

International comparisons on gas flaring

Canadian Energy Centre

This Fact Sheet analyzes the record on flaring and venting of gases in Canada's upstream oil and gas industry relative to other countries. The issue, while technical in nature, is relevant given that this is a source of greenhouse gas emissions (GHGs). For example, in 2018, 145 billion cubic metres (bcm) of flared gases were emitted worldwide, or just under 280 megatonnes of CO₂ equivalent. It is also relevant given that Canada is a major producer of oil and natural gas, with the third-largest proven [reserves](#) of crude oil and the [17th largest reserves](#) of natural gas, and the fourth-largest producer of both commodities.

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 un-combusted gases directly to the atmosphere, and flaring is a disposal by combustion of natural gas or gas derived from petroleum.)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** (which may occur continuously for years as the resource, oil, is being produced).

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

- **Fugitive emissions:** Releases from venting, flaring or leakage of gases from fossil fuel production and processing; iron and steel coke oven batteries; 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 the facility, the purpose of which is not to produce useful heat or work. This includes releases from waste petroleum incineration; hazardous emission prevention systems (in pilot or active mode); 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 which use natural gas as a driver; from compressor start-ups, pipelines, and other blowdowns; and from metering and regulation station control loops.

Flaring comparisons

This Fact Sheet provides international data comparisons on flaring only (given limited international data on venting) based on World Bank data. It also compares flaring by country with production for major petroleum (and others liquids) producing countries using U.S. Energy Information Administration (IEA) data.

¹ Many provinces regulate flaring and venting including Alberta ([Directive 060](#)) British Columbia ([Flaring and Venting Reduction Guideline](#)), and Saskatchewan ([S-10 and S-20](#)). Newfoundland & Labrador also has regulations that govern [offshore flaring](#).

Table 1 shows gas flaring volumes in 2014 and 2018. In absolute terms, Russia recorded more flaring than any other country at 21.3 billion cubic metres (bcm) in 2018, three bcm or 16% higher than in 2014. Among the 30 countries measured, Australia flared the least at 0.9 bcm or 18% less than in 2014. Canada was the 22nd lowest in 2018 at 1.3 bcm, and recorded a decrease of 0.8 bcm from 2.1 bcm in 2014, or 38%.

Figure 1

**Gas flaring volumes
2014–2018** (billion cubic meters)
30 highest-volume countries
(as of 2018)

		2014	2018	2014-18 change	2014-18 change
		(billion cubic meters)		(percent)	
1	Russia	18.3	21.3	3.0	16%
2	Iraq	14.0	17.8	3.8	27%
3	Iran	12.2	17.3	5.1	42%
4	United States	11.3	14.1	2.8	25%
5	Algeria	8.7	9.0	0.3	3%
6	Venezuela	10.0	8.2	-1.8	-18%
7	Nigeria	8.4	7.4	-1.0	-12%
8	Libya	2.9	4.7	1.8	62%
9	Mexico	4.9	3.9	-1.0	-20%
10	Angola	3.5	2.8	-0.7	-20%
11	Oman	2.6	2.5	-0.1	-4%
12	Saudi Arabia	1.9	2.3	0.4	21%
13	Egypt	2.8	2.3	-0.5	-18%
14	Malaysia	3.4	2.2	-1.2	-35%
15	Indonesia	3.1	2.1	-1.0	-32%
16	Kazakhstan	3.9	2.0	-1.9	-49%
17	China	2.1	1.8	-0.3	-14%
18	Rep. of the Congo	1.3	1.6	0.3	23%
19	Turkmenistan	2.0	1.5	-0.5	-25%
20	Gabon	1.5	1.4	-0.1	-7%
21	India	1.9	1.3	-0.6	-32%
22	Canada	2.1	1.3	-0.8	-38%
23	United Kingdom	1.3	1.2	-0.1	-8%
24	UAE	0.9	1.2	0.3	33%
25	Cameroon	0.9	1.1	0.2	22%
26	Brazil	1.5	1.0	-0.5	-33%
27	Qatar	1.3	1.0	-0.3	-23%
28	Ecuador	1.0	0.9	-0.1	-10%
29	Kuwait	1.4	0.9	-0.5	-36%
30	Australia	1.1	0.9	-0.2	-18%
	Rest of world	11.7	8.1	-3.6	-31%
	Global total	143.9	145.0	1.1	1%

Source: World Bank

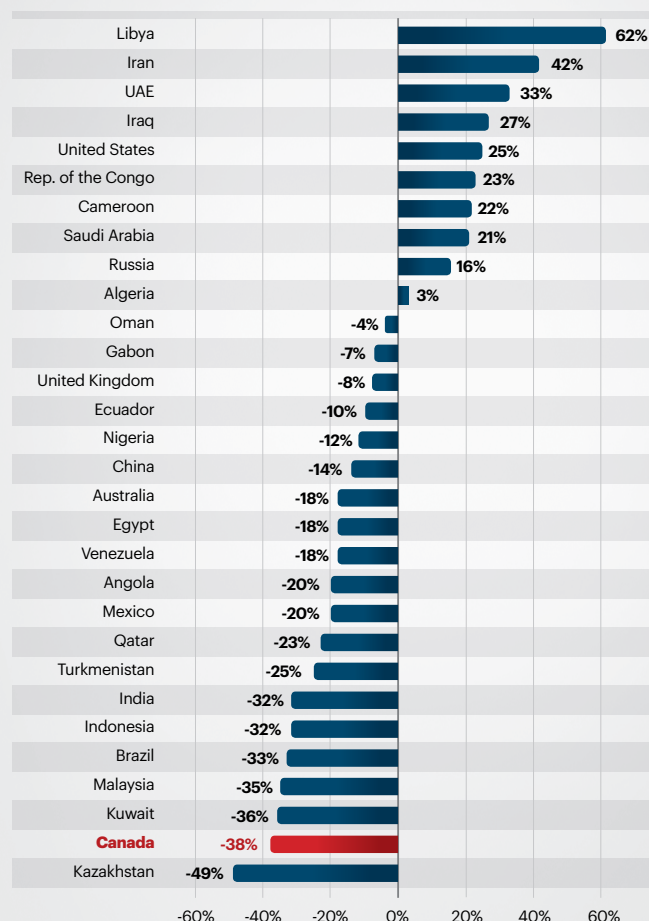
Ten countries flared more in 2018; 20 countries flared less

Figure 2 also shows changes in flaring volumes. In total, ten countries flared more in 2018 compared with 2014, while 20 countries flared less.

- The countries that showed the greatest increase in flaring were the United Arab Emirates (33%), Iran (42%) and Libya (62%).
- The countries that showed the greatest decrease in flaring were Kazakhstan (-49%), Canada (-38%) and Kuwait (-36%).

Figure 2

**Gas flaring
2018 vs. 2014**
(%)



Source: World Bank

Figure 3: Comparing flaring to increased production

- The decreases for Canada in Figures 1 and 2 understate the magnitude of the decrease in flaring between 2014 and 2018. The reason for that is that Canada's production of petroleum and other liquids has increased by 22%, all the while decreasing flaring by 38%.²
- In contrast, Venezuela, as one example, decreased flaring by 18% but this was driven in part by steep production declines (43% less in 2018 compared to 2014).
- In another example, the United States increased production of petroleum and other liquids by 27%, similar to Canada's 22% rise, but unlike Canada, U.S. flaring increased by 25%.

To fully grasp how much more efficient Canada has been in reducing flaring, Figure 3 compares both flaring and production.

The takeaway

Global flaring and venting of gases contribute to greenhouse gas emissions. Canada is an example of a producer country of petroleum and other liquids where a significant reduction in flaring has occurred not only in absolute terms but also when compared with increased production volumes.

Notes: This CEC Fact Sheet was compiled by Ven Venkatachalam and Mark Milke at the Canadian Energy Centre: www.canadianenergycentre.ca. The authors and the Canadian Energy Centre would like to thank and acknowledge the assistance of Philip Cross and Dennis Sundgaard in reviewing the data and research for this Fact Sheet. Image credit: 'Oil refinery in industrial estate at sunset' by Kampee Patisena.

Sources: (Links live as of June 11, 2020) Alberta Energy Regulator (2020). Directive 060. <<https://bit.ly/37jrLfi>>; BC Oil and gas Commission (2018). Flaring and Venting Reduction Guideline. <<https://bit.ly/3frjDfJ>>; Saskatchewan Energy & Resources (2010). S-10 and S-20. <<https://bit.ly/2BY68Wg>>; Canada-Newfoundland and Labrador Offshore Petroleum Board (2007). Offshore Newfoundland and Labrador Gas Flaring Reduction. <<https://bit.ly/30zqaAC>>; Environment and Climate Change Canada (2020). Facility Greenhouse Gas Reporting. Technical Guidance on Reporting Greenhouse Gas Emissions—2019 data. <<https://bit.ly/2AURpe7>>; 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>>; Natural Resources Canada (undated). Crude Oil Facts. <<https://bit.ly/3dSAzen>>; Natural Resources Canada (undated). Natural Gas Facts. <<https://bit.ly/2XN7kEe>>; International Energy Agency (2019). Tracking Fuel Supply, 2019. <<https://bit.ly/2YnU0FC>>; U.S. Energy Information Administration (undated). Petroleum and other liquids. <<https://bit.ly/2Ad6S9i>>; World Bank (undated). Gas flaring volumes 2014-2018. <<https://bit.ly/2MDsX3p>>.

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Figure 3

Countries ranked by increased production and compared on flaring

		Production increase (decrease) 2018 vs. 2014	Gas flaring increase (decrease) 2018 vs. 2014
1	Libya	86%	62%
2	Rep of the Congo	44%	23%
3	Iraq	37%	27%
4	Iran	31%	42%
5	United States	27%	25%
6	United Kingdom	25%	-8%
7	Canada	22%	-38%
8	Brazil	15%	-33%
9	Kazakhstan	14%	-49%
10	Malaysia	12%	-35%
11	Saudi Arabia	7%	21%
12	UAE	7%	33%
13	Russia	5%	16%
14	Oman	4%	-4%
15	Kuwait	4%	-36%
16	Turkmenistan	2%	-25%
17	Indonesia	0%	-32%
18	India	0%	-32%
19	Egypt	-5%	-18%
20	China	-5%	-14%
21	Qatar	-5%	-23%
22	Angola	-6%	-20%
23	Ecuador	-7%	-10%
24	Algeria	-8%	3%
25	Cameroon	-8%	22%
26	Gabon	-11%	-7%
27	Nigeria	-17%	-12%
28	Australia	-17%	-18%
29	Mexico	-26%	-20%
30	Venezuela	-43%	-18%

Sources: World Bank and U.S. Energy Information Administration

² As per the U.S. Energy Information Administration data sources, this measurement includes the production of crude oil (including lease condensate), natural gas plant liquids, and other liquids. It also includes refinery processing gain for volume (TBPD) only.