Of Technology and the Future

Posted by Heading Out on April 24, 2007 - 11:32am
Topic: Supply/Production
Tags: american petroleum institute, tar sands, technology [list all tags]

I was planning on writing a little more on technology, or rather the lack of development thereof, but thought I would begin by commenting on the Tar Sands issue a little more. I noted that in Robert's post on the API call where he began the discussion with the note about the rivers around Fort McMurray turning brown due to the tar sands residue. Well one of the wonders of today's technology is that you can check.

I had posted about this before, but this time thought to use modern technology. If you go to Google Earth and type in "Fort McMurray" it will give you an overview of the town in Alberta, and the mines can be found just to the North of it. Please note that the river running through the town, from the mines, is blue. Now I don't think that Google spends their time painting in rivers – so I guess it really is (Well it is really clear, but you get my point). As I noted at the time the brown color occurs as the water from the sand/bitumen separator carries the sand to the tailings pond. Because the clean sand is brown when wet the water looks brown, until the sand settles out in the pond. You can see that the sand then dries to a whiter color, and the contained water in the main body of the pond is also blue. (It was also blue when I saw it on my visit). Once the hole dug to remove the oil sand has been filled in, then the cover will be replaced and it will return to normal, except that the rivers and streams won't have a tarry bottom any longer.

As I saw, when going out to dinner last Saturday night, we are now entering High School Prom Season as this year's graduates prepare to move on to jobs and college. It is this generation that will see the unfolding energy crisis in all its facets. While in college they will likely see Peak Oil; while working Peak Natural Gas, and, before they retire, Peak Coal. Which means that between those about to retire and these kids lies the brain power that is going to have to solve the reality of finding alternate sources of fuel at World-scale volumes.

Oh, and before I get into the discussion of the technology we need, let me also note that you can waste far too much time wandering around KSA with Google Earth looking at the wells around Shaybah, and what an active site appears to be, and then going over to Ain Dar and looking at the sand covering the roads and parking lots. (Purely anecdotal - I know.)

There are two issues that, I believe, API does not really address in their response that technology will come to the rescue of a world that is going to be running out of fossil fuel. The first part is the personnel and knowledge base issue. In Episode 3 of Connections 1, James Burke noted that a generation after Henry V won the battle of Agincourt with Welsh longbows there was a drastic shortage of archers, because they had all found other things to do. (The same thing was to happen a few hundred years later in Scotland when the recruiters for the British Army went up to fill the

Highland Regiments and found the population largely diminished). And the same thing has happened in fossil energy.

It is an increasing concern to industry, now having to pay $80,000 for starting salaries to fresh graduates, with starting bonuses. It is a concern to the Universities, since their faculty are continuing to retire and are difficult to replace with qualified folk. And it came about because, for the past 20-odd years there was no demand for such engineers. A large number of those who graduated in the 70's and early 80's were laid-off and found careers elsewhere, and those that remained are now nearing the end of their time, with a large gap in the middle. It takes time after graduation to really learn the ropes of an industry, and more particularly to learn those things that need to be done differently to improve performance, and to have the clout to make that happen. The comment about Robert Service's poem The Man who Knew is more real than many may admit. And most of those who will graduate will be needed to meet the increasingly technical complexities of winning higher production rates from current but increasingly lean resources, rather than looking at the over-riding alternative approach that can give more than incremental change.

So where is technology needed? There are, of course, many avenues that can be followed, but it seems that, in the main, the problem can be divided into three parts. Given that liquid fossil fuels for transportation are likely to be the first to feel the pinch, and with an infrastructure in place, the initial effort should, most profitably, be directed at increasing production from existing reserves. By this I mean such things as developing fluids that will displace more of the oil from a reservoir than the current amount. One way to do this that has been discussed is the use of liquid carbon dioxide as a means of enhancing oil recovery. There are, however a variety of ways that can be used. And, were there motivation, there might well be additional ways that await development. However it should also be remembered that not all oil recovery methods work in the different rock conditions found in different reservoirs. These are techniques that can have very large rewards, but where the need is more immediate. As an illustration, consider that with mining of the oil sands all the oil is recovered, but when conventional or enhanced recovery techniques are used to extract it from wells only perhaps half of it is recovered. Perhaps this might lead to techniques where the oil-bearing rock is mined underground, stripped of value, and returned. This is, after all, how many metals are mined from large underground deposits. The likely economics of this are, however, driven by a preliminary need to do this remotely, since one of the higher energy costs in mining comes from providing for the safety and health of miners (things like providing clean air to breathe).

In the intermediate term we will still, to a large extend be burdened with existing technology as far as the need for liquid fuel is concerned, and this is where alternate sources of fuel are now getting all the attention. However there are, apart from the technical issues, also problems in relying on fuels that can be grown if they are vulnerable to the droughts and storms that are part of a normal farmer's life. From this point of view, if no other, the renewable fuels that are developed to act as the bridge into the future will have to be diverse. Thus there will need to be some form of conversion of resources such as coal to provide the backup to the vulnerability of plant production. Bear in mind that the initial need is for a fuel that will power today's fleet, and in this regard there may be some significant benefit from a more intense study of algae. However sustained large-scale algae growing may have some considerable challenges that may not become evident until it is first tried (which I don't think it has been yet).

And these two together should give us enough breathing time to start developing the transportation system of the future and the power sources that they will require, in the volumes needed. It is, in this context, important to remember that, as a history prof once commented, it

was the automobile and the highway system that really opened up the country and provided opportunity for the majority of the inhabitants. This occurred after the arrival of the railway and thus, while increased use of rail is a logical progression, it will not, in itself, be adequate and thus some form of personal vehicle will still be required. Thus some form of energy storage, whether liquid, battery or other will need to be developed, but bear in mind that there is a "cart and the horse" situation here and until such systems are defined and developed that there will be decades over which the change will have to take place. My own thought is that electric cars are likely to be a significant player - solar-powered cars have raced across various parts of the world at speeds above the legal limit (shhhh!), designed by undergraduate students, and the potential evolution of this into vehicles for use more mundane mortals is liely one of time (if the program continues to get support). For larger vehicles perhaps hydrogen may provide the fuel, particularly if more effective ways of producing it (say from the weak beer produced by cellulosic ethanol) prove to be effective.

Will it get done in the time before this years High School Graduates retire? For their sake I hope so, but there needs to be a sense of urgency and understanding of the size of the problem that sadly remains lacking. Further with the decline in interest in science and engineering shown by these self-same students, it may be that there won't be the critical mass of investigation needed for the breakthroughs that must come.