

Title:

Converting Green River Oil Shale to Liquid Fuels with ATP and ICP Technologies: A Life-Cycle Comparison of Energy Efficiency and Greenhouse Gas Emissions

Abstract: (Your abstract must use 10pt Arial font and must not be longer than this box)

My paper will summarize and compare the results of two studies which calculate the life-cycle energy efficiency and greenhouse gas (GHG) emissions from two prominent oil shale retorting technologies: the Shell In situ Conversion Process (ICP) and the Alberta Taciuk Processor (ATP).

For each technology, data were obtained from peer-reviewed literature, grey literature (including national laboratory research reports), patents, and documents from governmental or regulatory processes (such as documents submitted to the BLM and the Colorado Division of Reclamation and Mining Safety). Using these data sources, a detailed life-cycle-assessment is performed for each process. Each process is divided into stages, and important materials and energy flows in each stage are recorded. For process stages that have significant impacts (such as mining in the ATP process, or freeze wall construction in the ICP) calculations include detailed material and energy calculations, such as the energy embodied in steel or concrete. For the actual retorting processes, retorting models were constructed, using multi-chamber material and energy balances (in the case of the ATP), or simplified simulations of temperature profiles at completion of retorting (in the case of the ICP). Total primary energy consumption is calculated per unit of final fuel delivered (a composite final energy good that includes refined liquid fuels and co-product hydrocarbon gas produced). The resulting energy consumption estimates are then used to calculate GHG emissions per unit of final fuel delivered.

Results show that primary energy consumption per unit of final fuel delivered ranges between 0.36 and 0.59 MJ per MJ delivered for the ATP, and between 0.44 and 0.73 MJ per MJ delivered for the ICP technology. Despite the higher energy intensity of the ICP, emissions results indicate that full-fuel-cycle GHG emissions range between 34 and 42 grams of carbon per MJ for the ATP and between 27 and 36 gC/MJ for the ICP (as compared to about 25 gC/MJ for conventional petroleum-based fuels).

These technologies have achieved prominence due to recent commercialization efforts and their inclusion in proposals for BLM research leases. My results will help inform judgements about their ability to be used under possible future carbon regulation.

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