Mining Canadian Oil Sands into the future

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Well, let's see I have put on the helmet, the breast plate, the greaves and all that stuff, and so perhaps I might be armored enough to tip-toe into the debate about oil sands and oil shale. Tonight will be oil sand, if I survive and recover, then (after reading a few more scientific papers) I will tackle oil shale.

Just recently there has been increasing attention paid to the heavy oil sands of Alberta. Perhaps, as in the case of the Washington Post more negative than positive. And it is interesting to note, from the tone of those pieces, that it is now apparently more desirable to have your rivers flow over and through tarry sand, than to have the sand cleaned and replaced, along with the river. But it is not that argument that I would follow, but rather, OGJ having come out with a Supplement on Canadian Oil and Gas, to briefly comment on one or two of the features of that report. (Which apparently will take a while before it appears in the electronic version of the magazine).

The article lists some 69 projects that are currently ongoing or planned to expand the production of oil from the region in the next ten years. The table gives both current and projected production within that time frame, with four of these currently producing large amounts of oil. Suncor currently produces 269,000 bd; Syncrude, which has just upgraded to 350,000 bd; the Athabasca Oil Sands Project(AOSP) currently produces 155,000 bd, and Cold Lake produces some 150,000 bd. This adds to 924,000 bd, and there are sufficient small producers now to bring the total to over 1 mbd. It also notes that the Conference Board of Canada have projected that the costs of the planned expansions will be around $100 billion over the period, with production estimated, by the Canadian Association of Petroleum Producers to reach 2.7 mbd in the time frame.

The mining of the sand is often spoken of as though it is the only way in which the oil is recovered when, over the long run, it will be of much lower significance. This is because only 20% of the sand is shallow enough to enable current mining to be considered economic, while the rest of the oil will be recovered by more conventional petroleum extraction techniques. Thus of the projects for oil recovery 40 deal with this in-situ recovery (because it removes the oil from the sand in place). The sand can contain up to 20% of bitumen, with a barrel of oil requiring about 1.16 barrels of bitumen. (The bitumen is sufficiently robust that the article points to streets in Edmonton having been paved with it in 1915, and having lasted 50 years).

After the sand is mined, then the bitumen can be removed by being mixed with hot water and air which creates a froth. (There is already some 4% water around the sand, separating it from the oil and making this separation easier). The froth is fed into a Primary Separation Vessel (you can see pictures of some of these parts at the Syncrude and Suncor websites). The cleaned sand drops to the bottom of the vessel, while the oil is fed into the refining part of the plant, where the product is upgraded, and the coke and sulfur removed from the oil. The water is drawn off, and re-used. The sand is put into the parts of the mine where mining is complete, refilling the land so that it can be returned to its earlier condition (and they have photos of those lands also at these sites).

Because the bitumen is not evenly distributed throughout the layer, and there are also other layers of rock, and barren sectors within the deposit, it is not energy or cost efficient to mine all the rock and process it. Thus the mining technology has evolved from single unit large bucket wheel excavators to the current situation where the sand is mined by large shovels and loaded into trucks, which carry it to the pipelines and thence to the Separation Vessel. One advantage of the change in method is that the mine is no longer dependant on a single machine, but rather with a number of shovels all producing at the same time, if one goes down then production is no longer as seriously effected.

The process does, however, require considerable manpower, Suncor has more than 5,000 employees, and Syncrude some 4,000 (with 1,500 contract laborers also employed). And here is one of the problems that they will face. It is hard to find a place to live up at Fort McMurray and the need for workers is anticipated to reach 60,000 by 2020. Since the industrial growth also involves infrastructure, material and labor costs will likely increase significantly as this growth continues across the entire province. This is one of these places where a high-speed rail line, from Edmonton up to Ft McMurray might be the most logical solution, albeit one that could not be put in place for some time.

It is not only access for people and mining machines that are required, as the oil flow increases, but they will also need additional pipelines to carry the oil to the customer. One of those planned is for a pipe that will run 720-miles to the coast, carrying 400,000 bd for export to Asia and California.

However, as I noted above, surface mining is not, in the long-term, going to be where most of the oil is produced. Most of the sand is too far below the surface, and oil is already being produced by one of two methods. Because the bitumen is very thick and does not flow very easily towards the well it has to be both softened and made to flow more easily. The simplest way to achieve this is to heat the bitumen. And the best candidate to do the heating is steam. (Hot water requires too much power). There are two ways in which this can be used.

The more conventional way is based on something called Huff and Puff where the steam is injected, allowed to heat the oil, which can then flow to the well, and after a period the oil is pumped out of the well.

The alternative, and relatively new and more promising technology is called Steam Assisted Gravity Drainage, or SAGD. This requires that two horizontal wells are driven, one above the other. When steam is pumped into the upper well it heats the surrounding sand, and the bitumen softens and drains into the lower well, so that it can be recovered. At present the technique is simple but could be improved. But it is this process, increasingly planned for the future, that uses the greater amounts of water, and the natural gas that is required to convert it to steam.

Which is, I think, a good place to turn the debate over to Dave, who will shortly be posting more specifically on these issues, I will leave discussion of the THAI process (which involves burning part of the seam) to the post that I plan in the near future on oil shale. And the use of other injected gases to reduce oil viscosity is still sufficiently far away that I will leave that to a subsequent post also.

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