

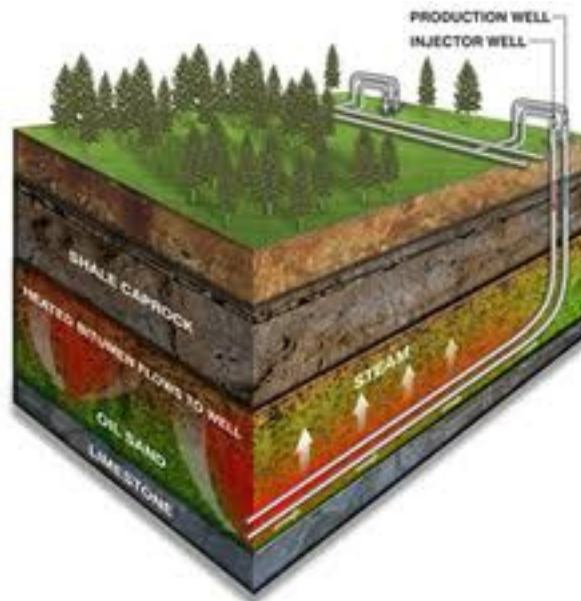
TRU Process – Environmental Impacts and Benefits

1. Breakthrough SAGD Technique with TRU Process

Oil sands, as the name implies, are grains of sand surrounded by an oil-like substance called bitumen. The bitumen must be separated from the sand. Then the bitumen needs to be lightened by removing carbon and adding hydrogen to produce marketable crude oil. Separation is done in one of two ways.

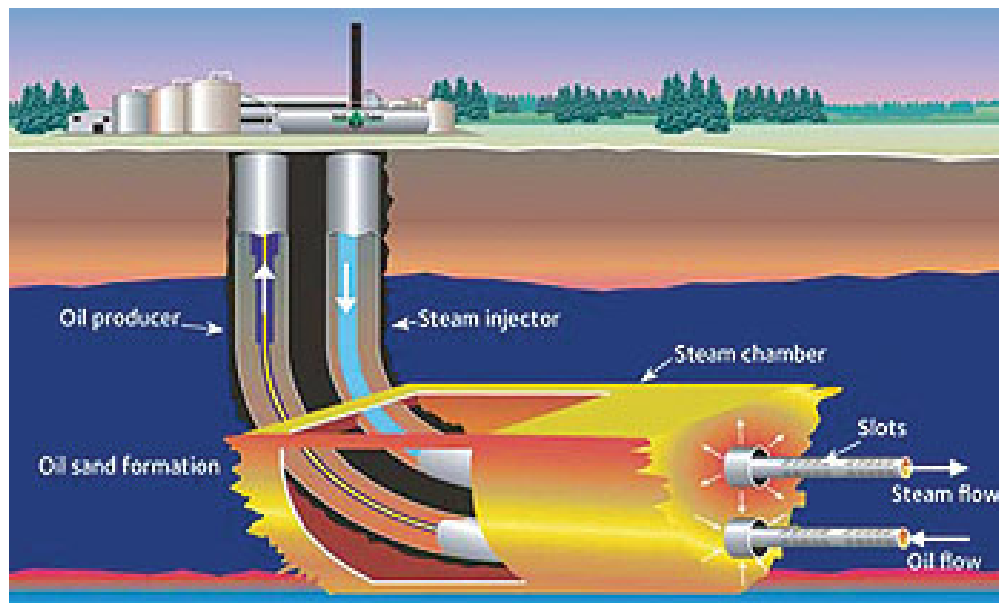
For oil sands near the surface, the mixture of sand and bitumen is mined and separation takes place in warm water baths with bitumen floated to the surface and sand sinking to the bottom. This mining – hot water production technique leads to large areas of disturbed boreal forest and huge tailing ponds, hence, the ugly land use side of oil sands development.

The environmental friendly alternative means of producing bitumen is to inject steam into the deeper oil sands deposits, melting the bitumen, collecting it at the bottom of the formation and pumping it to the surface – the steam-assisted gravity drainage (SAGD) technique. Less than 20% of the Alberta oil sands are near the surface and the mining technique is used. However more than 80% is deeper and the SAGD technique is used. The TRU Process is best suited to SAGD projects and is a breakthrough that provides upgrading at site for SAGD projects.



There are two approaches to 'lighten' bitumen and transform it into a marketable crude oil:

- Bitumen can be 'fully upgraded' to a low-sulphur synthetic crude oil; this requires major refinery-like equipment and costs are steep. Only the existing large-scale (100,000 plus barrels per day) mining projects have gone this route. Currently mining projects are forgoing the fully upgrading approach as costs are prohibitive.
- The alternative approach is to dilute bitumen with a very light oil (condensate) to the point where the bitumen/ diluent mixture (called dilbit) is of a consistency that it can be shipped by pipeline. The dilbit approach is mostly used by smaller-scale (25,000 barrel per day) SAGD producers. The cost penalties for this alternative are the extra costs of the diluent (condensate prices are significantly higher than the bitumen prices), the costs associated with shipped condensate to the production site and mixing it with the bitumen, and the extra volume that is shipped to the refiner (one barrel of bitumen becomes 1.42 barrels of dilbit – dilbit is 70% bitumen/ 30% condensate). And then there is a further penalty associated with dilbit because it is a 'dirtier', more troublesome refinery feedstock, and sells at a discount to lighter crude oils and low-sulphur synthetic crudes. Historically, the dilbit discount has averaged about 20%.



2. Significant GHG Emission Reduction with TRU Process

What are the environmental impacts of the TRU process?

Greenhouse gas (GHG) effects?

The GHG emissions associated with crude oil production are the sum of the emissions from each step in the process, from exploration through production to refining and end use. What is referred to as the 'well to wheels' GHG calculation for oil sands production is higher than for conventional crudes. (See: <http://www.oilsands.alberta.ca/ghg.html>). The TRU process takes bitumen and produces TRULITE, a sour synthetic crude oil and a by-product called asphaltene pitch. TRULITE is much cleaner, less toxic, and light enough that it can be shipped by pipeline without adding any diluent.

The TRU process will have far fewer GHG emissions than dilbit production. The TRU process eliminates an entire step in the process – the dilution of the bitumen. There are no GHG emissions from production of diluent (condensate), the shipment of it to the SAGD site, and for the additional diluent pipelined to the refinery.

Also, the lighter, cleaner and less toxic TRULITE is refinery-friendly compared to dilbit, resulting in fewer GHG emissions emitted from the refinery steps. Overall, the TRU process and TRULITE will have by far fewer GHG emissions.

3. Reduced Pipeline Risks with TRU Process

Pipeline Effects

Pipelining crude oil has the environmental risks associated with pipelining ruptures and spilled crude. Pipelining TRULITE presents reduced risks compared to dilbit. TRULITE is lighter, cleaner and less toxic than dilbit, and it floats on top of any water into which it spills. The dilbit emulsion can separate with the heavier bitumen sinking to the bottom. No one wants a pipeline spill; but TRULITE will definitely be easier to clean up than dilbit.



4. Major Savings with TRU Process

What does the TRU Process do and what are the economic benefits?

There are major financial pluses associated with TRULITE. All the costs of the diluent/ condensate, and the system to bring condensate to the production site go away. The effect is diluent savings of at least \$10 per barrel, and another \$6 to \$10 per barrel for the condensate delivery system that is no longer necessary. The cost of the TRU process (capital and operating costs) are estimated at about \$6 per barrel, leaving a clear \$10 per barrel advantage to the TRU process compared to shipping bitumen as dilbit.

TRULITE is a more valuable refinery feedstock than dilbit. It is cleaner, has lower heavy metals, and lower toxics resulting in reduced refinery operating costs; volatiles are higher resulting in better refinery yields and a more valuable slate of refined products. It is anticipated that the TRULITE discount will be much less than the dilbit discount, adding further to the financial return to the TRU process.

5. Additional Revenues with TRU Process

What about the by-products, coke and asphaltene pitch?

Bitumen is lightened (viscosity improved) by removing carbon, either by coking or by deasphalting. Coking is the standard technique used by the oil sands industry. Upgraders use coke drums or other continuous coking techniques. The TRU process used a non-coking cracker and deasphalting to remove carbon as asphaltene pitch.

There are important advantages to removing carbon by deasphalting compared to coking. Coke from bitumen has little or no value. Low volatility and high sulphur content of bitumen coke are the reasons. Oil sands producers usually dispose of their coke in the mined out pit.

Asphaltenes can be used as asphalt and are a feedstock for asphalt operations. Asphalt prices have soared in the last five years, and now sell for more than light crudes. The advantage to the TRU process is another \$10 per barrel compared to the bitumen alternative. Also, the heavy metals and sulphur in asphaltenes are bound with the asphalt products in elemental form and are of no harm to the environment; another significant environmental plus for the TRU process.

