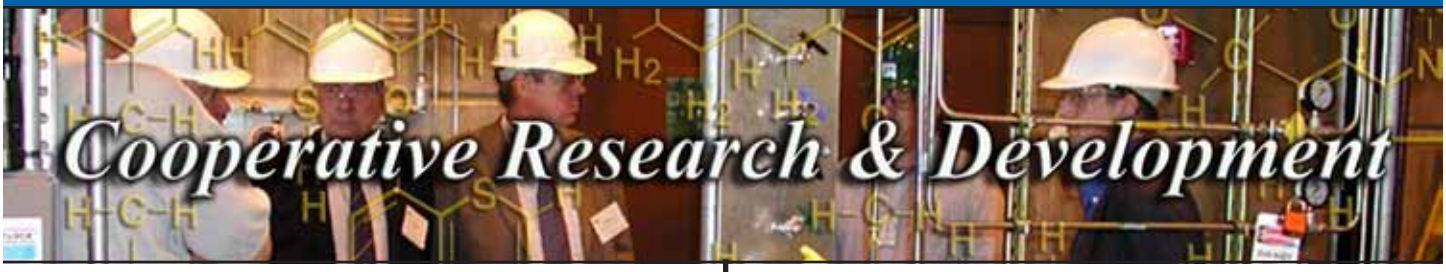
U.S. Department of Energy • Office of Fossil Energy
National Energy Technology Laboratory



Successes

WRITE Process for Pipeline Ready Heavy Oil

Advanced Research

To support coal and power systems development, NETL's Advanced Research Program conducts a range of pre-competitive research focused on breakthroughs in materials and processes, coal utilization science, sensors and controls, computational energy science, and bioprocessing—opening new avenues to gains in power plant efficiency, reliability, and environmental quality. NETL also sponsors cooperative educational initiatives in University Coal Research, Historically Black Colleges and Universities, and Other Minority Institutions.

Accomplishments

- ✓ Process improvement
- ✓ Cost reduction
- ✓ Greater efficiency
- ✓ Strategic benefits

Description

Researchers at the University of Wyoming's Western Research Institute (WRI) in Laramie are developing a field upgrading process to help make the conversion and upgrading of bitumen from Canadian oil sands more economical. Bitumen is a highly condensed, semi-solid form of crude oil. It is a natural asphalt that can be hard to recover and refine from tar (oil) sands without the use of expensive enhanced recovery methods. The bitumen must be heated or diluted with lighter hydrocarbons before it can flow readily enough to be piped or trucked from the field to central upgrading facilities or refineries, where it is further distilled to produce lighter products such as diesel fuel and gasoline. Alberta's oil sands contain the majority of Canada's crude oil reserves, which are second in extent only to those of Saudi Arabia.

The project is sponsored by the U.S. Department of Energy's Office of Fossil Energy (DOE-FE), and partially funded through the National Energy Technology Laboratory's (NETL) Advanced Research program. Also participating are an industrial partner, MEG Energy Corporation, Calgary, Alberta, which holds options for Canadian rights to the process and the site where the process will be piloted; and a leading architect/engineering firm, SNC-Lavalin, Montreal, Quebec, which specializes in process and facility design.

WRI regularly performs research with energy companies to evaluate and develop new technologies to upgrade heavy oil and residual oil products. WRI also is developing new patented technologies for recovering light ends, and performing pyrolysis and coke formation in the field. Work performed by WRI includes laboratory- to pilot-scale evaluations.

The WRI Thermal Enhancement (WRITE) process is designed to upgrade bitumen in close proximity to oil sands production fields. The field upgrader converts bitumen into a pure, heavy oil whose density and viscosity exceed the specifications for Canadian pipelines – making it unnecessary to add costly diluents such as naphtha prior to transport to a central location. The WRITE process also produces sufficient quantities of coke not only to sustain the thermal energy needs of the process itself, but also to meet some of the needs of the steam assisted gravity drainage (SAGD) bitumen recovery process.

The heavy oil produced by the process may be transported to any refinery that accepts Canadian crude, for further upgrading into finished products. A producer using the WRITE process thus is freed from the constraints imposed by costly additions of diluents; has a reduced need for natural gas for steam generation, hydrogen production, and plant energy needs; and produces a product acceptable to any refinery or upgrader that has access to Canadian crude via pipeline.

Project Duration

Start Date
10/01/03

End Date
09/30/07

Cost

Total Project Value
$703,346

DOE/Non-DOE Share
$393,817 / $309,529

Industrial Partner

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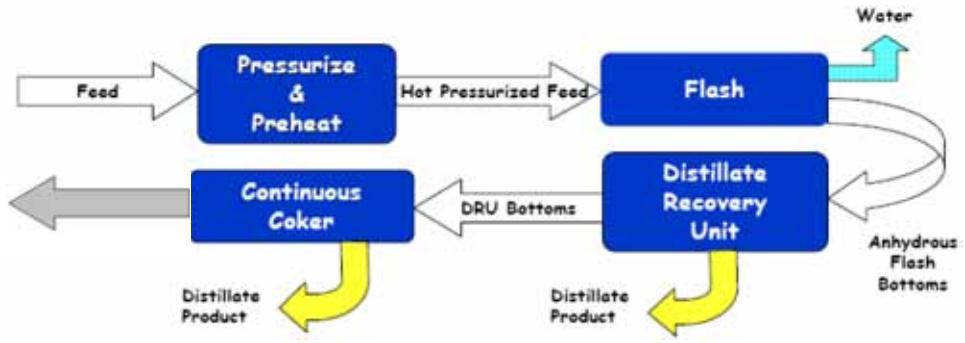


The WRITE process enables distillation of pipeline-ready heavy oil in the field rather than requiring transport to a central location as bitumen supplemented with diluents.

The WRITE process can be applied to Alberta's extensive oil sands, which are located in three major areas in the northeastern part of the province. These oil sands are underlain with deposits of an estimated 2.5 trillion barrels of heavy oil. Were all of that to be recovered and refined, it would meet the entire world's present demand for oil for more than 100 years. This process also is applicable to the extensive oil sands of Venezuela's Orinoco Belt, where a 200 km pipeline is used to transport diluent from Sincor's upgrader in Jose to the field, and to transport diluted crude back to the upgrader. The WRITE process for partial upgrading would eliminate the need for the diluent step, and could possibly eliminate the need for a coker at the upgrader, since a coker is already integral to the WRITE process itself.

Location of the Athabasca, Cold Lake, and Peace River oil sands areas

Goals

The objective of this project is to sufficiently demonstrate feasibility of the WRITE process technology to justify future development phases, leading to commercial-scale operation. Specific objectives are:

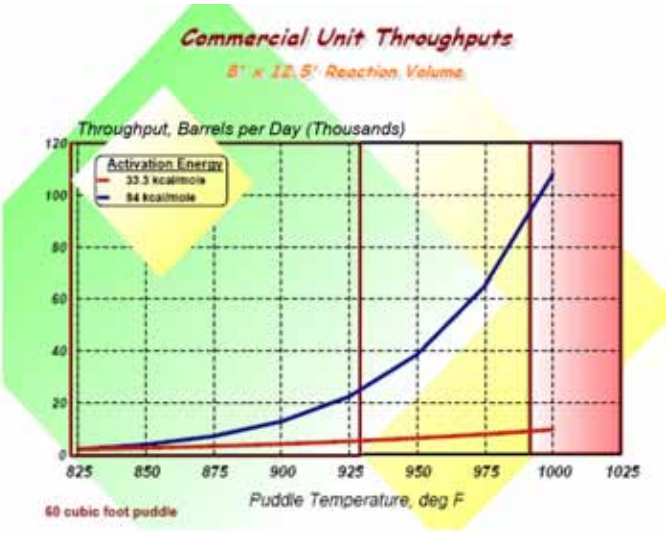
- Complete the optimization of the distillate recovery unit (DRU);
- Design and demonstrate operation of a bench-scale continuous coker appropriate to field upgrading; and
- Conduct hydro-treating studies on the product produced by the DRU and the coker.

The ultimate objective of present and future development efforts is for the WRITE process to achieve full commercial operation.

Technical Approach and Accomplishments

To date, WRI has demonstrated, through laboratory- and bench-scale testing, that the process can work, and that it does create a pipeline-ready heavy "sour" synthetic crude oil that is suitable for further processing. DRU optimization has taken place, and a six-inch pyrolyzer (coker) was operated to develop preliminary information on the chemistry of coke formation.

Based on experimental results, preliminary design studies support a throughput of 10,000 barrels per day (bpd), with future capacities of 25,000–50,000 bpd suggested. The WRI work has not yet reached a point where demonstration plant design parameters can be defined. Additional pyrolyzer development continues.



Analysis indicates that high capacities are probable

Upon completion of the process research and product development indicated above, a conceptual design of a 20,000 bpd commercial field upgrader facility will be performed, and its capital and operating costs determined. Design of the pilot plant will include a complete process layout, as well as a bid package for construction and a pre-contract estimate of the pilot plant capital and operating costs. Pilot plant design completion represents a milestone in the development effort, and a "go/no-go" decision point for future funding.

Benefits

Commercial development of unconventional fuel sources promotes energy independence and so provides Canada and the United States a strategic advantage. The U.S. Energy Policy Act of 2005 (EPAct) established a task force to accelerate and coordinate development of these sources, and to make recommendations regarding a partnership with the Province of Alberta relating to the development and production of refined oil products from oil sands. Development and future commercialization of the WRITE process adds to the likelihood of successful utilization of this abundant but expensive and difficult to extract fossil fuel resource.

Acknowledgement: The late Dr. Lee E. Brecher was the pioneer in the development and commercialization of the WRITE process.

"Commercial development of unconventional fuel sources promotes energy independence.... Development and future commercialization of the WRITE process adds to the likelihood of successful utilization of this abundant but expensive and difficult to extract fossil fuel resource."

States and Localities Impacted

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