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BACKGROUND MATERIAL RELATED TO OIL PRODUCTION
FROM TAR SAND
BY GREAT CANADIAN OIL SAND

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MAY 1978

A background paper for the Energy Policy Sector related to the production of suitable paragraphs in a Cabinet document dealing with the current expansion program of GCOS.

ENERGY RESEARCH PROGRAM
ENERGY RESEARCH LABORATORIES
REPORT ERP/ERL 78-48 (TR)



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Historical Background

During the planning and approval stages for the construction of Canada's first plant to extract oil from the bituminous sand of Alberta, the Great Canadian Oil Sands Company was obliged to limit the size of the plant to 45,000 barrels per day (B/D) due to the objections of the conventional oil producers who felt that they might be subjected to increased levels of prorating if the tar sand plant were permitted too large a share of the market. It was recognized that the large capital investment in a tar sand plant would require that such a plant be operated continuously at full capacity and that prorating of this type of plant was not possible. In retrospect, the profitability of the Great Canadian Oil Sand operation has been impaired by this requirement ever since its construction in 1967. However it did serve the purpose of demonstrating to Syncrude of Canada Limited the importance of increasing the scale of the operations to 125,000 B/D.

As a pioneer in developing this new operation, Great Canadian Oil Sands Ltd. had to combine three new major operations:

- (1) A mining operation capable of handling 200,000 tons per day of oil sand plus overburden.
- (2) An extraction process to remove the oil from the sand.

- (3) An up-grading facility to process the heavy oil which contains mineral matter water, combined metals and 5.0% of sulphur.

These operations were successfully combined and have provided a model for future plants.

The GCOS plant was designed and built during the period of "cheap oil" from 1964 to 1967 when one of the prime considerations was to keep down the capital cost. This factor dictated the selection of delayed coking as one of the key components in the up-grading process. In this process the crude oil from the tar sands is heated to a high temperature (over 480°C) and allowed to coke in large coking vessels which produce approximately 70 weight percent of coker distillate and 30 percent of coke ^{and gases.} This amounts to a production of 2700 tons per day of coke of which 2000 tons are burned to produce power for the mining operation and 700 tons per day are thrown out on the waste bank. Newer fluid coking technology will improve the yield of distillate to 74% which is close to the limit of coking technology.

Great Canadian Oil Sands is now considering for inclusion in their proposed expansion the application of more modern commercial hydrocracking technology as developed by Hydrocarbon Research Incorporated in Trenton N.J. and as applied in Kuwait. Such a process would convert 80 percent of the crude oil to liquid products.

Advantages of Hydrocracking Technology

Energy Mines and Resources favours the introduction of this new technology for the following reasons:

1. In the expanded program, it eliminates the production of 1000 tons/day of waste coke which pose an environmental problem in that oxidizing ground waters tend to leach out the heavy metals, vanadium and nickel.
2. It would demonstrate the desirability of this technology to process Canada's heavy oils, and tar sand oils produced by in situ methods to secure higher liquid yields.
3. It would demonstrate the desirability of the greater flexibility of this system to use other fuels such as natural gas and coal to achieve higher liquid yields.
4. It offers an opportunity to determine to what extent environmental emissions can be brought under better control by this technology.
5. It offers an opportunity for the development of EMR hydrocracking technology which accomplishes the same objectives at reduced catalyst cost.
6. The success of the hydrocracking technology will encourage future builders of tar sand plants and in situ tar sand oil producers, to adopt this technology.

Technical and Financial Risk

The introduction of hydrocracking technology to this particular Canadian situation is considered by GCOS to introduce technical and financial risk in spite of the fact that the process has been used in Kuwait for 10 years, due to the higher levels of vanadium and nickel that are encountered in Athabasca

bitumen than in Kuwait crude oils. It is also appreciated by GCOS that "down time" for whatever reason, could seriously jeopardize the profitability of the expansion so that an experimental program has been initiated at Hydrocarbon Research Inc. in Trenton to reduce some of the technical uncertainties and enable the management to assess the financial risk.

From the point of view of Energy Mines and Resources if these experimental trials in Trenton are successful it is important to Canada to know if there is a viable commercial option to the coking route since this would effectively increase Canada's reserves of oil from the heavy oils and tar sands by 10 percent.

The Future of Hydrocracking Technology for Liquid Fuel Production from Oil and Coal

Energy Mines and Resources has demonstrated in its pilot plant operations that there is a synergism involved in processing small amounts of certain types of coal with tar sand crude oils in the hydrocracking operation. This greatly reduces the catalyst costs and improves the operability of the hydrocracking process through better control of the coke precursors. It is felt that this technology will provide an interesting option to expand Canada's liquid fuel resources through the simultaneous processing of coal and heavy oils when the time comes.

The United States government is currently funding the

construction of a 600 T/D coal hydrogeneration facility at Catletsburg, Ky. to make liquid fuel by the catalytic hydrocracking of coal using the H-coal process of Hydrocarbon Research Inc. This process is very similar to the H-Oil process currently being tested on Athabasca bitumen. It is important for Canada to know what options this type of processing may hold for processing Canada's low grade crude oils and coals. The introduction into Canada of a commercial hydrocracking unit at GCOS would therefore be regarded as a very important first step in the introduction of the improved technology for the future.