

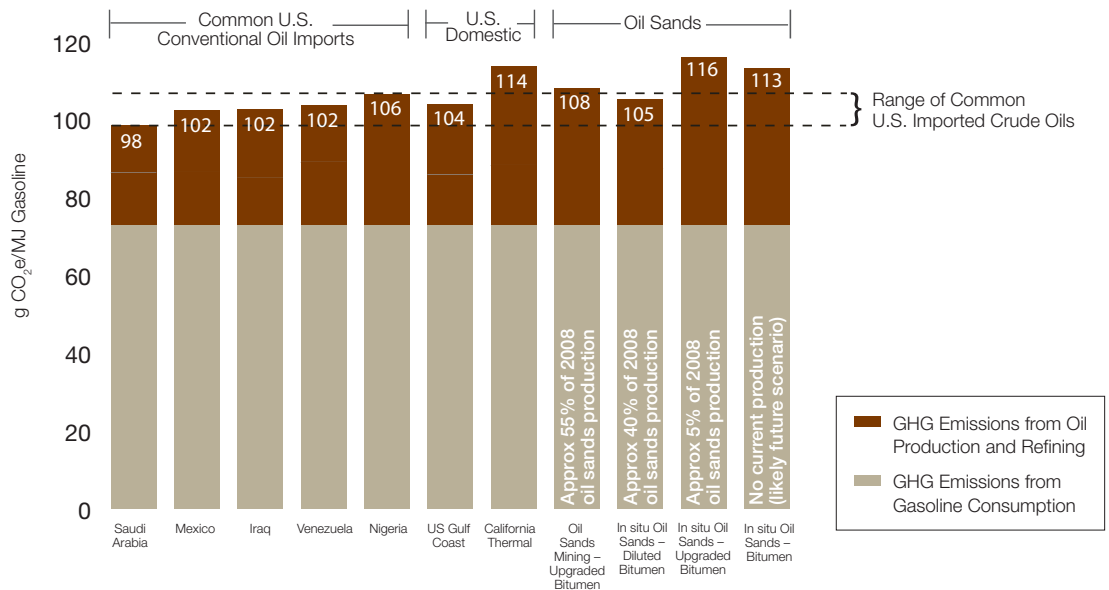


# OVERVIEW: GREENHOUSE GAS EMISSIONS IN CANADA'S OIL SANDS

## KEY CONCLUSIONS OF LIFE CYCLE GHG ANALYSIS

- Life cycle GHG emissions for oil sands are comparable to domestic and imported conventional crude oils.
- About 75 per cent of GHG emissions occur during fuel consumption and are not impacted by the source of the crude oil.

Life Cycle GHG Emissions of Various Crude Oils



Source: Jacobs Consultancy, Life Cycle Assessment Comparison for North American and Imported Crudes, June 2009

## GREENHOUSE GAS EMISSIONS

The variance in the amount of Greenhouse gases (GHG) emissions generated in different types of oil production depends on how much energy is required to produce and process the oil.

Some oil is just pumped out of reservoirs. Other reservoirs need injections of water or steam to retrieve the oil. Light oil requires less energy than heavy oil to be refined into transportation fuels.

The amount of natural gas contained in the oil that may be flared or vented also contributes to overall GHG emissions.

GHG emissions are also generated when transportation fuels are consumed in vehicles (this accounts for about 75 per cent of all GHG emissions). Total GHG emissions from production to consumption are referred to as life cycle GHG emissions.

A recent report by a major international engineering firm found that overall life cycle GHG emissions of oil sands are comparable to conventional oil (see above figure).

The variability in GHG emissions in oil sands operations depends primarily on what is being produced. Some operations produce a high quality upgraded light crude oil while other operators mix unprocessed heavy oil (bitumen) with a lighter petroleum product (diluent) before sending the diluted bitumen to the refinery. This results in the lowest life cycle GHG emissions in the oil sands because the diluent has lower life cycle GHG emissions.

As oil sands production increases, it's unlikely there will be sufficient diluent supply to continue transporting the majority of in situ bitumen as blended product. More likely, the diluent will be separated at the refinery and sent back to Alberta via pipeline for reuse.

WE WILL CONTINUE TO REDUCE GREENHOUSE GAS EMISSIONS PER BARREL OF PRODUCTION BY IMPROVING OUR ENERGY EFFICIENCY AND BY DEVELOPING NEW TECHNOLOGIES.

## Reducing GHG Emissions

The primary source of GHG emissions in oil sands mining is the energy required to mine and transport the oil sand, separate the oil from the sand, and process the oil. For in situ operations, the primary source of GHG emissions is the combustion of natural gas to generate steam. The oil sands industry has, through continual advancements in technology and energy efficiency, reduced GHG emissions per barrel by more than 30 per cent since 1990. Cogeneration further reduces GHG emissions and additional reductions are expected through the development of Carbon Capture and Storage (CCS) and new in situ extraction technologies (as shown in the adjacent figure).

### Cogeneration

Cogeneration produces steam and electricity from a single source, and because cogeneration plants are sized according to a facility's steam requirements there is often more electricity produced than required.

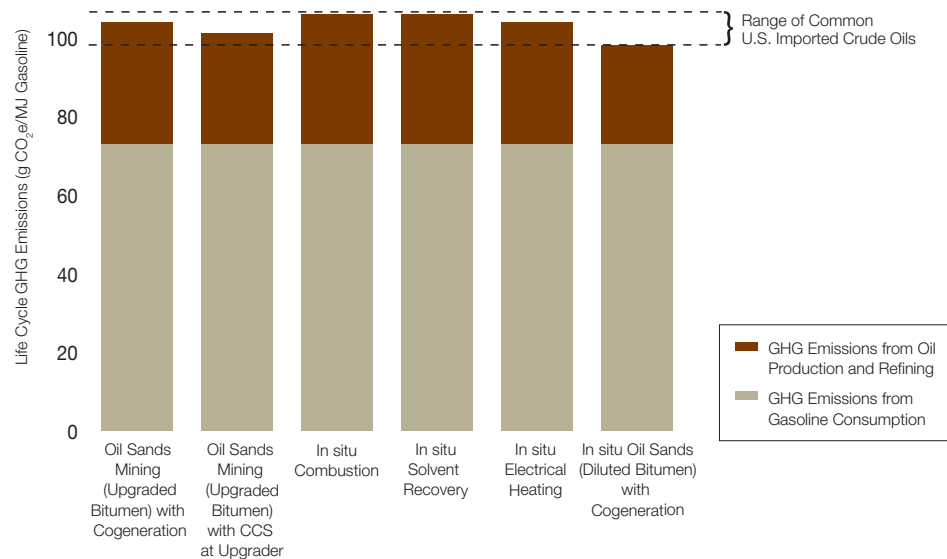
The excess electricity is sold to the grid meaning less natural gas and coal needs to be used to meet Alberta's electricity needs. This significantly reduces GHG and other air emissions. All existing oil sands mines and all but a few small in situ projects have cogeneration facilities (over 98 per cent of oil sands production has associated cogeneration). Cogeneration in the oil sands provides approximately 18 per cent of Alberta's total electricity supply.

### Carbon Capture and Storage

Carbon capture and storage is another technology that will reduce emissions. CCS is well understood from a technical perspective but widespread implementation is limited by challenging economics and a lack of infrastructure. The Alberta government has committed \$2 billion to CCS development, the federal government has committed \$1 billion, and industry is also investing heavily.

As the required infrastructure is developed, CCS has the potential to significantly reduce GHG emissions from the oil sands. However, it's likely that initially CCS will be applied to coal-fired electricity facilities due to their larger and more concentrated sources of CO<sub>2</sub>.

Comparison of Common U.S. Imported Crude Oils vs. Various Oil Sands Technologies



Source: Jacobs Consultancy, Life Cycle Assessment Comparison for North American and Imported Crudes, June 2009 CAPP 2009

### New In Situ Extraction Technologies

In situ operations require significant amounts of energy to generate the steam which is injected underground to warm the bitumen before it can be pumped to the surface.

There has been significant progress in reducing the amount of steam required to achieve this and there are several technologies that have the potential to further reduce GHG emissions per barrel to levels equivalent to – or better than – imported conventional oil.

Some field-piloted technologies nearing commercial implementation include:

- heating bitumen with electrical current instead of steam
- using underground combustion to warm the bitumen
- reducing or eliminating the use of steam by adding solvents

### Alberta GHG Regulation

The Government of Alberta implemented GHG regulations in 2007 (the first jurisdiction in North America to do so) requiring a 12 per cent reduction in GHG emissions per barrel for all existing oil sands operations.

Emitters can meet the reduction target, acquire approved offsets, or pay \$15 for every excess tonne of GHG emitted into a fund that supports research and development on reducing GHG emissions.

In its first two years, the legislation has resulted in approximately 6.5 million tonnes of actual reductions in Alberta and \$122 million paid into the Climate Change and Emissions Management Fund.