl/1000 ft to lift the oil to the surface. (Which is quoted as being about a 66% efficiency). Deeper wells are reported to require from 0.27 to 0.81 kwh/bbl/1000 ft. And if the wells are 4,500 ft deep, that can create an electricity bill of up to $2,000. (H/t to Joulesburn for raising the topic). Part of the problem and loss in efficiency comes from the need to start and stop the pump because of the low flow of oil into the well.

The Web site dealing with Stripper wells (those defined as producing below 10 bd) notes:

> In the United States of America, one out of every six barrels of crude oil produced comes from a marginal oil well, and over 78% of the total number of U.S. oil wells are now classified as such. There are over 400,000 of these wells in the United States, and together they produce nearly 900 thousand barrels of oil per day, 15 percent of U.S. production.

The average stripper produces around 2.2 bd (ibid). (The 25-minute movie "Independent Oil: Rediscovering America's Forgotten Wells" can be obtained from Amazon, or by dropping a note to the Stripper Well Consortium.

Further, it points out the economic factors that inhibit re-starting these wells once they are abandoned.

> When marginal wells are abandoned, significant quantities of oil remain behind--sometimes as much as 1/2 to 2/3 of the total oil. In many instances, the remaining reserves are not easily accessible when oil prices subsequently rise again: when marginal fields are abandoned, the surface infrastructure - the pumps, piping, storage vessels, and other processing equipment - is removed and the lease forfeited. Since much of this equipment was probably installed over many years, replacing it over a short period should oil prices jump upward, is enormously cost prohibitive.

The site notes that between 1994 and 2003 some 142,000 wells were plugged and abandoned, losing the remaining oil that they might have produced. This oil is sufficiently important (since it makes up about 10 - 20% of the domestic oil production, depending on what is counted) that DOE has a program dealing with Stripper Well Revitalization (covered on CNN here) and funds the stripper well consortium that investigates ways of improving the technology.

Many of the advances have focused on improving the pumping systems used in these old wells, since the old conventional plunger systems are not that efficient, relative to the new units. The large number of wells means that even where these improvements are significant, it will take some period of time to get enough new units into the field to have a significant impact on overall production.

> The Gas Operated Automatic Lift (GOAL) PetroPump developed by Brandywine Energy & Development Company. The pump removes fluid from the wellbore more consistently than currently available plunger lift systems. Test results on wells in New York showed a 1.5 to 2.3-time increase in gas yield using the GOAL PetroPump over other casing plunger- type tools. The tool is inexpensive to operate because it requires no external energy source and limited manpower.

One area that they have just started work on involves the use of high-pressure jetting for drilling laterals, with the work being developed by Buckman Jet Drilling Inc. Since I jet drilled my first lateral of this type back some 30-odd years ago and have some considerable familiarity with both the promises of the technology, and some of the problems and other issues that have arisen, I suspect that I will be following this in a bit more detail than I usually allow. But that too will come in a future post; for the moment I will note that, after having watched the promotional video I do have some significant concerns that arose out of an earlier incident where a somewhat similar technology was claimed to be able to achieve considerable improvements in well production. In that case my concerns were expressed in Federal Court.

One other recent breakthrough that they have highlighted involves the conversion of the significant amounts of water than come from these stripper wells, but which is often brackish, and thus difficult to dispose of into water of potable quality (i.e. you can drink it). I n a slide presentation by Texas A&M, who developed the membrane technology used, the resulting water is compared with Evian, Perrier, and similar commercial products. Given the problems that Texas is currently facing with drought this could well solve two problems at one time. Further by lowering the cost of water disposal it, like other SWC developments, can encourage the economies of these small producers and sustain their production further into the future.

Each well may not contribute much, but in the aggregate even small changes can add up, when the totality of the wells affected runs into the hundreds of thousands. This improvement in the tail of well production, sadly, is only likely to be viable in the relatively small on-shore wells and close off-shore where the costs of maintaining the infrastructure above the well is minimal. Once those costs become significant it becomes more difficult to make the economics of the process work.

I'll talk about some of the other ideas for stimulating these wells in a post somewhat later in the series. But this, from Total, is one I have written about before.