



# **A Comprehensive Assessment of Toe-to-Heel Air Injection (THAI<sup>TM</sup>) Process**

## **Guidelines for Development of Future Generations of In-Situ Combustion Processes**

*What is the current status of Toe-to-Heel Air Injection (THAI<sup>TM</sup>) process development 20 years after its patenting, more than 14 years of laboratory investigations and 11 years of field testing?*

This question can be legitimately asked. This report, by a specialized team, including the inventors of the process, attempts to provide a comprehensive and informed response. The authors of the Report are: Dr. Alex Turta, Prof. Malcolm Greaves and Dr. Janusz Grabowski.

The most important value of this report is that it documents the development of a novel oil recovery process, Toe-To-Heel Air Injection (THAI), which for the first time, achieves the underground upgrading of the oil and hydrogen production, while mobilizing and producing oil via a horizontal well. Oil mobilization and production is achieved by using the in-situ combustion applied in a unique well configuration consisting of vertical air injection wells and horizontal production wells, which have their toes close to the injectors.

The report summarizes in a critical way the whole knowledge acquired/produced during the last 20 years, starting from the original patent and going through the laboratory experiments, simulation and field testing. After intensive field testing -with production of more than half a million bbls of upgraded oil - the process has been technically validated. The Report analyzes 6 THAI pilots conducted on different reservoirs within 3 countries, with by far more details for the Canadian pilots in Athabasca (Whitesands pilot) for oil sands exploitation and Kerrobert Pilot in Saskatchewan Province, for conventional heavy oil recovery. The Whitesands Pilot tested the process in 3 “vertical injector-horizontal producer” pairs for 5 years; it constituted the first in the world as far as the day-by-day in-situ upgrading of the produced oil was concerned. The Kerrobert Project tested the process in 12 “vertical injector-horizontal producer” pairs for more than 7 years, and confirmed the day-by-day consistent in-situ upgrading of the produced oil.

However, improvements are needed to enhance its performance, more specifically, the daily oil production; this report shows what essential improvements are needed in four areas: well configuration; initial communication between wells; ignition and operation practice. To conclude: a lot of knowledge has been acquired, and based on this there are very good chances to make the THAI process more efficient, opening the doors towards its commercial application.

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A special chapter in the report elaborates on the guidelines/IP necessary for the development of new generations of ISC process, not necessarily applied in a toe-to-heel configuration. A novel ISC process, conducted in a SAGD-type configuration, is also discussed.

There are two reports: the long report has 500 pages with 13 appendices, while the short version of the Report has around 300 pages. Additionally, associated to the Report there is a special simulation study comparing the performance of THAI in a direct line drive configuration with the THAI conducted in a staggered line drive configuration.

There are also 6 main technical presentations associated with the Report, with the aim of making the Report easier digestible. These presentations will be available after the acquisition of the Report by the company or organization. In principle, they will be presented by one of the specialists involved in this project. These presentations are:

1. A general technical presentation; current status of THAI development
2. A presentation focused on the THAI as the first EOR process producing underground upgraded oil
3. A presentation focused on the simulation studies, their merits and limitations
4. A detailed presentation on Athabasca Whitesands THAI Pilot
5. A detailed presentation on Kerrobert Field THAI Project
6. A presentation focused on improved THAI processes and guidelines for development of future generations of in-situ combustion processes to be applied stand-alone or follow up to thermal processes, including as follow up to SAGD

If you feel that you may be interested in acquisition of this Report, but need more information please let us know and we will send you an abbreviated marketing presentation or arrange with you for a personal full-length marketing presentation in Calgary or at your place, as per your convenience. Also, we will send to you two materials; a teaser and an advanced brochure of the THAI process. At that time, we will provide you all the price information.

Marketing Manager: To be announced (TBA) soon

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