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Measuring oilsands carbon emissions intensity

How Alberta's Climate Leadership Plan can help reverse a worrying trend

by Benjamin Israel | August 2016

Summary

Carbon emissions intensity from overall oilsands extraction operations increased by 25 per cent between 2004 and 2014. While emissions intensity from in situ processes experienced a slight decrease (-3 per cent), mining intensity surged 22 per cent over the same period.

Emissions intensity is only expected to increase in the near future, reflecting the growth of carbon-intensive in situ production. However, the implementation of the Alberta Climate Leadership Plan will motivate the oilsands industry to significantly reduce its carbon intensity if it wants to keep production growing.

What is carbon emissions intensity from oilsands?

Carbon emissions intensity indicates the amount of GHG emissions that are produced industry-wide on average to extract one barrel of bitumen. This intensity indicator depends on a number of factors, such as the quality of the ore and the processes involved in its extraction. This factsheet distinguishes between mining and in situ technologies.

How is carbon emissions intensity calculated?

Carbon emissions intensity, expressed in kg of CO_2e per barrel of bitumen produced, is calculated by dividing the GHG emissions from a given technology by the production of bitumen associated with these emissions.

While Environment Canada used to officially report on emissions intensities from the oilsands industry[1], updated numbers have not been recently made available. In this analysis we use data from two government sources:

[1] Environment Canada, *Canada Emissions Trends 2013,* Figure 4. https://www.ec.gc.ca/ges-ghg/985F05FB-4744-4269-8C1A-D443F8A86814/1001-Canada's%20Emissions%20Trends%202013_e.pdf

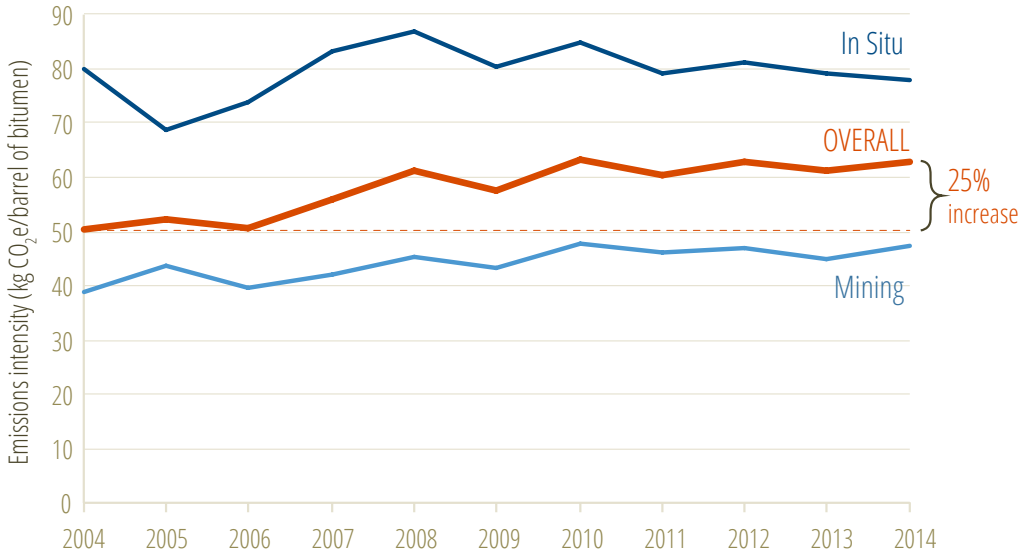
- Oilsands production data is from the Alberta Environment and Parks Oil Sands Information Portal[2]
- GHG emissions data comes from the National Inventory Report 2016 published by Environment and Climate Change Canada[3]

Table 1 reports the emissions intensity from mining and in situ bitumen production for the 2004-2014 period, also illustrated in Figure 1.

Table 1. Emissions intensity from oilsands extraction operations in Alberta

	Emissions intensity (kg of CO_2e per barrel of bitumen)										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mining	39	44	39	42	46	43	48	46	47	45	48
In Situ	80	69	74	83	87	81	85	79	81	79	78
Mining and In Situ (average)	50	52	51	56	61	57	63	60	63	61	63
Year over year growth	-2%	4%	-3%	10%	10%	-6%	10%	-5%	4%	-2%	3%

Figure 1. Emissions intensity from oilsands extraction operations



[2] Alberta Environment and Parks, *Oil Sands Information Portal,* Total Oil Sands Production Graph. http://osip.alberta.ca/library/Dataset/Details/46

[3] Environment and Climate Change Canada, *National Inventory Report 1990-2014*, Annex 10, Table A10–1 Canada's GHG Emissions by Canadian Economic Sector, 1990-2014. https://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=83A34A7A-1

Scope of analysis

In order to adhere to the activities captured under the 100 Mt limit established by the Alberta Climate Leadership Plan, carbon emissions intensities discussed in this factsheet solely account for mining and in situ extraction operations; upgrading processes are excluded from the scope of this analysis.

It must also be noted that the average intensity is weighted based on the level of production and emissions from each production technology.

Discussing the surge in emissions intensity from oilsands

Framing the discussion on the evolution of oilsands emissions intensity

Many voices from industry[4] and government[5] regularly claim that the emissions intensity from the oilsands industry has decreased by as much as 30 per cent between 1990 and 2013.

While these figures are accurate, they are misleading, and disregard what happened as bitumen production ramped up in the 1990s.

Indeed, the oilsands industry did make some significant one-off improvements in emissions intensity about 25 years ago, when it was credited with moving to cogeneration and less-carbon-intensive burning fuels. Similarly, improvements at upgrading facilities[6] in the early 2000s allowed intensity to fall by a third, contributing greatly to the 30 per cent decrease in the sector's overall emissions intensity.

These were undeniably important steps. However, when you take a closer look at the period between the mid-2000s and 2010s, this claim does not reflect recent trends in oilsands performance.

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[4] "Canada's oil sands industry continues to reduce GHG emissions intensity. Between 1990 and 2012, GHG emissions associated with every barrel of oil sands crude produced have been reduced by 30 per cent." Canadian Association of Petroleum Producers, *Canada's Oil Sands*. http://www.canadasoilsands.ca/en/

[5] "GHG emissions per barrel of oil produced from the oil sands decreased by 30% between 1990 and 2013." Natural Resources Canada, *Key Facts and Figures on the Natural Resources Sector*. http://www.nrcan.gc.ca/publications/key-facts/16013

[6] Upgrading processes are usually included in the figures mentioned by industry and government, allowing for an improved performance in emission intensity of the overall sector. As noted previously, our analysis excludes upgrading in order to adhere to the activities captured under the 100 Mt limit from the Alberta Climate Leadership Plan.

Recent trends show oilsands extraction intensity has increased by 25%

Data from governmental sources demonstrate that, on average, there has been no improvement in oilsands emissions intensity between 2004 and 2014 (Table 1). In fact, while the emissions intensity from in situ production has experienced a slight decrease of 3 per cent, mining operations intensity has surged by 22 per cent (Table 2). However, production from in situ operations has been growing rapidly; since these operations produce higher emissions, the overall emissions intensity of oilsands extraction has increased by 25 per cent between 2004 and 2014. This is discussed in more detail below.

Table 2. Change in emissions intensity between 2004 and 2014

	Change in emissions intensity between 2004 and 2014 (%)
Mining	22%
In Situ	-3%
Mining and In Situ (average)	25%

Why is emissions intensity is not improving?

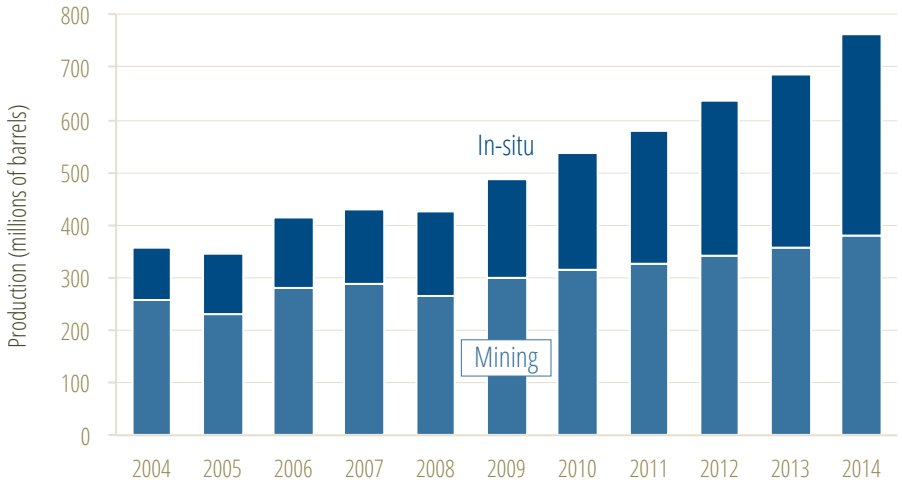
Although in situ intensity experienced a slight drop over the last decade, a closer look at the figures indicates that the trend is actually quite stable over the period, averaging about 80 kg of CO_2e per barrel.

By contrast, emissions and emissions intensity from mining operations grew quite consistently over the same period, as companies accessed deeper, lower quality bitumen, and as distance to the processing facility increased.

The even more rapid growth in intensity for the sector as a whole reflects the fact that in situ production, associated with nearly twice as much emissions as mining on a per-barrel basis, has developed faster relative to mining extraction (Figure 2). Indeed, in situ production almost quadrupled between 2004 and 2014, exceeding at the end of the period the moderately increasing mining production. The overall amount of bitumen extracted doubled in this period. This trend is expected to continue as the industry forecasts mining production to nearly plateau after 2018, while in situ production expands.[7]

[7] Canadian Association of Petroleum Producers, *Crude Oil Forecast, Markets and Transportation* (2016). http://www.capp.ca/~/media/capp/customer-portal/publications/284950.pdf

Figure 2. Oilsands production between 2004 and 2014



Data source: Alberta Environment and Parks[8]

Ultimately, in the absence of drastic technology improvement, the combined effects from increasing intensity in mining and from oilsands production moving to more carbon-intensive in situ processes will only further boost the emissions intensity of the sector overall.

Why is reducing emissions intensity critical for the oilsands?

Alberta's Climate Leadership Plan emphasizes major improvements in emissions intensity of the oilsands. The commitment to limiting oilsands emissions to 100 Mt annually, along with the implementation of a carbon pricing mechanism based on a performance standard, sets a new objective for the oilsands sector.

The Government of Alberta indicates that currently operating projects account for 70 Mt[9]; however, forecasts show that the oilsands 100 Mt limit could be reached before 2030. In other words, if emissions intensity does not improve, future growth in bitumen production is likely to be constrained — if not forced to be reduced in order to adhere to the limit.

Indeed, the new policy supports developing only the most efficient, least carbon-intensive projects. Projects associated with a high carbon intensity will be subject to penalties in proportion to their performance. This policy provides a strong incentive for companies to tackle emissions intensity from their oilsands operations and has the potential to turn the recent increasing trend around.

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[8] Alberta Environment and Parks, *Oil Sands Information Portal,* Total Oil Sands Production Graph. http://osip.alberta.ca/library/Dataset/Details/46

[9] Government of Alberta, "Capping oil sands emissions," *Climate Leadership Plan*. http://www.alberta.ca/climate-oilsands-emissions.aspx