The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Cleaning up after elephants*, or more on EOR

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So you're feeling cheap and don't feel like going to the sandwich shop, huh? So lets see what's in the refrigerator. An apple, some cheese, some butter â€“ that will do. So you put them on the table andâ€¦. darn, you got a blob of butter on the apple. Rather than have it roll all over the table making a mess, you stick it under the tap.

With the water running on cold it seems to take forever to wash the butter off the apple, but if you turn the tap to hot, the butter runs off very quickly. The same sort of thing happens when you apply hot water or steam to the oil left on the sand grains of a rock after the primary and secondary recovery of the oil is over. The oil is a lot thicker than butter and you generally have to heat the water a bit hotter (it works best above 185deg F) but you can still clean the oil from the rock that way. There is, however, a bit of a snag. (And from this point on DO NOT TRY THIS AT HOME).

Think of it as little Johnnie (helped of course by Jessica) having raided the orchard and spread butter onto all the apples, gluing them together and filling the kitchen full, right to the ceiling. How do we clean the butter off and get it back without taking all the apples out and cleaning them one by one (which is sort of what they do with the oil sand up in Canada).

We could just stand in the hall and stick heaters up against the wall of apples, hoping that the heat would melt the butter and work its way back to the ones further into the kitchen. That sort of works, but burns the local apples and doesn't reach all that far. (They have tried setting fires inside oil wells). You could fill the kitchen with hot water, but while that washes out some of the butter, a lot of the heat goes into the apples and the water is cold before it reaches the back of the room. And the water doesn't have that much pressure to push the remaining butter off the apples. (In oil wells this is the secondary recovery that might get us back another 10 â€“ 20% of the oil, except that they use cold water and some rocks have clays that swell when wet and this stops the oil from flowing).

What we need is something that will get through the gaps between the apples and keep its heat. So how about steam? So you go and get a steam cleaner (such as you use for carpet cleaning) and blow the steam into the apples. That works but as the butter starts to flow out it clogs the gaps and starts to re-harden except when the steam is right there. So you start to run the steam for a bit, stop and collect the butter that comes out, run the steam for a bit, etc. You can do this in an oil well and it has the exciting technical name of "Huff and Puff" (would I kid you?). (ask Your Government). To make the steam more effective it is heated to between 150 and 300 deg C. Where the rock is very permeable and the steam can, in time, work its way back through the particles (apples) this can recover a lot of our butter. But you still lose a lot of heat, which is expensive to generate, just in heating the apples.

What if we could use something else that does chemically what we have done with the heat? How about a soap? Yes that might work, the only thing is that soaps cost a lot of money and there

really isn't that much butter, so unless we can get our soap back we really can't afford it. And what we have to do is to put in the soap, wait for it to work, and then push some water through to move the water:soap:butter to a place that we can collect and separate them.

Hmmm, but what if we had a chemical that could mix with the butter, and make it melt, so that it ran off without heat? That might be a lot simpler. Well it turns out that carbon dioxide, that gas we all love to hate, does exactly that.

(But now we have to talk just about oil). When carbon dioxide mixes with oil the resulting liquid has a larger volume, which means that it is thinner. (You could think of this as being the same sort of change as when you add a teaspoon of hot water to honey). The thinner oil is also less sticky and so it comes away from the rock more easily. So the thick sticky oil left in the rock becomes thinner, and will flows more easily. And tests, at the UT Austin (see yesterday), show that CO_2 will move right through a rock of the right sort, reaching all the oil that might be there, and coughing up a lot more of it.

We can do the same sort of Huff and Puff approach that is used for steam injection, except using liquid CO_2 and, in the right rocks we can get much more of the oil out. Or we can drill one well and pump in the carbon dioxide, and collect the oil and gas from the next well over. But there is an additional advantage. When we get through with pumping out the oil, we just pump all the carbon dioxide back into the rock and it stays there. So not only have we got the oil out, we have replaced it with the gas that is causing global warming, and once put into the rock it will stay there, in just the same way as the oil did. And what the experiments in China showed are that we can use the gases from power stations, without separating the components out, which would otherwise be a lot more expensive. What is also interesting is that the Chinese gases did not appear to have been liquefied, and that there might have been some production gain (up to perhaps 40% of the oil recovered) by combining the flue gas with steam.

Which leaves us with that apple, and the butter. Why don't you spread the butter on two slices of bread, slice the apple on top of one of them. Sprinkle blue cheese crumbs on the top of the apple, put the second slice of bread on top and have lunch â€“ you deserve it, and (like me) you don't have to go the sandwich shop today.

(Technophiles can read a less dramatic version of the above here.).
* From a play here.
Technorati Tags: peak oil, oil
