

Environmental performance: Oil sands GHG emissions intensity

Increasing scrutiny and emissions assessment

Over the past several years, investors and shareholders in major energy companies have sought greater transparency on climate change-related financial risks. Over time, shareholders and investors are increasingly factoring in environmental, social, and governance (ESG) performance metrics and carbon risk when making investment decisions. For oil sands companies, greenhouse gas (GHG) emissions represent one of the most contentious ESG concerns.

Evaluating emissions intensity

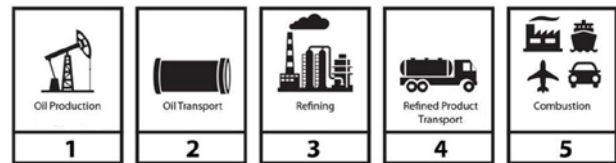
Several organizations have released ESG assessment tools that help investors determine a company's environmental performance. Examples include Yahoo Finance's sustainability scores. However, the methodologies used to evaluate emissions intensities underlying such ESG assessment tools vary widely and can have a significant impact on results if not done properly. Understanding a model's methodology and base assumptions is critical in understanding its accuracy.

Greenhouse gas emissions intensity

The amount of GHG emissions emitted per unit of output during the production, transportation, refining, and end use of a fuel is known as lifecycle GHG emissions intensity. Crude oils exhibit different crude properties and originate from varying geological formations; therefore, they are produced, refined, and transported in many different ways. Consequently, the GHG emissions associated with the lifecycle of

crude oil to final products, such as gasoline and diesel, varies. A common method researchers use to model or estimate the GHG emissions of global crude oils and fuel products is a lifecycle assessment (LCA). Calculating the GHG emissions for the LCA of a crude oil is typically divided into five distinct stages, which is known as a "well-to-wheels" analysis.

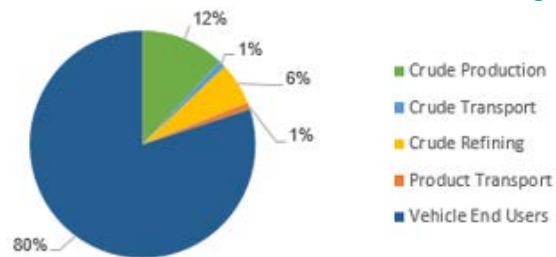
Lifecycle assessment stages



Source: Modified from ARC Resources 2017

The availability and quality of GHG emissions data depends heavily on the regulatory requirements enforced by a particular jurisdiction and, as such, the availability and quality of crude oil production data entered into LCA models is highly variable. This data variability introduces significant challenges for LCA modelling of crude oils for the crude oil production stage.

GHG emissions emitted at various stages



Source: Modified from Jacobs 2012 and ARC Resources 2017

Lifecycle assessment (LCA) models

There are many LCA models used to assess GHG emissions intensity estimates for Alberta and U.S. crude oils. The reliability of the outputs of any of these models varies, depending primarily on the quality of the data used. Key metrics and design parameters help determine whether data sources meet the LCA standards required for GHG policy decision-making and/or investment analysis, including the reliability of the data, and its granularity, accuracy, vintage, and overall quality.

Data quality and availability should be considered when evaluating any investment decisions associated with a particular crude stream.

Alberta uses credible GHG emissions intensity models and displays world-class data quality and availability. Since 2007, Alberta has collected third-party verified, high-quality production and GHG emissions data from Alberta oil sands facilities and refineries. Furthermore, Alberta is one of the few oil-producing jurisdictions that provides public access to such data, thereby demonstrating Alberta's reputation for data transparency and quality assurance. In comparison, crude production and GHG emissions data used by many other jurisdictions is not as comprehensive, which leads to higher uncertainty when comparing estimated GHG intensities across jurisdictions.

Leading LCA research studies have provided trend results for the GHG intensity of many commonly exported Alberta crude oils. Researchers, such as the U.S. Department of Energy, IHS Markit, and Jacobs Consultancy, have illustrated a continuous improvement in GHG emissions intensities for commonly traded Alberta oil sands crudes over the course of the last decade.

Similarly, credible public LCA models, such as Stanford University's Oil Production Greenhouse Gas Emissions Estimator (OPGEE) model, show that crudes can have a wide range of GHG intensities. Results from the OPGEE model show that many commonly traded crude oils in the U.S. have GHG emissions profiles that fall within a range similar to, or higher than, average Alberta crudes.

Key LCA methodology considerations

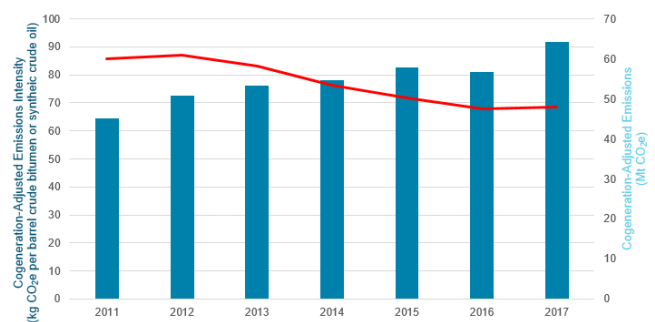
- Data quality and availability are critical in GHG intensity estimates.
- Accurate lifecycle assessments should differentiate and evaluate GHG intensities for each crude oil, using public, transparent, verifiable, and reproducible data and modelling.

Alberta is on a path to reducing GHG emissions intensity

Since 2000, technological development has substantially reduced the energy and GHG intensity of Alberta's marketable crude products.

The crude production GHG intensity of Alberta oil sands crudes commonly exported to the U.S. has decreased by approximately 20 per cent since 2011. This trend shows that Alberta oil sands crude production is becoming less GHG intensive on a per unit basis (i.e., GHG intensity basis).

Alberta's declining crude production GHG emissions intensity



Source: Alberta Environment and Parks, 2019

Canadian Oil Sands Innovation Alliance (COSIA) is a group of oil sands producers focused on accelerating the pace of improvements in

environmental performance of the Canadian oil sands through innovation. The alliance, which accounts for more than 90 per cent of oil sands crude production in Alberta, has identified promising areas for innovations where the oil sands industry could reduce GHG intensity by a further 10 to 30 per cent in the next five years, with even greater improvements in the next decade and a half.

Reduction in emissions intensity and water usage

Between 2012 and 2016, COSIA members reported a reduction of:

In situ:

- 11 per cent in GHG emissions intensity
- 42 per cent in water usage

Mining:

- 9 per cent in GHG emissions intensity
- 18 per cent in water usage

Source: COSIA, 2018

In 2016, Suncor Energy pledged to reduce the GHG intensity of its crude oil by 30 per cent by 2030. Since 2016, Suncor has made rapid progress toward this target. More recently in 2018 and 2019, respectively, Imperial Oil pledged to reduce oil sands GHG emissions per barrel by 10 per cent over the next five years, and Canadian Natural announced a long-term target of net zero oil sands emissions, as both companies continue to increase production. Other oil sands companies have also pursued GHG emissions reduction opportunities via investments made in technology and innovation.

Similarly, coordinated efforts are being made by provincial agencies, such as Alberta Innovates and

Emissions Reduction Alberta, to develop various low-carbon recovery and energy efficiency technologies. These agencies are on the path to make Alberta oil sands crude among the lowest GHG emissions intense crude oils.

Alberta – U.S. comparison

When compared to the U.S., IHS Markit's LCA analysis shows that roughly half of the commonly traded crude oils in the U.S. have GHG emissions profiles that are similar to or higher than the average Alberta crude oil.

Alberta's climate policies provide certainty to investors

Currently, most of the world's major oil producers lack GHG emissions reduction targets, enforcement of flaring and venting regulations, and any hard limits on GHG emissions for crude production. In comparison, Alberta has strived to be viewed as a climate change policy leader by ensuring all commitments are in place via various legislative pieces such as the *Oil Sands Emissions Limit Act* (establishes a hard limit for GHG emissions from all oil sands facilities) and the Technology Innovation and Emissions Reduction (TIER) system. Since 2007, Alberta's industry carbon pricing system has generated more than \$1 billion in funding for reinvestment in GHG emissions reductions. The TIER system, which becomes effective in January 2020, will continue to encourage energy-intensive facilities (ie. oil sands facilities) to seek innovative ways to reduce GHG emissions and invest in clean technology. The majority of TIER funds will be used for new and cleaner Alberta-based technologies that reduce GHG emissions.

About half of the commonly traded crude oils in the U.S. have GHG LCA emissions intensities that are similar to or higher than the average Alberta crude oil

