

INTERNATIONAL COMPARISONS OF

GAS FLARING AMONG TOP OIL PRODUCERS

Overview

This Fact Sheet analyzes the upstream oil industry's record on flaring in Canada relative to other top oil-producing countries. Gas flaring is the burning off of the natural gas that is generated in the process of oil extraction and production. Flaring is relevant because it is a source of greenhouse gas emissions (GHGs) (see Appendix).

In 2022, 138,549 million cubic meters (m³) (or 139 billion cubic meters (bcm)) of flared gases were emitted worldwide, creating 350 million tonnes of CO₂ emissions annually. Canada is a significant oil producer; it has the [third-largest](#) proven crude oil reserves and is the fourth-largest crude oil producer in the world (Natural Resources Canada, undated), and so contributes to flaring.

Flaring comparisons

This Fact Sheet uses World Bank data to provide international comparisons of flaring. It also draws on U.S. Energy Information Administration (EIA) crude oil production data to compare flaring among the top 10 crude oil producing countries.

Table 1 shows gas flaring volumes in 2012 and 2022. In absolute terms, Russia recorded more flaring than any other country at 25,495 million m³ (25.4 bcm) in 2022, which was 1,628 million m³ (7%) higher than in 2012.

The four countries that are the top GHG emitters through flaring (Russia, Iraq, Iran, and Algeria) accounted for 50% of global gas flaring in 2022.

At 945 million m³, Canada was the eighth lowest flarer in 2022 (23rd spot out of the top 30 countries). It decreased its flaring emissions by 320 million m³ from the 2012 level of 1,264 million m³, a 25% drop.

In 2022, Canada contributed just 0.7% of the global amount of gas flaring despite being the world's fourth largest oil producer (see Table 1).

Flaring declined worldwide between 2012 and 2022

Figure 1 shows the change in flaring volumes between 2012 and 2022. Nine countries flared more in 2022 than in 2012, while 21 countries flared less. In the last decade, the global flaring volume decreased by 3 percent.

- The three countries that most significantly increased flaring between 2012 and 2022 were the Republic of the Congo (65%), Iran (56%), and Iraq (41%).
- The three countries that most significantly decreased flaring between 2012 and 2022 were Uzbekistan (-76%), Columbia (-75%) and Kazakhstan (-74%).
- As noted earlier, flaring fell by 25% in Canada between 2012 and 2022.

Table 1

Gas Flaring Volumes from 2012 to 2022
(in million m³ flared/year) in the 30 Countries with
the Highest Volume of Flaring as of 2022

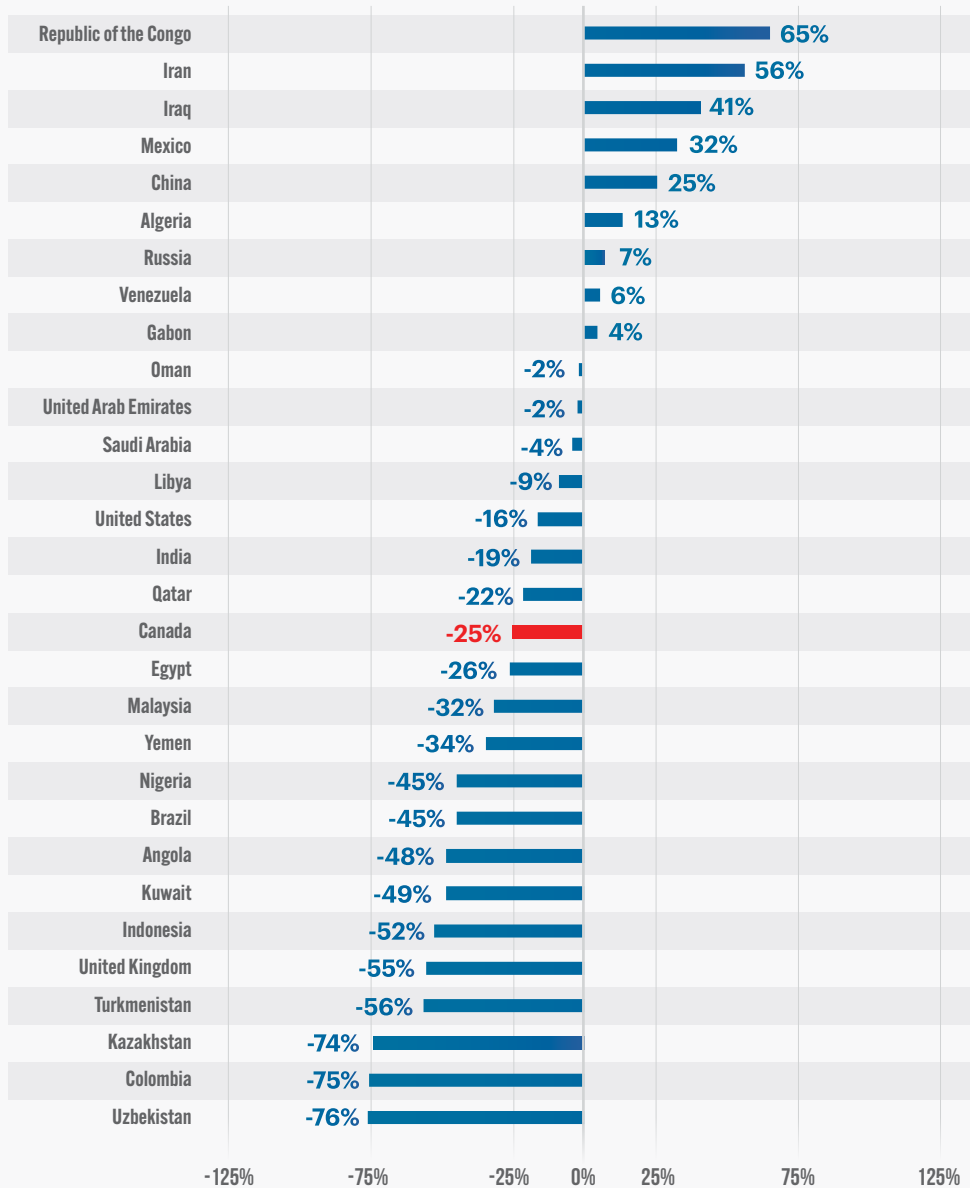
| Flaring Rank based on million m ³ gas flared in 2022 | Country | 2012 | 2022 | 2012 to 2022 change |
|--|-----------------------|--|----------------|------------------------|
| | | Million m ³ gas flared/year | | |
| 1 | Russia | 23,867 | 25,495 | 1,628 |
| 2 | Iraq | 12,701 | 17,903 | 5,202 |
| 3 | Iran | 11,027 | 17,221 | 6,194 |
| 4 | Algeria | 7,599 | 8,614 | 1,015 |
| 5 | Venezuela | 8,151 | 8,612 | 460 |
| 6 | United States | 9,530 | 7,967 | -1,563 |
| 7 | Mexico | 4,282 | 5,668 | 1,386 |
| 8 | Libya | 5,945 | 5,420 | -524 |
| 9 | Nigeria | 9,622 | 5,318 | -4,304 |
| 10 | China | 1,985 | 2,488 | 503 |
| 11 | Oman | 2,113 | 2,072 | -41 |
| 12 | Egypt | 2,668 | 1,969 | -698 |
| 13 | Saudi Arabia | 1,939 | 1,860 | -80 |
| 14 | Republic of the Congo | 1,104 | 1,820 | 716 |
| 15 | Indonesia | 3,537 | 1,682 | -1,854 |
| 16 | Angola | 3,247 | 1,676 | -1,571 |
| 17 | Malaysia | 2,364 | 1,610 | -754 |
| 18 | India | 1,911 | 1,555 | -356 |
| 19 | Gabon | 1,344 | 1,403 | 59 |
| 20 | Turkmenistan | 2,449 | 1,070 | -1,379 |
| 21 | Kazakhstan | 3,959 | 1,026 | -2,934 |
| 22 | Qatar | 1,260 | 987 | -273 |
| 23 | Canada | 1,264 | 945 | -320 |
| 24 | United Arab Emirates | 949 | 927 | -22 |
| 25 | Brazil | 1,595 | 881 | -714 |
| 26 | Yemen | 1,110 | 728 | -383 |
| 27 | Kuwait | 1,132 | 582 | -550 |
| 28 | United Kingdom | 1,296 | 579 | -717 |
| 29 | Uzbekistan | 1,828 | 438 | -1,390 |
| 30 | Colombia | 984 | 244 | -741 |
| | Rest of world | 10,503 | 9,790 | -713 |
| | Global total | 143,267 | 138,549 | -4,718 |

Source: World Bank (Undated).

Figure 1

Global Gas Flaring, 2022 vs. 2012

Percent change in million m³ gas flared/year



Source: World Bank (Undated).

Comparing flaring to increased production

The decreases in flaring in Canada between 2012 and 2022 shown in Table 1 and Figure 1 understate the magnitude of the decline in flaring in the country. That is because Canada’s crude oil production increased by 45% in that period, even as absolute flaring decreased by 25% (see Table 2).

Canada compares very favourably with the United States, which increased crude oil production by 82% and decreased flaring by 16%.

Table 2

Comparing Countries on Oil Production* and Flaring

2012 vs. 2022 (percent change)

| Rank | Country | Production increase or decrease of crude oil | Increase or decrease in absolute gas flaring |
|------|-----------------------|--|--|
| 1 | United States | 82% | -16% |
| 2 | Iraq | 50% | 41% |
| 3 | Brazil | 47% | -45% |
| 4 | Canada | 45% | -25% |
| 5 | United Arab Emirates | 16% | -2% |
| 6 | Oman | 16% | -2% |
| 7 | Kazakhstan | 14% | -74% |
| 8 | Kuwait | 7% | -49% |
| 9 | Saudi Arabia | 6% | -4% |
| 10 | Republic of the Congo | 5% | 65% |
| 11 | Russia | 4% | 7% |
| 12 | China | 0.5% | 25% |
| 13 | Iran | -3% | 56% |
| 14 | Qatar | -11% | -22% |
| 15 | Egypt | -12% | -26% |
| 16 | Turkmenistan | -13% | -56% |
| 17 | Malaysia | -14% | -32% |
| 18 | Gabon | -15% | 4% |
| 19 | United Kingdom | -16% | -55% |
| 20 | Colombia | -21% | -75% |
| 21 | Algeria | -21% | 13% |
| 22 | India | -23% | -19% |
| 23 | Libya | -26% | -9% |
| 24 | Indonesia | -29% | -52% |
| 25 | Mexico | -34% | 32% |
| 26 | Angola | -35% | -48% |
| 27 | Nigeria | -46% | -45% |
| 28 | Uzbekistan | -48% | -76% |
| 29 | Yemen | -71% | -34% |
| 30 | Venezuela | -72% | 6% |

*Ranking based on increase (decrease) in crude oil production.

Sources: World Bank (Undated) and EIA (2023).

Largest oil producers and flaring intensity

To fully grasp how much more effective Canada has been than many other oil producers in reducing flaring, Table 3 compares both flaring intensity (gas flared per unit of oil production) and crude oil production among the top 10 oil producing countries (which account for 73% of the world oil production).

Canada is the fourth-largest producer of crude oil, and its gas flaring intensity declined by 48% between 2012 and 2022. Four of the top 10 oil producers witnessed their flaring intensity increase between 2012 and 2022.

Table 3

Top 10 Oil Producers* and Flaring Intensity

| | Million barrels per day (2022) | Share of world total (2022) | Global Gas Flaring Intensity for Crude Oil Production, 2012 | Global Gas Flaring Intensity for Crude Oil Production, 2022 | Percent change in m ³ gas flared per barrel of oil produced (m ³ /b) 2022 vs. 2012 |
|----------------------|--------------------------------|-----------------------------|---|---|--|
| United States | 20.21 | 20% | 3.99 | 1.84 | -54% |
| Saudi Arabia | 12.14 | 12% | 0.53 | 0.48 | -10% |
| Russia | 10.94 | 11% | 6.57 | 6.80 | 3% |
| Canada | 5.70 | 6% | 1.10 | 0.57 | -48% |
| China | 5.12 | 5% | 1.33 | 1.67 | 25% |
| Iraq | 4.55 | 5% | 11.63 | 10.97 | -6% |
| United Arab Emirates | 4.24 | 4% | 0.87 | 0.73 | -15% |
| Brazil | 3.77 | 4% | 2.11 | 0.80 | -62% |
| Iran | 3.66 | 4% | 8.90 | 14.33 | 61% |
| Kuwait | 3.02 | 3% | 1.17 | 0.56 | -52% |
| Total top 10 | 73.36 | 73% | 3.87* | 3.87 | 1% |
| World total | 99.89 | | 5.11 | 4.72 | -8% |

*Arithmetic mean of top 10 oil producers.

Sources: World Bank (undated) and EIA (2023).

Conclusion

Gas flaring contributes to greenhouse gas emissions. However, it is possible for countries to both increase their oil production and still reduce flaring. Canada is one noteworthy example of a country that has significantly reduced flaring not only compared to its increased production of crude oil, but also in absolute terms.

Appendix

Background

Flaring and venting are two ways in which an oil or natural gas producer can dispose of waste gases. Venting is the intentional controlled release of uncombusted gases directly to the atmosphere, and flaring is combusting natural gas or gas derived from petroleum in order to dispose of it.¹ As Matthew R. Johnson and Adam R. Coderre noted in their [2012 paper](#) on the subject, flaring in the petroleum industry generally falls within three broad categories:

- **Emergency flaring** (large, unplanned, and very short-duration releases, typically at larger downstream facilities or off-shore platforms);
- **Process flaring** (intermittent large or small releases that may last for a few hours or a few days as occurs in the upstream industry during well-test flaring to assess the size of a reservoir or at a downstream plant during a planned process blowdown); and
- **Production flaring** (may occur continuously for years while oil is being produced).

To track GHGs from flaring and venting, Environment Canada (2016) [defines](#) such emissions as:

- **Fugitive emissions:** Unintentional releases from venting, flaring, or leakage of gases from fossil fuel production and processing, iron and steel coke oven batteries, or CO₂ capture, transport, injection, and storage infrastructure.
- **Flaring emissions:** Controlled releases of gases from industrial activities from the combustion of a gas or liquid stream produced at a facility, the purpose of which is not to produce useful heat or work. This includes releases from waste petroleum incineration, hazardous emission prevention systems, well testing, natural gas gathering systems, natural gas processing plant operations, crude oil production, pipeline operations, petroleum refining, chemical fertilizer production, and steel production.
- **Venting emissions:** Controlled releases of a process or waste gas, including releases of CO₂ associated with carbon capture, transport, injection, and storage; from hydrogen production associated with fossil fuel production and processing; of casing gas; of gases associated with a liquid or a solution gas; of treater, stabilizer, or dehydrator off-gas; of blanket gases; from pneumatic devices that use natural gas as a driver; from compressor start-ups, pipelines, and other blowdowns; and from metering and regulation station control loops.

Notes

This CEC Fact Sheet was compiled by Ven Venkatachalam and Lennie Kaplan at the Canadian Energy Centre: www.canadianenergycentre.ca. All percentages in this report are calculated from the original data, which can run to multiple decimal points. They are not calculated using the rounded figures that may appear in charts and in the text, which are more reader friendly. Thus, calculations made from the rounded figures (and not the more precise source data) will differ from the more statistically precise percentages we arrive at using source data. The authors and the Canadian Energy Centre would like to thank and acknowledge the assistance of an anonymous reviewer in reviewing the data and research for this Fact Sheet. Image credits: Gas is burned off at a mobile flare system in Germany. Getty Images photo

References (All links live as of September 23, 2023)

Alberta Energy Regulator (2022), Directive O60: Upstream Petroleum Industry Flaring, Incinerating, and Venting <<https://bit.ly/3AMYett>>; BC Oil and Gas Commission (2021), Flaring and Venting Reduction Guideline, version 5.2 <<https://bit.ly/3CWRa0i>>; Canada-Newfoundland and Labrador Offshore Petroleum Board (2007), Offshore Newfoundland and Labrador Gas Flaring Reduction <<https://bit.ly/3RhKpKu>>; D&I Services (2010), Saskatchewan Energy and Resources: S-10 and S-20 <<https://bit.ly/3TBrVGj>>; Johnson, Matthew R., and Adam R. Coderre (2012), Compositions and Greenhouse Gas Emission Factors of Flared and Vented Gas in the Western Canadian Sedimentary Basin, *Journal of the Air & Waste Management Association* 62, 9: 992-1002 <<https://bit.ly/3cJRqPd>>; Environment Canada (2016), Technical Guidance on Reporting Greenhouse Gas Emissions/Facility Greenhouse Gas Emissions Reporting Program <<https://bit.ly/3CVQR5C>>; Natural Resources Canada (Undated), Oil Resources <<https://bit.ly/3oWWhW0>>; U.S. Energy Information Administration (undated), Petroleum and Other Liquids <<https://bit.ly/2Ad6S9i>>; World Bank (Undated), Global Gas Flaring Data <<https://bit.ly/3zXuxGX>>.

Creative Commons Copyright

Research and data from the Canadian Energy Centre (CEC) is available for public usage under creative commons copyright terms with attribution to the CEC. Attribution and specific restrictions on usage including non-commercial use only and no changes to material should follow guidelines enunciated by Creative Commons here: [Attribution-NonCommercial-NoDerivs CC BY-NC-ND](#).

1. Many provinces regulate flaring and venting including Alberta ([Directive O60](#)) British Columbia ([Flaring and Venting Reduction Guideline](#)), and Saskatchewan ([S-10 and S-20](#)). Newfoundland & Labrador also has regulations that govern [offshore flaring](#).