The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

When CHOPS are not a dinner menu, but for heavy oil production

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When the weather in the mid-West gets hot and humid, as it does at this time of year, it is pleasant to have the chance to head up to Maine, (along I might note with two solid streams of traffic from Boston all the way North). Thus it was that I could get up, this morning, and pick fresh raspberries for breakfast from the bush outside the window. Raspberries are, like cherries, one of the transient crops that one savors each year when they are in season and then waits until they appear on the bush again next year.

In this way they are a food resource when they grow, but if we don't put additional work into their condition, they cannot be considered as a reserve for the longer haul. Unless that is, we are willing to make the time and money investment, by canning them, or making them into jam, they don't count much toward the family food reserve (and note that I have, in the past, helped make raspberry jam).

The difference between a reserve and a resource is a relatively important distinction that often gets overlooked in the debate about our energy future. Some sources of energy are fairly easy to describe and to understand. Place a wind turbine in an area with a recognized wind pattern, or a solar collector array in the American South-West, and we can run tabulated data through simple calculations to understand the value of the returning energy on the initial investment. It is however, the amount of heavy oil that can be justified as a reserve volume that drives today's post, and with very heavy oil we have to go the other way - in other words turn the consistency from something closer to jam back into something closer to juice.

As, we enter the second, declining part of the oil production curve, the definition of what counts as a reserve and what counts as a resource is going to become a lot more difficult. This is going to be particularly true as the size, nature and quality of remaining fields of oil and gas are considered.

Whereas on the front end of the production curve for oil and gas it was relatively easy and cost effective to produce oil, as we, over the next few decades, enter into the closing tail of oil and gas production, we will increasingly be faced by the economic return on investment, relative to the amount of oil/gas that we will be able to recover from a particular deposit.

As the best oil, the light and sweet crude, starts to become in shorter supply, we have to deal with heavier crudes, and as a Halliburton pdf points out, the problems that arise are not just because the oil is more difficult to transport. Industry has recognized this, and thus heavy oil has its own

Science Center, as well as an an information site provided by Schlumberger.

The process for extracting the oil has to recognize that increased viscosity makes it more difficult to produce oil from a formation, and also makes it less likely that high rates of return will be achieved. Water flood becomes a less successful technique for driving oil to the well, since the water can more easily bypass the oil, and some of the earlier rules for production have thus to be modified. In the process a technology known as CHOPS, the Cold Heavy Oil Production with Sand has been developed. The process is an alternative to the use of hydraulic fracturing of oilwells – which came in for some criticism in a recent post, but, as with the more conventional practice, the disposal of spent liquids from the oil production program has to be satisfactorily planned for in agreement with regulatory agencies, before the process starts (as, for example, Raindog and Sorensen explained).

The CHOPS process involves a modified procedure for the control of crushed rock or sand coming from the well. In most oil producing practices the completion zone of the well is designed to retain the rock that is crushed around the well (sand), or disturbed by the oil flow to the well. This makes it easier to process the oil once it reaches the surface.

However with the heavier oils there is a need to extend the flow paths out from the well. One way to do this is to allow the sand to erode out into the well and carried away with the oil, creating flow paths, or wormholes through the reservoir. These still need to be controlled, and, as Chris West of BP has noted:

> In CHOPS wells, high drawdown brings in sand. Most of this sand production comes from the creation of wormholes radiating out from the well; providing the horizontal component and increasing the productivity index (PI). . . . . CHOPS operations produce a lot of sand; up to 50% at the start of production, reducing rapidly as a percentage over time. Early total production is very low; perhaps just 20 bbl of oil equivalent (per day) as the wormholes start to form. As wormholes develop, production rises while the proportion of produced sand reduces, typically to 1–2% after about 6 months. At Lloydminster, maximum oil production levels are usually reached within 6 –12 months. Sand production requires special surface facilities, which BP is currently constructing. . . . . Recovery factor (RF) is, as yet, unknown, but is expected to be in the range of 8–10% as is typical of CHOPS wells in Canada. BP is working to enhance recovery from the Ugnu pilot wells through a better understanding of the production process, imaging of the wormhole network and improved operating practices. . . . . Once wormholes extend into water, they often stop producing oil. Using geosteering to optimally position horizontal wells should improve oil recovery close to the OWCs.

He also points out, in regard to spent fluid disposal

> he company already operates the world's largest “grind and inject” facility, located 35 miles away from the new pilot site in Prudhoe Bay. Here, produced sand and solids are injected into a highly porous non-hydrocarbon bearing semi-brackish aquifer, a solution that meets with government agency approval.

CHOPS is also used in extraction of the very heavy crudes in the Faja region of Venezuela, as an earlier Rigzone article described. In that 2006 article it noted that the Orinoco production included:

> Using CHOPS alone, Venezuela now produces about 625,000 barrels a day from the Faja, and the economics are good. The lifting costs of heavy oil production have dropped 70 percent since 1991, to just under one dollar per barrel today. The average well produces about 850 barrels a day on cold production, which is remarkable considering that at room temperature, the oil is as thick as peanut butter.

While economical, cold production alone recovers less than 10 percent of the oil in place. The government of Venezuela has now set recovery targets of more than 20 percent for all new heavy oil projects, which means that producers will be moving quickly to deploy current and emerging technology in a region rich in extra heavy oil.

The low rates of production and of recovery factor mean that this process has considerable potential for improvement and given the size of the heavy oil reserves around the world.(Venezuela alone is considered to have perhaps a trillion barrels of such oil) But while there are some techniques, such as thermal stimulation using Steam Assisted Gravity Drainage (SAGD) for example, that can improve recovery considerably these have limitations relating to oil depth and condition.

I have suggested, in the past, that one might consider a form of remote mining of some of this oil, since it is a way that the Canadians have shown can recover virtually all the oil, even from the extremely heavy oils of the Canadian Oil Sands.

It may be that neither of these methods is realistically practical as a future means of significantly enhancing the production and recovery factors for heavy oils, but given the volumes that are there, the poor recovery rates and production rates of existing wells, it would certainly seem an area where larger investment in research might return a satisfactory return.