

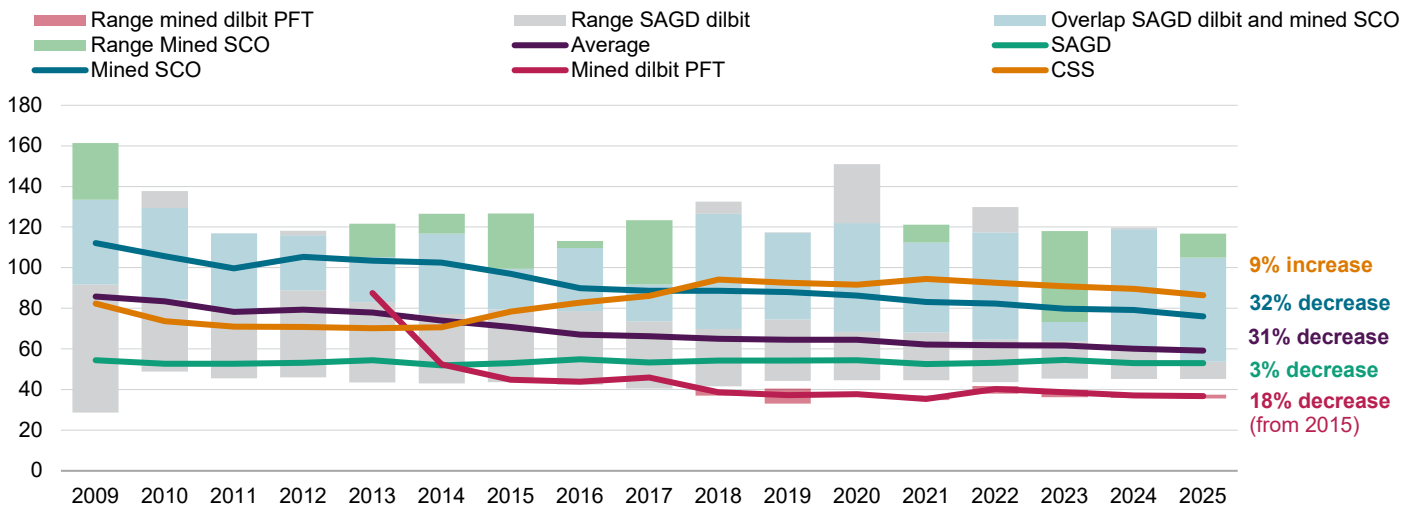
# Canadian oil sands GHG intensity continues a 17-year decline — down nearly one-third since 2009

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The trajectory of declining oil sands greenhouse gas emissions intensity is a well-established trend. Since 2009, the earliest year covered by the S&P Global Energy oil sands emissions model, the GHG intensity of oil sands marketable product has declined by 31%.

Figure 1  
**Range and average of GHG intensity of oil sands extraction by year and by technology (2009 to 2025 in kgCO<sub>2</sub>e/b of marketed product)**



Data compiled May 4, 2026.

PFT = paraffinic froth treatment; SAGD = steam-assisted gravity drainage; SCO = synthetic crude oil; CSS = cyclic steam stimulation.

Source: S&P Global Energy.

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Multiple factors contributed to reductions in intensity over the past 17 years. At the macro level, changes in production composition, including the growth of less GHG-intensive steam-assisted gravity drainage (SAGD) operations, the development of less intensive mining operations, and the ramp-up of new facilities and optimization of legacy operations, all contributed to a lower average oil sands intensity.

At a more granular level, thermal operations benefited from advancements in drilling technology, including longer laterals and better well placement; more predictive maintenance; improved steam chamber management; and the application of non-condensable gas co-injection, which lowered the steam intensity (and thus natural gas emissions intensity) per barrel. We have also seen some smaller, more mature projects operating in more challenging reservoirs in more challenging areas — all of which are often associated with higher emissions intensity — shut-in or replaced. We have also seen older wells in more challenging areas of larger operations phased out and replaced.

Mining operations experienced improved fleet optimization, better waste-heat integration, improved predictive maintenance and shorter maintenance turnaround periods.

Many mining and thermal efficiency gains contributed to higher productivity, which spread similar levels of absolute emissions over higher oil output.

These improvements are coupled with larger step-out technologies, such as the deployment of the Shell Quest Carbon Capture, Utilization and Storage (CCUS) project in 2015 and the completion of Suncor's coke boiler phaseout in 2024, further reducing product-level emissions.

Since 2009, legacy integrated mining operations that market synthetic crude oil (SCO) have seen the greatest improvement in emission intensity — down 32%. This was followed by the ramp-up of newer, unintegrated mines that market diluted bitumen, declining 18%.

In 2025, the marketable product-level GHG intensity of oil sands averaged 59 kilograms of CO<sub>2</sub> equivalent per barrel, 2% lower than in 2024.<sup>1</sup> At the same time, production rose by 150,000 barrels per day from 2024 to 2025. This pushed absolute emissions up to an estimated 89 million metric tons of CO<sub>2</sub> equivalent, 2% higher than in 2024.<sup>2,3</sup> These changes indicate that the incremental barrel coming from the oil sands is of much lower intensity than the average. Between 2024 and 2025, the marginal incremental GHG intensity of oil sands production growth averaged 33 kgCO<sub>2</sub>e/b.<sup>4</sup>

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1. Changes were made to S&P Global Energy's oil sands emissions model for this year's update. These changes affected the entire study period. Prior versions included upstream natural gas production emissions from the export of surplus power from cogeneration, which resulted in a credit value of about 439 kgCO<sub>2</sub>e/megawatt. Upstream natural gas fuels were removed to align with other S&P Global Energy upstream carbon-intensity product benchmarks. This increased carbon intensity estimates overall, with a larger impact earlier in our survey period due to higher electrical export intensity. Other changes included updated cogeneration intensity data from Alberta Environment and Parks.

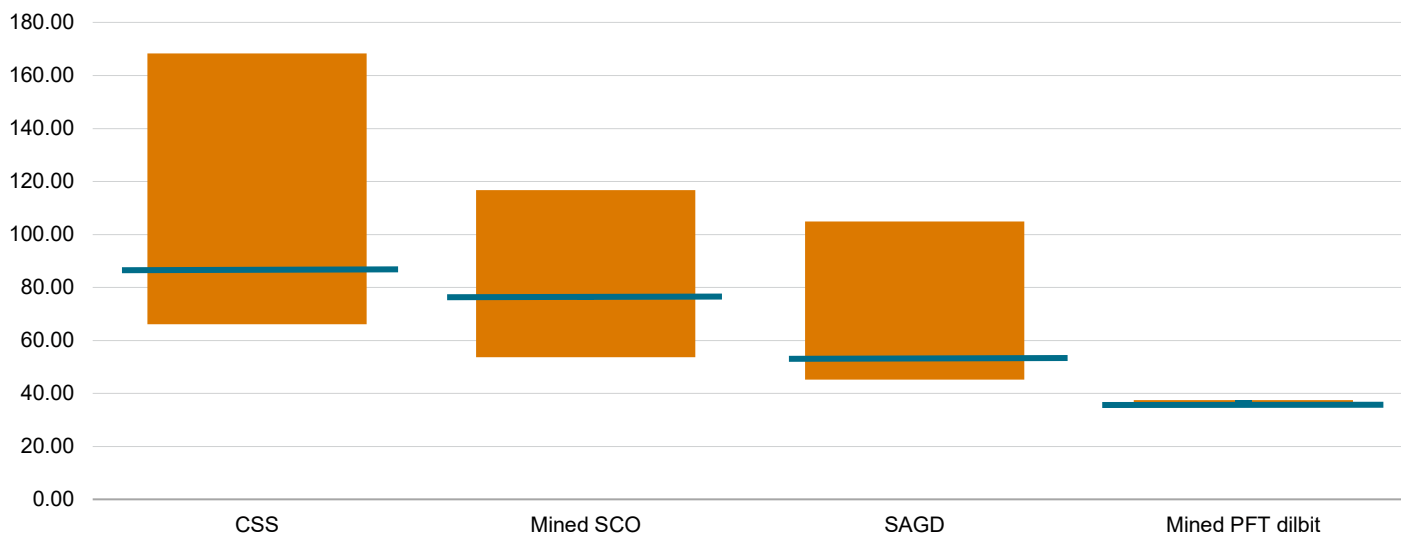
2. There are other system boundary differences of note between absolute emissions estimates and the GHG intensity of the oil sands marketable product. Absolute emissions estimates are aligned with National Inventory reporting and include all direct on-site emissions. Any electrical purchases that occur off-site and are imported are not included. GHG intensity estimates are consistent with life-cycle GHG accounting approaches, where any electrical power purchased and imported for use in the creation of oil sands marketable crude oil products is included. Similarly, any electrical power resulting from cogeneration that exceeds on-site use and is exported for other uses is not included.

3. S&P Global Energy's estimate of absolute oil sands emissions differs from Canada's National Inventory Report (NIR). Compared to the NIR, S&P Global Energy does not include the North West Redwater Sturgeon Refinery or the Lloydminster heavy oil upgrader, which do not exclusively process non-oil sands products. This can result in a discrepancy of about 2-3 MMtCO<sub>2</sub>e depending on the year. After adjusting for this difference, S&P Global Energy's absolute emissions are within 2% of the National Inventory over the past five years, with a larger error in the most recent year (2024), where S&P Global Energy's estimate is greater than the National Inventory.

4. The marginal emissions intensity is estimated as the total change in absolute emissions over the period divided by the change in production.

Figure 2

**Average and range of GHG intensity of oil sands extraction by technology (2025 in kgCO<sub>2</sub>e/b of marketed product)**



As of May 4, 2026.  
 Source: S&P Global Energy.  
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There is growing speculation that oil sands production growth may accelerate, with a potential expansion of processing and steam generation capacity. Without further expansion of CCUS capacity, an acceleration in absolute emissions growth should also be expected. However, the impact of production growth on oil sands' GHG intensity is more complex. As newer operations come online, they take time to ramp up and optimize, which is typically a more emissions-intensive period. SAGD dilbit is expected to dominate any acceleration in production growth. Given that SAGD is, on average, below the current oil sands intensity, depending on the scale and control of the ramp-up of these new facilities, greater SAGD dilbit volumes, coupled with further mining intensity improvements, could continue to push oil sands emissions intensity lower.

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