Oil Sands Crude - Part of the Global Range of Crude Oils

All crude oils consist of a complex combination of hydrocarbons and other chemical compounds. Oil sands crude is a heavy crude oil with properties similar to other heavy crude oils found and produced throughout the world. While all sources of crude oil have different properties, all of the final refined transportation products such as diesel and petrol are essentially the same.

What are the oil sands?

The oil sands comprise more than 97 percent of Canada's 174 billion barrels of proven petroleum reserves. Located in Western Canada, the oil sands are a naturally occurring mixture of sand, clay, water, and crude oil. Oil sands crude oil is a heavy and viscous form of crude oil. This resource was formed when crude oil migrated upwards from source rocks towards the shallow reservoirs where it is found today.

Oil sands heavy oil falls within the continuum of global crude oils. Crude oils are comprised of a common set of chemical compounds and their individual compositions differ across the continuum of crude oil sources. Crude oil is a refinery "feedstock" and is typically designated as light to heavy or sweet to sour, based on density and/or viscosity, or by sulfur content. Heavy crude oils similar to oil sands crude are found in many places around the world besides Canada, such as Venezuela, the United States and Russia. However, only Canada and Venezuela produce and export significant amounts.

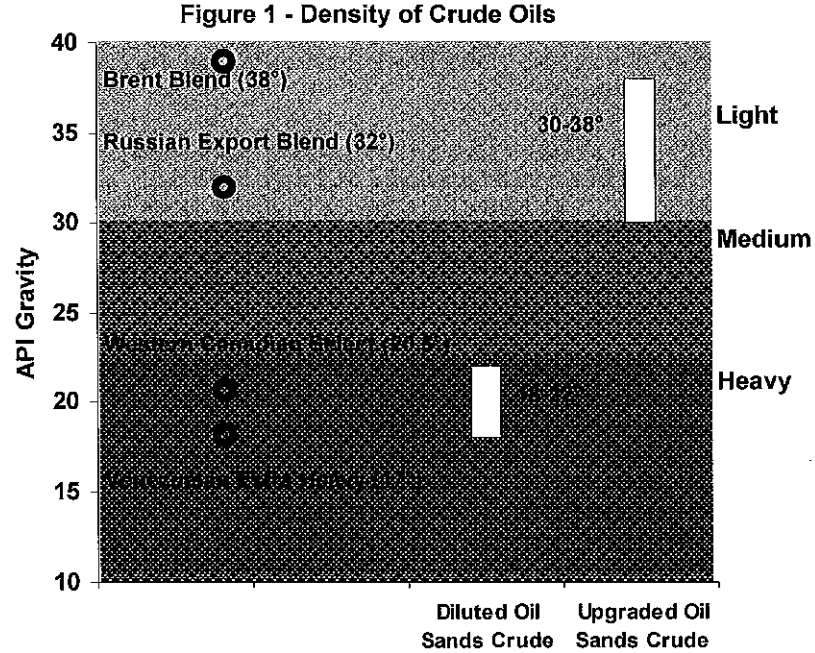
Oil sands derived crude does not constitute a separate feedstock for transportation fuels. It is simply a heavy crude oil with properties that are similar to other heavy crude oils found and produced throughout the world. Furthermore, transportation fuels derived from oil sands crude are indistinguishable from transport fuels derived from other crude oils.

How is Oil Sands Crude Processed?

From the oil field where it is produced, oil sands crude is transported to North American refineries through pipelines. Pipeline transport requires the oil sands crude to be either diluted with the addition of lighter hydrocarbons or converted into an "upgraded" crude oil. Upgrading uses some basic refinery steps involving heat, pressure, and hydrogen to crack larger hydrocarbon molecules into smaller molecules.

Heavy oil from the oil sands region can also be transported as part of a blend of crude oils. Western Canadian Select (WCS) is a crude oil blend that includes oil sands derived products as well as other Western Canadian crudes (both light and heavy). WCS is one of a number of Canadian benchmark crude oils and is similar to other heavy crude oils used in North America such as Maya crude oil from Mexico. The various densities of crude oils, as measured by the commonly used American Petroleum Institute's (API) scale, are shown in Figure 1. A lower API gravity indicates a denser fluid, with the density of water being 10° API.

Figure 1 - Density of Crude Oils



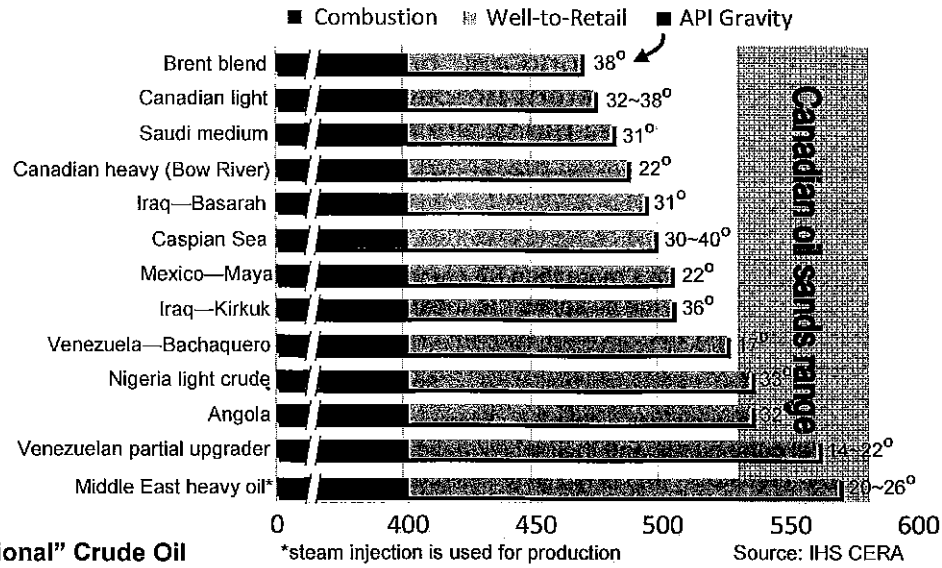
Typically, crude oil with API greater than 30° is termed light; between 22° and 30°, medium; and below 22°, heavy

Sources: National Energy Board of Canada, American Petroleum Institute, and the Energy Information Administration of the US Department of Energy

Upgraded crude oil and heavy blends are processed at traditional refineries to produce the usual suite of liquid refined petroleum products such as transportation fuels and petrochemicals for modern society's day-to-day use. The refining process removes impurities such as sulfur and metals, separates the crude oil into different sets of hydrocarbons by boiling point, and converts the high-boiling hydrocarbons into refined petroleum products. Refineries are often optimized to accept a certain types of crude oil blend (i.e., light to heavy and sweet to sour) and each refinery is unique and often optimized to a specific local market.

In general, extracting and processing heavier crude oils can lead to higher GHG emissions. As a result oil sands crude oil has similar life cycle GHG emissions as other heavy oil used in Europe, including Venezuelan[1] and Middle Eastern heavy oil. However, technology choices and industry practices also impact the GHG emissions associated with extracting and processing crude oil. For these reasons, the physical aspects of crude oils are not an accurate proxy for their GHG emissions intensity (see figure 2).

Figure 2 - Well-to-wheels GHG Emissions for Oil Sands and other Crude Oils
(kg CO_2eq. per barrel of refined product)



*steam injection is used for production

Source: IHS CERA

"Conventional" vs. "Unconventional" Crude Oil

According to the International Energy Agency, there is no universally accepted definition for "conventional" or "unconventional" oil. One definition that is commonly used is that any source of crude oil is described as unconventional if it requires production techniques that are significantly different from traditional oil well extraction. However, this is an imprecise and time-dependent definition.

Globally, many sources of petroleum that have been long described as conventional are being produced using unconventional means such as with gas reinjection or through the use of heat, rather than through traditional oil extraction methods. These trends are making "unconventional" oil recovery, as defined above, more the norm rather than the exception.

Commercial petroleum production from Canada's oil sands pre-dates oil production from areas such as the North Sea (the source of a benchmark crude oil known as "Brent"), and the scale of the resource is such that commercial production from oil sands will continue long after North Sea crude oil is depleted. For example, Canadian oil sands mining extraction and processing techniques, while continuously being improved upon, have been in use commercially since 1967. Mined oil sands currently account for about half of current oil sands production; the other half comes from drilled well configurations, known collectively as *in situ* production. Commercial *in situ* production began in 1985 in Alberta, Canada, and has been improved upon and expanded since that time.

The Changing Global Oil Market

Oil plays a dominant role in meeting the world's primary energy needs, particularly in the transportation sector, and this is expected to continue for decades to come. As more easily accessible and lighter crude oil deposits are depleted, the market is turning increasingly to heavier and less accessible resources. This, along with more stringent fuel quality specifications, will increase the greenhouse gas intensity of extracting and processing crude oil around the world, including those crude oils used in the European Union.

As this shift in production sources continues, the average greenhouse gas intensity of the global oil supply is expected to increase in the foreseeable future. The Governments of Canada and Alberta support innovation in Canada's energy sector and the adoption of clean energy technologies to reduce GHG emissions and other environmental impacts associated with energy development. The oil sands sector has, for one, already made significant reductions in the GHG intensity, with further improvements expected based on new processes and technologies being piloted today. Canada's oil industry operates under a strict and comprehensive regulatory regime. Other oil producing countries, however, with less stringent oversight can produce lighter crude oils that are more GHG intensive than heavy crude oils and some countries are less transparent than Canada about their oil sector's GHG emissions.

[1] Under the European Union's draft Fuel Quality Directive's petrol and diesel default values, separate values are not being sought for other heavy crudes imported into the EU, such as Venezuelan crude, even though Venezuelan heavy crude has similar properties and is as heavy or heavier than Canada's oil sands crude products.