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EDITOR'S PAGE

OIL SHALE TECHNOLOGY CHALLENGE

Despite 40 years of continuous operations, the Canadian Oil Sands industry is providing less than 3% of the worlds' need for liquid fuels. With a proven technology, the industry is limited by the cost of the developments and location. The industry has, however, achieved a marriage between mining and conventional oil, which is also key for surface based oil shale processing. How then might the expectant oil shale industry develop in time, given the state of technology and the general lack of accumulation of operating knowledge in the field, after so many false starts.

My experience with the Stuart Project in Gladstone in Australia from 1989 to 2004 in a range of positions from Process Engineer, Operations Manager to Development General Manager, provided an overview of the highs and lows of to be experienced by members of the industry. While many people may feel the project was a failure, a core of dedicated people have vivid memories of the lessons learned during the period in which over 1.5 million barrels of oil were produced and over 700,000 barrels of full range naphtha hydrotreated to less than 1 ppm nitrogen and sulphur. There is little written reference in the public domain to the lessons learned from the project and so the knowledge is in danger of being lost.

In talking with people who have been immersed in commissioning and operations of an oil shale plant there soon develops a certain camaraderie as they inevitably, independent of a common spoken language, understand the issues faced by the other party through their own hard won even bitter experience. Few if any specific oil shale industry problems are realised by the designers unless they have first-hand experience. Projects then suffer by requiring more attention in the early production stages to define and solve problems to achieve profitable operations. This oft repeated cycle of new technology development can be reduced by having a common body of knowledge which is freely available. As we see from the oil sands industry there is room for many players, and sharing can be for mutual benefit.

However the main dilemma facing the industry involves the lack of commercially proven technology. There are few if any technologies which have been commercially proven to current-day standards of performance in capacity, safety, economically or environmentally. A quick review of the oil shale industry shows that there has been little recent technology development (since the 1980s) at or past the pilot stage. Potential technologies abound, but getting to pilot is a major hurdle given time and cost pressures. Part of the problem, I suggest is that there is so little data and experience available to new players.

With renewed interest in oil shale, the larger conventional oil players have aligned with the different semi-developed technologies including some currently operating. The resultant unions will be required to make clear improvements for suitable technologies to emerge to be applied to different deposits.

Predicting the performance of an infant technology from little operating experience on a particular shale deposit feed is risky. Without proper background research, process understanding and operating experience, scale up attempts in a new industry are faced with many demands, which may only become apparent after the plant has been built and is undergoing commissioning. Currently operating processes generally have been developed over a long period around one deposit (Estonia, China, Brazil), which has little variability; this cuts down the potential for surprises and lowers risk of failure between different developments. The transfer of a technology to another deposit will require a substantial amount of innovation.

Initially for each prospective project, matching the technology with the shale deposit is important. The mining side has its own complexities and the need to produce a consistent feed grade with properties equivalent of that tested in a pilot plant is not insignificant. Once we understand the deposit a little better (it may however take years of mining to really understand it fully), we soon discover that no processing technologies are directly transferrable to all shale types. The differences between deposits can impact the processability of shale in the same technology, differences in the feed from within one mine will also process differently.

One key choice for above ground processing, the decision of fines versus lump retorting should be taken early with the knowledge that fines processes tend to be much more complex than lump retorting. Each group attempting a new project will then have to adapt the technology of choice to the new deposit, ideally by operating a pilot plant or larger for a substantial period of time, months not days. It can take years and many millions of dollars for companies to reach this understanding. A technology, which is robust to feed variations from a single deposit and readily transferrable to other deposits, is the holy grail of oil shale processing.

Hands on technology development is an interesting vocation. Taking an idea through any of the stages from paper to laboratory, pilot, demonstration and commercial scales involve a huge range of skills, not likely found in one organisation. Not many companies or people are used to the difficulties faced in management, design development and commissioning of a first of a kind plant or technology, and the skills necessary to effect prompt solutions are hard won. Entering each stage of technology development is a risky business with problems relating to the quality and consistency of the feed ore, scale up, product acceptance, reliable operation to name a few elements. It is probably fair to say most groups enter this situation without a full appreciation of the enormity of the problem. For oil shale, it seems as though there is never enough big money and skills available to develop a process which may take years to produce revenue.

As with all major projects, it helps to define success as one enters a project stage. Changing the project goals mid stream or during commissioning will make the job of satisfying goals much more difficult. For example a demonstration plant is unlikely to be a money winner, that is if the design objective is to demonstrate the technology in preparation for the next level of scale up.

Skipping logical stages or scaling up too far in any one stage will lead to higher risks of low production or high costs of maintenance or repairs. A real concern for the industry is the cost and time to achieve the outcomes from the plant and successfully juggling the challenges of retaining director and board support, project managing, matching skills and money for a project development stage is therefore quite an achievement, the thrill is even better if the technology works. From the past, we have also seen oil shale dropped when there are cheaper alternatives around.

The history is littered with such valiant attempts to master a first-of-a-kind process scale up, including Union Oil Company of California (Unocal), Southern Pacific Petroleum NL (SPP) in oil shale. While the actual failure may be directly attributable to a bad decision or judgement, there are many specific and valuable lessons still to be learned across the many faces of a project, and there is little evidence that these lessons are being shared or heeded in our industry. It is important for these stories to be told to instil an understanding of the required levels of due diligence necessary at the early stages of a project and continuing through out to reduce the potential for problems which may swamp your project. Needless to say, it is cheaper to make changes in the design phase rather than to make changes to a plant to make it operate, but how to convince project backers of this simple assessment?

A risk-based approach applied to each step of technology development with inputs from experienced personnel through risk analyses and on going third party progress audits, are ways of alerting management to the more obvious pitfalls. Thereafter, it certainly helps to have deep pockets and many resources at your disposal dependent on your technology choice.

The ongoing challenge for the industry is how to collect, collate and distribute the available resource, design and operational information produced from past projects and have that information applied to the progressive development of a world-class industry.

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