



The Catalyst Group Resources

(a member of The Catalyst Group)

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As many are aware, there is growing interest in oil recovery from unconventional resources, such as heavy oils, tar sands bitumen and shale oil, in part due to recent increases in the price of crude oil. However, compared to conventional oils, these resources must undergo additional processing to increase their value (upgrading). Two (2) major aspects of this economic opportunity are technology advances that improve processing efficiencies and the correct commercial strategy. Proper balance between technical approaches, logistics, investments and market leverage is essential. Highlighted in this announcement are a recently issued technical report and a pending study that will clearly define the strategic options available in the Heavy Oil market segment.

Members of The Catalyst Group Resources' (TCGR's) **Catalytic Advances Program (CAP)** recently received a detailed and comprehensive technical report which covers the opportunities and challenges in the upgrading of heavy oils, bitumen, shale oil and residua, and covers the technology available for converting heavy feeds into transportation fuels and petrochemicals. Entitled, "*Catalysis for the Upgrading of Heavy Oil,*" some of the noteworthy findings in this analysis include:

- ? In situ recovery methods, such as in situ combustion or in situ conversion using steam and hydrogen, are promising technologies for oil recovery from heavy oil or bitumen deposits as they have the potential advantage of leaving unwanted coke-forming precursors in the ground, and a partially upgraded product can be recovered at the well-head. It may also be possible to carry out catalytic upgrading using catalysts packed into annulars in the well.
- ? In bitumen and resid upgrading, coking will continue in the foreseeable future but coking processes may have only a minor role in new upgrading facilities. Short residence time cracking processes are an economically attractive alternative to coking, as they produce more valuable liquid and gaseous products than coking and use more compact plants.
- ? The Deep Catalytic Cracking (DCC) process developed by Sinopec to convert naphtha and gas oils to light olefins has recently been modified to crack residual oil feeds at higher temperatures. The new process, called

Catalytic Pyrolysis Process (CPP), will be commercialized in China, in a collaboration between the Shaw group and Shenyang Chemical and marketed by Stone and Webster as a complement to DCC.

- ? Increasingly rigorous environmental regulations will drive the development of more efficient hydrotreating catalysts to produce ultralow sulfur heavy oils. The use of hydrotreating for the pretreatment of FCC feedstocks will also increase, which will promote efforts to improve hydrogen management in refineries.

Now, in a companion report which supplements this highly technical study, a Strategic Assessment of Commercial Progress in heavy oil is underway. TCGR's study "**A Strategic Assessment of the Commercial and Technical Progress in International Oil Sands and Heavy Oil Upgrading**" will move beyond publicly available documentation to show how international oil companies (IOCs), national oil companies (NOCs), refining and petrochemical companies, as well as energy investors (both established and venture capitalists) can manage the technological and financial uncertainties associated with this market segment. In addition, an assessment of the climate for foreign investment, along with the role (if any) for government incentives, are factors that need consideration.

Critical issues to be addressed include:

- ? Natural gas availability for hydrogen production via Steam Methane Reforming (SMR) will become limiting to heavy oil upgrading. This will increase the supply/demand price for natural gas; prices of \$2-3 MIL BTU are tolerable but at \$6-7 MIL BTU, they are not. What alternative sources of hydrogen exist (e.g., gasification) and to what degree are they being pursued? To what degree is this a factor in various global regions?
- ? A new slate of technologies will be needed to change methods of oil sands/bitumen production and upgrading, to reduce future costs. Depending on who adopts which direction(s) first, there are numerous paths that need to be considered and a number of options which need to be reviewed. What R&D and piloting initiatives are required to achieve the projected production goals over the next 10+ years of less than \$US 30 BOE equivalent?
- ? An overriding issue faced by all international oil companies and investors is the processing logistics and associated asset management decisions. Where should the upgrading be done and how should geographical "integration" of the various processes be handled? These decisions impact the economics directly and will be influenced by a number of "interested parties," not only the IOCs and the NOCs but the governmental and regulatory concerns as well.
- ? In Alberta, there are clearly major labor, technical capacity and infrastructure challenges to the Province's ability to support development there. How will

Alberta, and Canada, respond to this challenge to work with international oil companies (as this will be critical for the path and pace of development)?

As a strategic analysis, this supplemental report will consolidate the critical changes in technology, the competitive landscape (participants, activities), external factors and business/financial considerations required for successful participation in the areas of heavy oil, oil sands development and upgrading to products.

Attached is an updated study proposal and proposed Tables of Contents for the report.

Sign up now as a “charter member” in order to have your individual interests and issues included as part of the study scope, and to take advantage of a substantial pre-publication discount price.

The study is available in printed format as well as electronically (as a PDF file), allowing unlimited use/distribution of the report on a site-license basis. For more information, see our website at <http://www.catalystgrp.com> or contact Jeanne Drahos (jmd@catalystgrp.com) or John J. Murphy (jjm@catalystgrp.com) at 215-628-4447.

The Catalyst Group Resources (TCGR), a member of The Catalyst Group, is dedicated to monitoring and analyzing technical and commercial developments in catalysis as they apply to the global refining, petrochemical, fine/specialty chemical, pharmaceutical, polymer/elastomer and environmental industries. The Catalyst Group Resources' assessment is based on information obtained from the public domain as well as internal sources and industry interviews. TCGR's analysis will report factual information, as well as hypotheses/interpretations based on this information, in order to derive a reasonable set of expectations. Factors could cause actual results to differ from our forward-looking statements and The Catalyst Group Resources.