Relative performance of countries on flaring, venting and leaking

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How data and carefully selected metrics can accelerate action

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A Capterio Perspectives article

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Objectives of this paper

Flaring, venting and leaking are major — and potentially avoidable — sources of emissions from the oil and gas industry. Yet all three remain stubbornly high.

This is not simply an emissions problem; it is a resource-efficiency problem. Every molecule of gas flared, vented or leaked is potentially valuable energy that never reaches the market. The wide variation in performance between countries shows that this waste is not inevitable.

That matters more than ever. At a time of heightened concern over energy security and diversification, reducing avoidable losses should be an obvious priority. Before searching for new molecules, surely, we should make better use of the ones we already produce?

In part 1, this paper aims to answer three questions, each of which has not (to the best of our knowledge) been properly addressed in the increasingly extensive literature on this topic:

1. *How much gas is wasted?* We **integrate data from all sources of upstream waste**, which include flaring, venting and leaking, to understand the total level of wasted gas. Most other literature refers to methane (CH4) – ignoring flaring (which mostly delivers CO2). These silos are unhelpful. And yet both are material sources of waste.

2. *How do countries compare on scales of waste?* We **present data on a country basis**, integrating data on waste methane from the IEA Methane Tracker and waste flared gas from the World Bank. Few reports are joined up to expose the total level of waste; for example, the IEA reports on methane (in units of million tonnes), and the World Bank reports on flaring (in billion cubic metres, BCM). Yet both forms of waste represent economic opportunity – and this is best understood in a common set of units.

3. *How do countries perform on intensity metrics, and which metrics are most insightful?* We **compute and compare multiple options for country-level intensity metrics**. Most papers discuss options for metrics (there are many) – *but only in the abstract, sometimes with illustrative examples* (or without significant depth). We weigh in with views on the relative merits of several options, underpinned and illustrated with the best available data. The country-level data presented here (even if some may challenge it) is likely directionally correct, rich with insight, and urgently needs to be understood and acted upon.

   Because metric choice is complex (and can be prone to lobbying), we discuss some of the main issues and point the reader to other comprehensive analyses.

For clarity, we emphasise that the figures below are necessarily based on estimates of upstream flaring, venting and leaking. We do not consider other sources of emissions (e.g. energy used in the production of energy), or other sources of waste (e.g. methane from the transportation of gas as LNG or pipe). These considerations are important, but not part of this analysis.

In part 2, we draw conclusions and offer ideas to accelerate waste reduction.

* * *

This work builds on various recent publications, including "*Methane by the Numbers: The Need for Clear and Comparable Methane Intensity Metrics*" by Johnson et al, 2026[1] and "*Methane intensity for oil and gas production: key methodological considerations*" by Carbon Limits and the CATF, 2026 and others.

[1] https://doi.org/10.1021/acs.est.5c13990, Environmental Science Letters

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Part 1: Analysis of core data on the scale and intensity of wasted gas

Question 1: How much gas is wasted from flaring, venting and leaking?

Surprisingly, this question is relatively rarely addressed, hindered by silos. Flaring, venting and leaking are (perhaps inevitably) measured separately, using different methodologies, by different institutions, and reported, by choice, in different units. Methane, for example, is usually reported in millions of tonnes whereas flaring is reported in billions of cubic metres. Tonnes speak to a problem. Cubic metres speak to opportunity. We prefer the latter.

Our analysis, powered by Capterio's global "WasteIntel" model, combines country-level data on emissions and production with site-level observations of all flares globally, plus selected methane sources. Our primary country-level data sources are the IEA's Methane Tracker (which estimates methane from flaring (through incomplete combustion), venting, and leaking) and the World Bank (which is similar to our proprietary algorithms in our real-time analytics platform, FlareIntel). We refer to these primary sources but note that – especially for methane – numerous studies have different estimates, although most "top-down" figures are significantly larger than company-reported "bottom-up" figures.

Figure 1 has the global overview, and – for context – we present the global numbers for the wasted gas together[2] with the global numbers for produced gas[3]. To bring the numbers to life, we present them in gas volume terms (left), revenue potential (middle) and in CO2-equivalent emission terms (right), using a Global Warming Potential of methane of 82.5 times that of CO2 on a mass basis over a 20-year period[4].

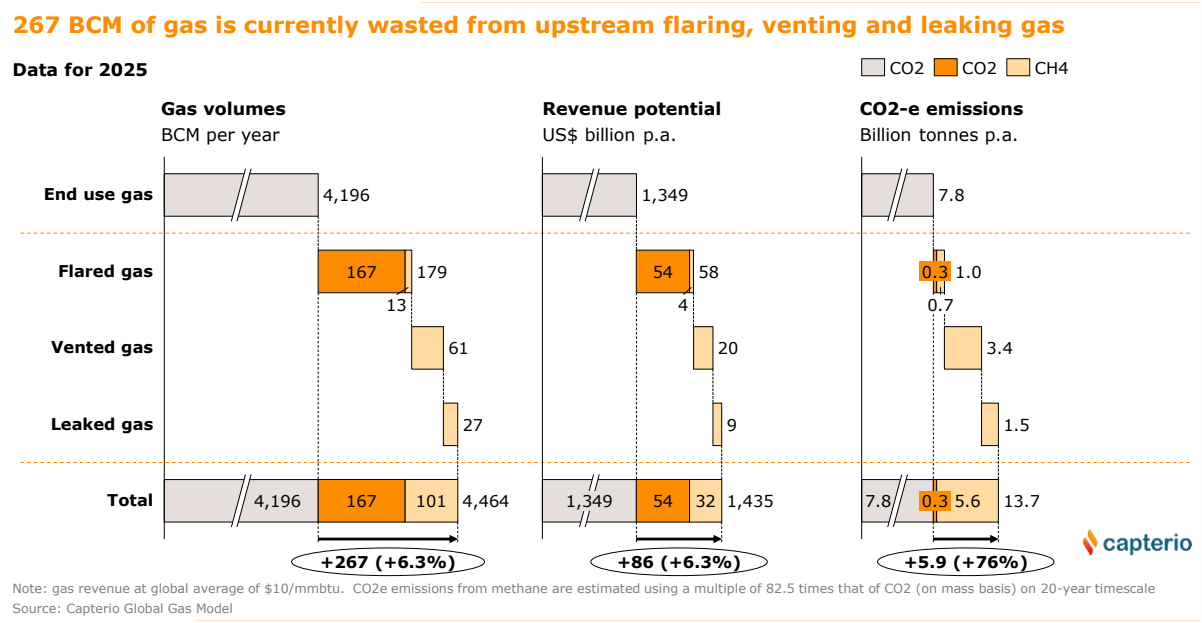

Figure 1: Overview of wasted gas globally from flaring, venting and leaking, expressed in volume (BCM per year), revenue potential (billion dollars per year – at a notional price of $10 per million btu) and in CO2-

[2] Regular readers may notice that we have produced this chart every year since 2018 and remain surprised by the continued silos between flaring vs methane

[3] Using data from the Energy Institute Statistical Review of World Energy

[4] Incidentally, on many occasions we note that the important distinction between a mass- and volume-basis is misunderstood (e.g. Aldy et al, 2026: "*Methane Abatement Costs in the Oil and Gas Industry*"). 82.5x more potent on a mass basis is equivalent to 30x on a volume basis (since the molecular weight difference between CO2 and CH4 is 44/16, i.e. 2.75)

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equivalent emissions (assuming Global Warming Potential of methane of 82.5 that of CO2 – on a mass basis – over a 20-year period).

Some 267 BCM is currently wasted from flaring, venting and leaking globally per year. Compare that to the 4196 BCM of gas consumed, and it's a staggering 6.3%. If waste was a country, at 267 BCM it would rank global #3, after the US (1074 BCM) and Russia (609 BCM)[5]. Put differently, this wasted gas is nearly double the volume that Europe previously imported from Russia. It is also 9.1 EJ of energy, the equivalent of 2,400 moderate-sized LNG cargoes and US$2,700 per second of waste[6], 158 GW of continuous electrical power (1380 TWh per year, assuming 55% conversion efficiency), enough to power 512 million UK-equivalent homes with power[7]. The IEA estimates that data centres consumed 475 TWh per year[8] (1.71 EJ) suggesting that wasted gas (after conversion losses) could power 2.9x all data centres operating last year. Equally, as the figure shows, the waste is also 5.9 Gigatonnes of CO2-equivalent emissions[9] – meaning that these scope 1 emissions (when methane is put in CO2-e terms) are on a par with the scope 3 emissions from the combusted gas. This figure is also significant compared to the total CO2 emissions of energy (some 38.4 billion tonnes in 2025[10]), meaning that flaring and methane account for 15% of the scope 3 emissions from energy. If fully oxidised, it would create 435 million tonnes of water per year (equivalent to 2-3 very large desalination plants). By almost any measure – energy, value or emissions – this is a problem of global significance

Questions 2 and 3: analysis of country-level metrics on an absolute and relative basis

In addition to discussing the absolute scale of waste, this section inevitably explores metrics on a relative ("intensity") basis in addition to absolute terms. The core numbers centre on global estimates of energy and wasted gas from upstream oil and gas, as shown in Figure 2.

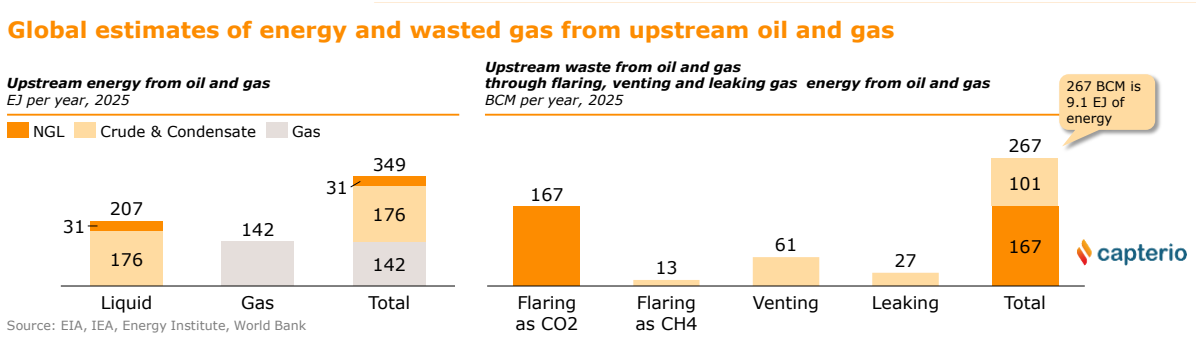

Figure 2: Global energy (left) and waste (right) from upstream oil and gas. These key inputs are used to define the numerator and denominator of metrics and the derived intensities discussed below.

As Johnson et al[11] note, intensity metrics are "*fraught with methodological challenges, […] definitions, terminology and different bases*" which adds much confusion. To create alignment across the industry, the CATF funded a significant report by Carbon Limits exploring the pros and cons of a range of metrics. Carbon Limits notes that metric design choices include whether

[5] Gas production data from the Energy Institute Statistical Review of World Energy, June 2026.
[6] At a notional figure of $10 per mmbtu (although we appreciate that this is likely to vary significantly by country, especially domestically in countries with heavy subsidies
[7] Based on the UK's average electricity consumption, assuming 55% efficiency of a gas-fired power station.
[8] https://www.iea.org/reports/key-questions-on-energy-and-ai/executive-summary
[9] Assuming CH4 is 82.5x more potent than CO2 (on a mass basis) over a 20-year period. On a 100-year basis, methane is 29.8x that of CO2, meaning that the CO2-equivalent emissions are 2.3 billion tonnes in 2025.
[10] https://www.iea.org/reports/global-energy-review-2026/co2-emissions
[11] "*Methane by the Numbers: The Need for Clear and Comparable Methane Intensity Metrics*" by Johnson et al, 2026. https://doi.org/10.1021/acs.est.5c13990, Environmental Science Letters

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to use a single formula (or not) for oil vs gas, produced vs marketed product, choices about granularity and scope, and methane vs total gas and relevant units.

Throughout this paper, we discuss a set of useful metrics that all flow from data on scale of waste (the numerator) and production volume (the denominator) as presented in Figure 2. We convert the underlying energy production, measured in EJ, into BCM-equivalent terms[12,13] to ensure that both production and waste are expressed on a common basis.

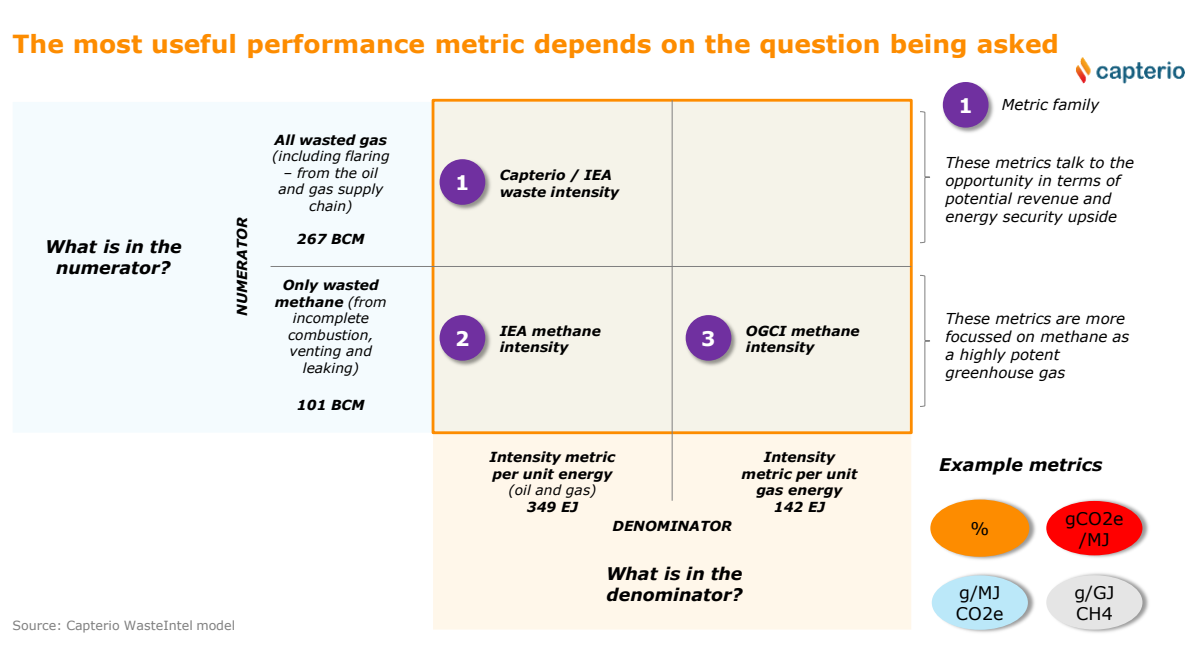

Figure 3: A conceptual framework that is used to define and summarise (in Figure 12) some of the most useful intensity metrics for waste and methane. The "metric families" highlighted in purple in the figure are also referenced below.

We return to this framework in Figure 12, populated with the global results derived through the analysis that follows.

In the calculations that follow, we present intensity metrics on both a unit-of-energy basis (e.g. g/GJ) and a dimensionless basis (i.e. a percentage of energy). Other options for the units of the denominator include "per barrel", "per BCM", per "oil-equivalent tonne", etc. Figures 8 and 11 and Table 1 provide a comparative illustration of the impact of some of these design choices.

Our figures and approach is significantly more detailed than recent work, including the infamous WoodMac[14] vs Rystad Energy[15] reports. The former includes has only one page on this topic does not mention intensity.

Metric family #1: Waste intensity — all wasted gas / all oil & gas energy

[12] For gas, our calculations are reported at 15 degrees Celsius and 1 atmosphere. We assume 0.03392 EJ per BCM (using the low heating value), and methane has a density of 0.6784 kg/m3

[13] For oil, we use 5.71 GJ/barrel derived from the IEA

[14] https://www.fuelseurope.eu/uploads/files/modules/publications/1773042008_2026_03_09%20-%20EU%20Methane%20Emissions%20Regulation%20Study.pdf

[15] https://library.edf.org/AssetLink/7000haw3l6ml1w87b58kilq13tirkfoh.pdf

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To explore the scale of waste/opportunity by country, it is instructive to look both in absolute and relative, i.e. intensity terms. We therefore also integrate oil, condensate, gas and natural gas liquids (NGL) production data from the Energy Institute and the Energy Information Agency[16].

For clarity, our first *waste intensity* metric differs from the *methane intensity* metric(s) commonly used because it includes waste from flaring. The 267 BCM of wasted gas from flaring, venting and leaking globally is equivalent to 9.1 EJ of energy. Compared to the total energy of 349 EJ, this represents a global waste rate of 2.6%, although performance varies widely by country.

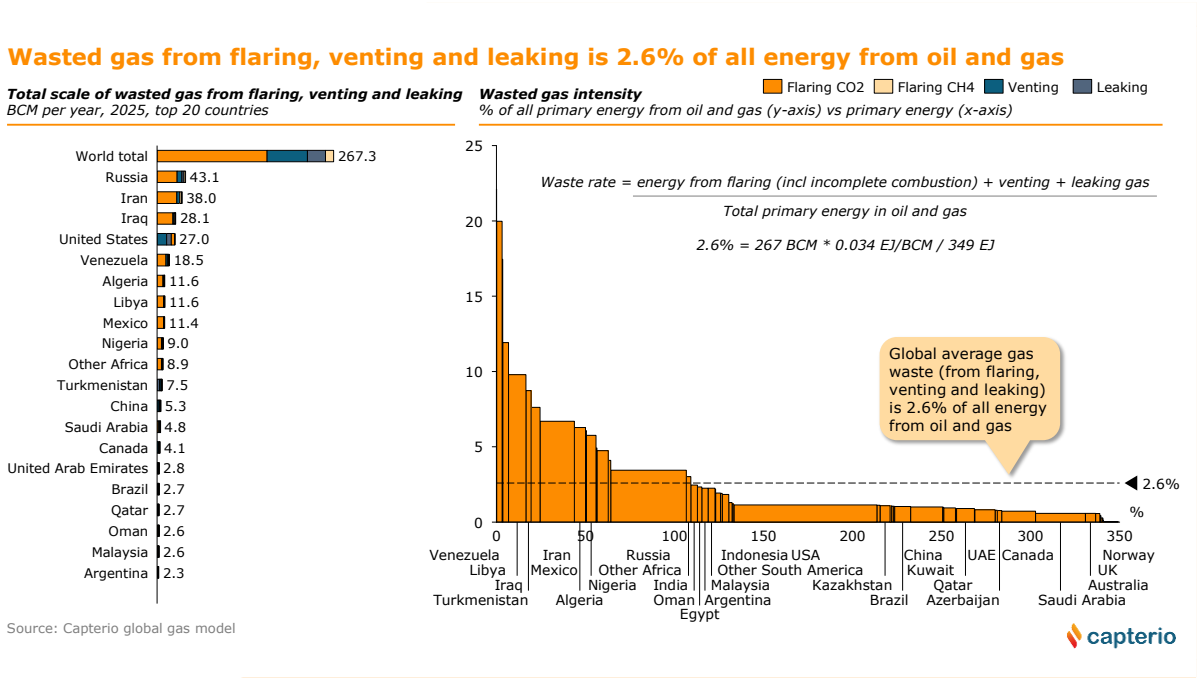

Figure 4: global league table of flaring, venting and leaking gas for top countries. Left chart shows absolute waste in BCM, and right chart shows the waste in percentage terms.

The variation, however, between countries is striking. Norway wins at 0.03% of its produced energy from oil and gas wasted through flaring, venting and leaking, whereas Venezuela wastes 19%, and Libya and Turkmenistan both waste 11%. It is hard to believe that some of the very high rates of wasted gas are acceptable in today's world where energy security, affordability and climate concerns collide.

Nevertheless, it is also useful to explore how these losses/waste vary between oil and gas supply chains. For this analysis, guided by the IEA, we make a number of assumptions to allocate flaring, venting and leaking between oil and gas. According to the IEA's analysis/model, most flaring is associated with the oil supply chain, while methane leakage from venting and leaking is roughly equally split between the oil and gas supply chains. Globally, 37 BCM is therefore attributed to the gas supply chain (some 13.9% of the total), with 230 BCM to the oil supply chain (accounting for the overwhelming majority of flaring, for example).

While necessarily approximate (and potentially contentious and certainly hard to allocate in practice in complex integrated systems), we think this provides a useful first-pass view. Equally, it reveals some interesting insights into the very different patterns of waste and

[16] For purposes of the calculations, we attribute NGLs to the gas supply chain

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emissions across oil and gas supply chains. Figure 5 shows how the league table varies markedly between the oil and gas supply chains on an "intensity" basis.

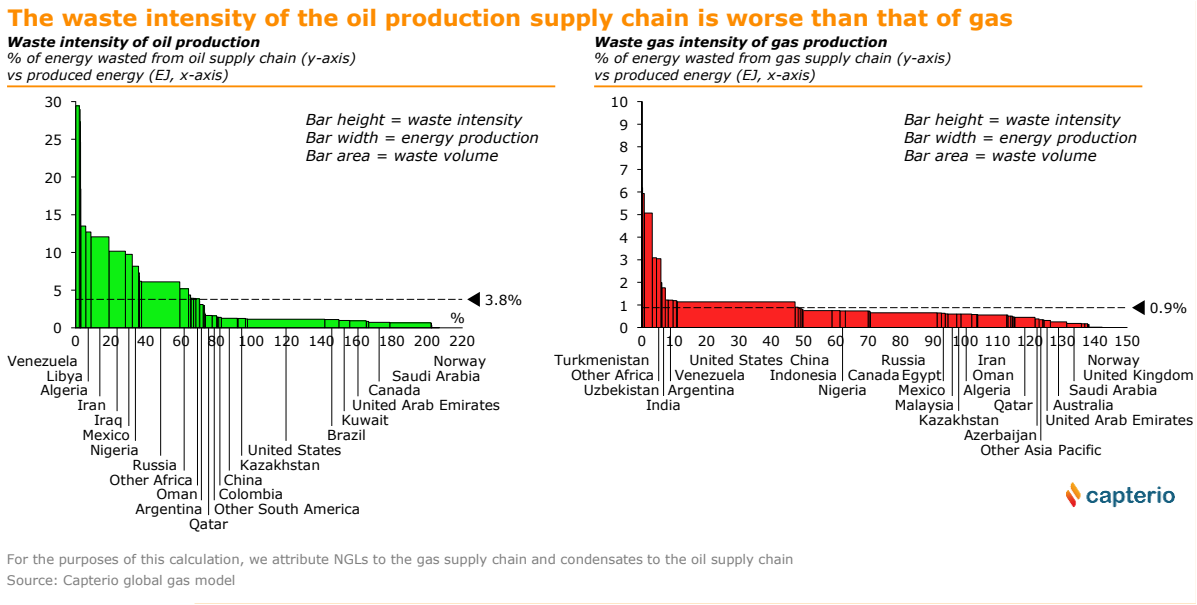

Figure 5: Waste rates from the oil and gas supply chains – noting that flaring, venting and leaking can be allocated to their respective supply chains.

The analysis reveals a striking — and perhaps counter-intuitive — result: oil production is considerably more wasteful of gas than gas production itself. Globally, gas equivalent to around 3.8% of the primary energy produced *from the oil supply chain* is lost through flaring, venting and leaking, compared with around 0.9% for the gas supply chain[17]. This is perhaps counter-intuitive. We often think about waste as being synonymous with methane and that therefore it is a gas problem. But, in terms of pure waste (BCM of potentially recoverable gas), oil leads.

The variation between countries is even more striking: waste intensities range from well below 1% among the best performers to more than 20% in the worst. This huge span of performance implies that high levels of waste are not inevitable. Oil producers such as Venezuela, Algeria, Iran, Libya, Iraq and Nigeria stand out, while Norway, Saudi Arabia and the UAE demonstrate what much good can look like. For gas, the challenging countries are Turkmenistan, Nigeria, Iran and Algeria – but Norway and Australia show how it can be done. Norway's leadership in this space, for example, is underpinned by strong (and enforced) policy since 1971[18].

Metric family #2: Methane intensity — methane / all oil & gas energy

With methane increasingly in focus — not least because of its potent climate-warming impact and of emerging regulation — one particularly useful lens is the *methane* intensity of production. Our first methane intensity metric calculates the emissions of methane from flaring (through incomplete combustion) plus venting and leaking to underlying production – a formulation that we dub the "IEA method". Compared to our waste metric above, volumes of gas that generate CO2 from flaring are removed – and the metrics scale accordingly.

[17] Note this contrasts with the IEA, who says that "methane emissions intensity of oil and gas production is around 1% in 2025" (https://www.iea.org/reports/global-methane-tracker-2026/key-findings), as this figure ignores gas flaring.

[18] See Capterio Perspectives article "Lessons from Europe"

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The IEA estimates upstream oil-and-gas methane emissions at 68 million tonnes, equivalent in our calculations to approximately 101 BCM of methane. (The more commonly cited figure of 81 million tonnes also includes downstream emissions). Relative to the 349 EJ of energy supplied by oil and gas, this equates to a methane intensity of 195 g/GJ (which is equivalent to 1.11 tCH4/kboe).This is directly equivalent to a perhaps more intuitive, dimensionless methane intensity of 1.0% — consistent with the figure independently reported by the IEA[19]), see Figure 6.

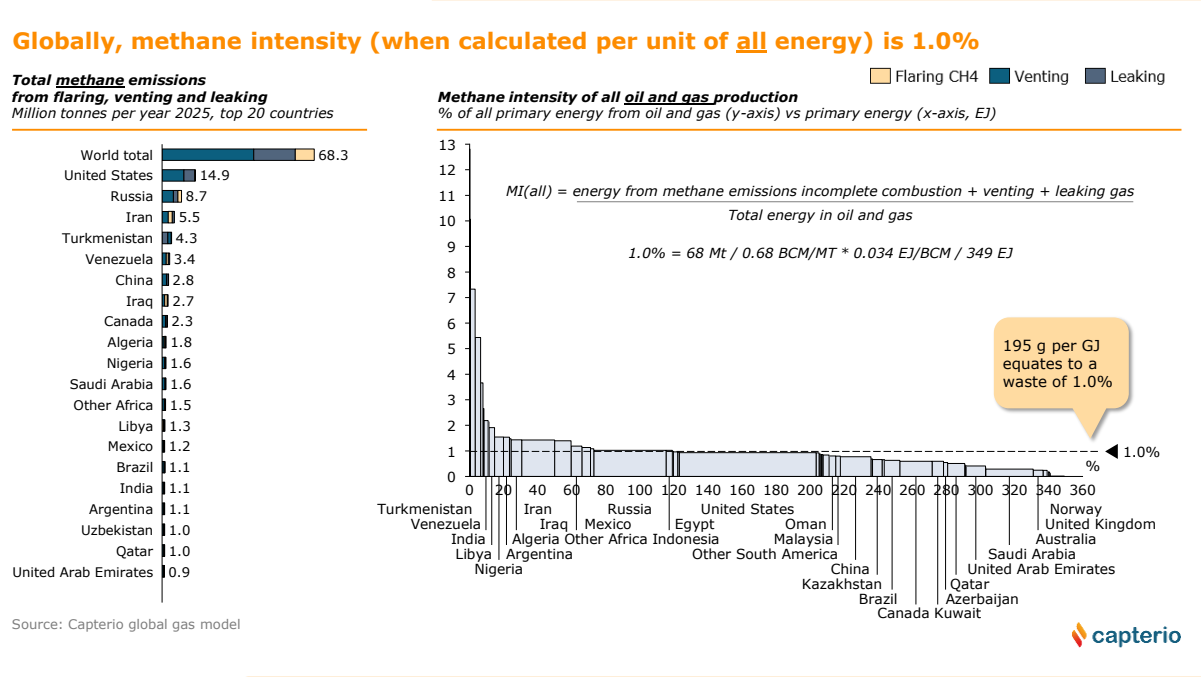

Figure 6: Methane intensity of oil and gas, quoted on g/GJ basis and on a percentage of all energy basis.

Metric family #3: OGCI methane intensity — methane / gas production. An alternative metric would be wasted methane from *oil and gas operations* divided by a gas production (and expressed in the more intuitive percentage terms). This metric is closely aligned to the definition used by the Oil and Gas Climate Initiative (OGCI), which defines methane intensity as "upstream methane emissions / marketed gas[20]", Figure 7.

[19] https://www.iea.org/reports/global-methane-tracker-2026/key-findings

[20] Although the definition is applied only to operated assets. Their metric also uses marketed gas, not gas production.

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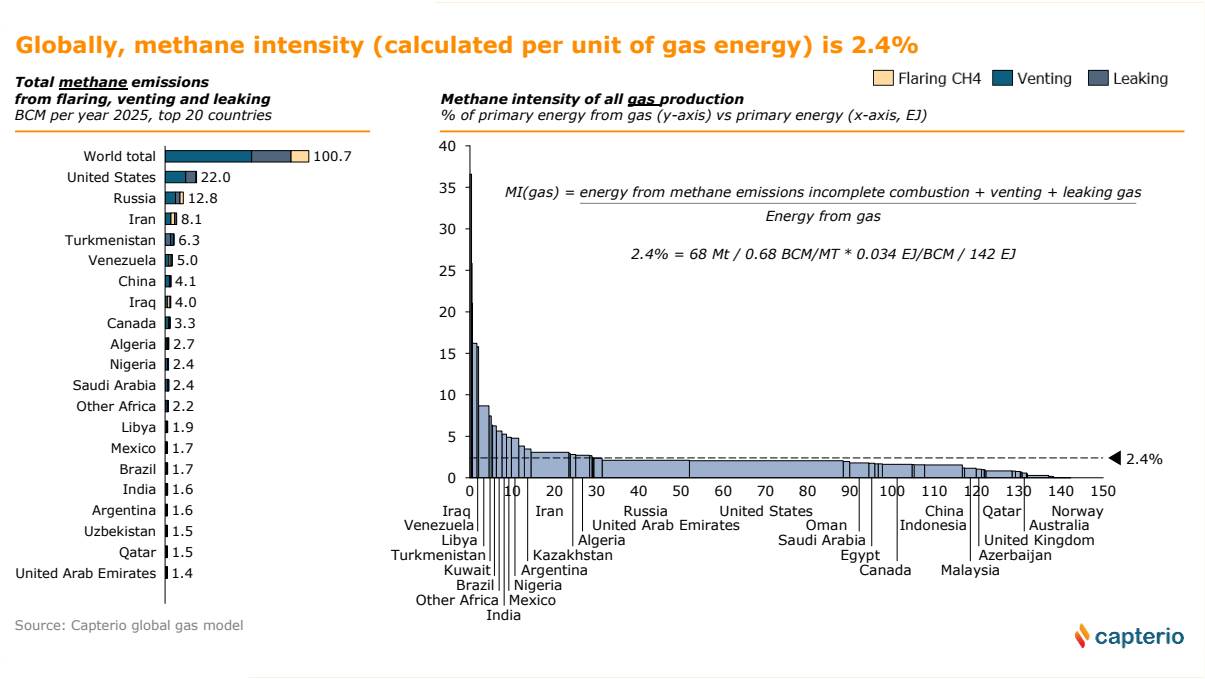

Figure 7: Methane intensity by country, using the "OGCI" method (where the numerator is not total oil and gas energy, but just that from gas).

The methane intensity league table using the "OGCI" method differs significantly from the "IEA" method in rank order. Iraq and Libya are significantly promoted, reflecting their disproportionately high levels of gas waste per unit of gas production.

The OGCI methodology is simple and pragmatic, but includes methane emissions from both oil and gas operations in the numerator while using *only (marketed) natural gas* in the denominator. Johnson et al report a conceptual challenge with this approach: "*in addition to being inconsistent with lifecycle principles, [… it] unrealistically implies zero methane emissions associated with oil production [and] can lead to double counting should oil be subsequently assigned methane emissions*".

In our view, this formulation of a methane intensity metric is potentially problematic as it systematically increases the apparent methane intensity of oil-heavy producers, as illustrated by countries such as Saudi Arabia and Kazakhstan, while predominantly gas-producing countries sit much closer to an intensity calculated using total oil-and-gas production – see Figure 8.

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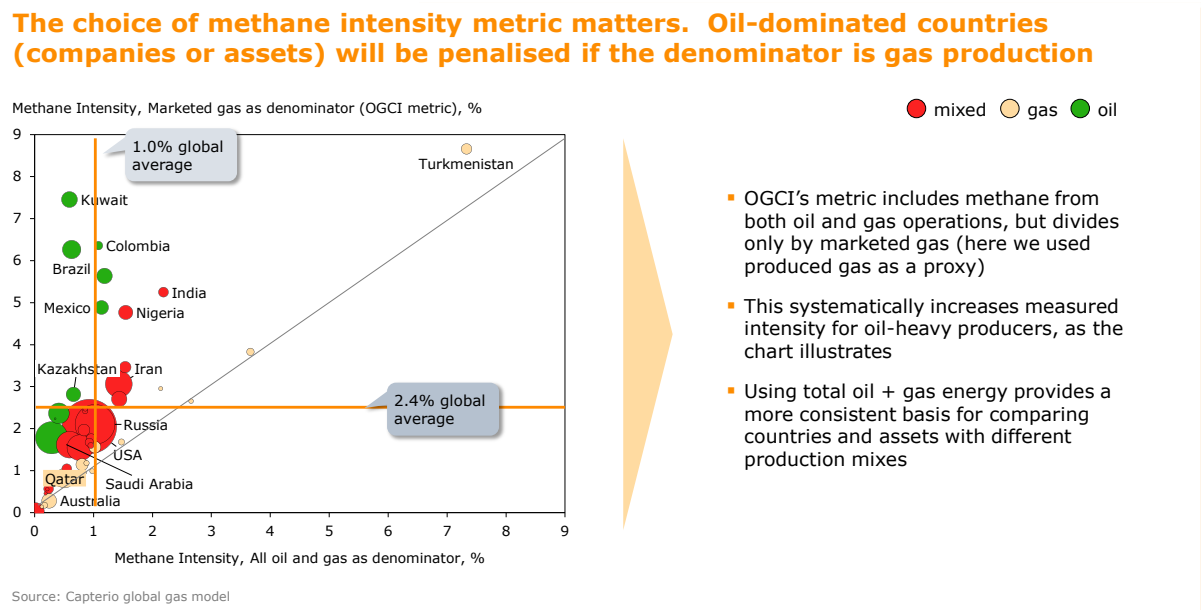

Figure 8: Comparison of intensity metrics for methane based on total energy (x-axis) and gas energy (y-axis, as per the OGCI method). Several key countries (e.g. Iraq) are off the chart on the y-axis and hence not shown.

Unlike the OGCI methane-intensity metric (which expresses methane emissions from both oil and gas operations relative to marketed gas production alone), our preferred analysis expresses wasted gas relative to the primary energy produced. This allows the waste intensity of oil and gas production to be compared on a consistent energy-based measure of production efficiency and enables meaningful comparisons between countries and assets with very different oil/gas production mixes.

Table 1 illustrates the key data. Among the world's top eleven oil and gas producers, performance varies widely on a g/GJ basis for *all* energy. Iraq, Iran, and Russia exceed 200 g/GJ, while Saudi Arabia, the UAE, and Norway are below 100 g/GJ (with Norway being exceptionally low; see Table 1).

Country	Oil and gas energy EJ	Energy rank	Gas % of total energy	Total waste BCM	Waste rank	Revenue upside $ billion	Waste % of all energy	Methane g/GJ of all energy	Methane intensity % vs all energy ("IEA")	Methane intensity g/GJ of gas	Methane intensity % vs gas ("OGCI")
United States	80.3	1	45%	27.0	4	8.7	1.1%	186	0.9%	410	2.1%
Russia	42.5	2	49%	43.1	1	13.9	3.4%	205	1.0%	421	2.1%
Saudi Arabia	28.0	3	16%	4.8	13	1.5	0.6%	58	0.3%	357	1.8%
Iran	19.3	4	47%	38.0	2	12.2	6.7%	286	1.4%	612	3.1%
Canada	19.0	5	37%	4.1	14	1.3	0.7%	119	0.6%	323	1.6%
China	18.0	6	50%	5.3	12	1.7	1.0%	154	0.8%	309	1.5%
United Arab Emirates	11.4	7	17%	2.8	15	0.9	0.8%	82	0.4%	473	2.4%
Qatar	10.0	8	62%	2.7	17	0.9	0.9%	102	0.5%	164	0.8%
Iraq	9.7	9	4%	28.1	3	9.0	9.8%	279	1.4%	7317	36.6%
Brazil	9.0	10	10%	2.7	16	0.9	1.0%	126	0.6%	1253	6.3%
Norway	8.4	11	49%	0.1	48	0.0	0.0%	3	0.0%	5	0.0%
Global	349.3	n/a	41%	267.3	n/a	85.9	1.0%	196	1.0%	480	2.4%
Top 11 % of total	73%			59%		59%					

Table 1: Overview of key performance metrics by country for the top 11 energy-producing countries by EJ. Revenue figures are calculated using a notional (and illustrative) gas price of $10 per mmbtu. An earlier version had an error in the waste and revenue upside reported in this table.

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Methane intensity metrics for the gas supply chain

In the context of the application of the upcoming EU Methane Regulations, we explore the question "*what is the quality of oil and gas imported in Europe?*" Readers will likely know that from May 2025, importers of oil and gas into the EU will be required to disclose sourcing data. This first-of-a-kind legislation is an important move from the optional voluntary market to a comprehensive mandatory market requirement.

From January 2027, importers of oil and gas will be required to demonstrate (for contracts signed after August 3, 2024) reporting equivalent to OGMP 2.0 level 5, under Article 12[21]. By 2030, importers will have to demonstrate that the methane intensity of imports is below a maximum threshold that has yet to be defined. We note that the Commission, in late July 2026, recommended that its member states consider a non-binding suspension of penalties, whilst stressing that progress must be maintained.

Focussing on imported gas, an even narrower / more targeted (and depending on its formulation, less bias-prone) metric is also instructive, being *the methane intensity of gas*. In the calculations to follow, we compute the weighted average metric accounting for the volume of gas (some 290 BCM) supplied into Europe in 2025 (which was dominated by Norway at 31%, followed by the US at 26%, then Algeria and Russia at 12% - plus others). Figure 10 below profiles three different formulations of the intensity metric. The first two metrics, presented above, include all methane emissions in the numerator, divided by total energy and total gas in the denominator. The third narrows the denominator to gas only.

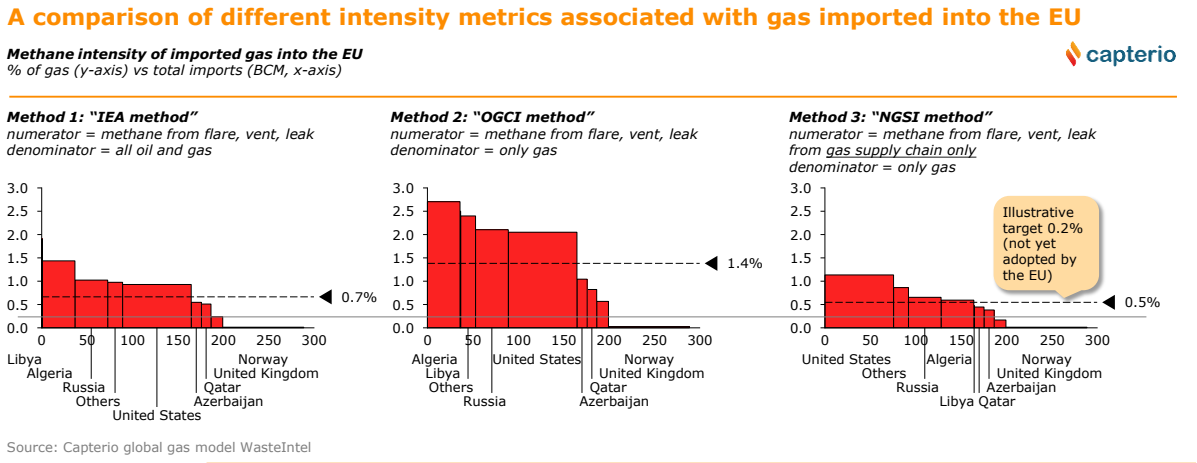

Figure 9: Methane intensity for imported gas into Europe by exporting country using 3 different methods. Left: all methane emissions divided by all energy. Middle: all methane emissions divided by only gas production. Right: all methane emissions from the gas supply chain, divided by gas production.

More specifically, Figure 10 (left) computes the methane intensity metric using total methane/total energy (akin to the IEA's methodology). In the middle, we use the "OGCI" method (total methane emissions in the numerator and only gas production (albeit for "marketed gas") in the denominator), noting that EDF has proposed a similar metric. In Figure 10 (right), we compute methane from the *gas* supply chain vs gas production, in a method comparable to the Natural Gas Sustainability Initiative (NGSI), which has been endorsed by MiQ and Veritas, with Context Labs using a variant[22]. In our view, the middle metric is probably the

[21] European Parliament and Council (2024). "*Regulation (EU) 2024/1787 on methane emissions reduction in the energy sector*"
[22] As discussed in the CATF/Carbon Limits paper "*Methane intensity for oil and gas*"

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most problematic, especially since it creates double-counting in the event that a methane intensity metric for oil is also required (plus it creates bias for where the oil vs gas mix varies materially between basins and/or countries, as per Figure 9 and Table 1).

Stepping back, we make three important observations.

- Firstly, weighted-average methane intensities range from 0.5% to 1.4% and the rank order of intensities changes by method.

- Secondly, each metric is materially higher than the illustrative 0.2% threshold considered here, although there are very large variations between countries. Whilst some countries (notably Norway) are able to meet this threshold, it seems unlikely for many others (although, inevitably, particular assets from leading companies would, surely).

- Thirdly, we note that OGCI companies already report a methane intensity (using the OGCI method) of less than 0.2% *on an operated basis*, which is 7x better than the average of countries supplying the EU. Whilst plausible (since member companies' *operated* exposure has relatively limited exposure to high-intensity countries) – plus member companies are likely to have been driving down their emissions (over multiple years) aggressively – it does highlight both the challenge for other companies to catch up and the potential exposure if non-operated assets were to be incorporated[23].

More broadly, analysis of this kind – underpinned by "real-world" country assessments – is considerably more instructive and insightful than abstract analysis. Equally, such analysis can ultimately help shape what constitutes an acceptable methane-intensity threshold for imported gas — particularly important as the EU progressively implements its methane import requirements towards 2030.

Reconsidering flaring

But methane emissions are only part of the story. Flaring remains a major source of emissions — and the numbers continue to move in the wrong direction. The World Bank's latest data, published in June, show global flaring rising for the third consecutive year to 167 BCM, together with increasing "flaring intensity".

Given today's intense focus on methane, it is perhaps surprising that flaring receives comparatively less attention, even though flaring is also a source of significant methane emissions from "methane slip" through incomplete combustion. Whilst the data is scant, in our experience it is highly unlikely that the global average real-world combustion efficiency is at the 98-99% "best practice" level. This work assumes a 93% combustion efficiency (derived from the IEA's methane emissions from flaring and the World Bank's estimate of combusted gas).

Methane is rightly a priority: it is a highly potent greenhouse gas and tackling it is essential. But flaring (which is 1.7x that of methane on a volumetric basis), we think, deserves at least as much attention. Flaring is, after all, highly visible and concentrated at discrete flare stacks that are mostly (but not exclusively) from the oil supply chain. Methane, in contrast, escapes from thousands of valves, pumps, compressors, tanks and pipelines across complex oil and gas systems. In many respects, flaring should be the easier problem to solve (although a "quick win"

[23] See also Capterio's paper on the importance of addressing flaring at non-operated assets: https://flareintel.com/insights/out-of-bounds-out-of-report-the-non-operated-problem-and-how-to-fix-it

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for many flares is to improve their combustion efficiency, thereby lowering their emissions of methane).

Put differently, if we cannot eliminate the large, concentrated and readily identifiable sources of waste represented by flaring (which arguably are also easily aligned with commercial incentives), how realistic is it that we can comprehensively tackle the much more diffuse challenge of methane?

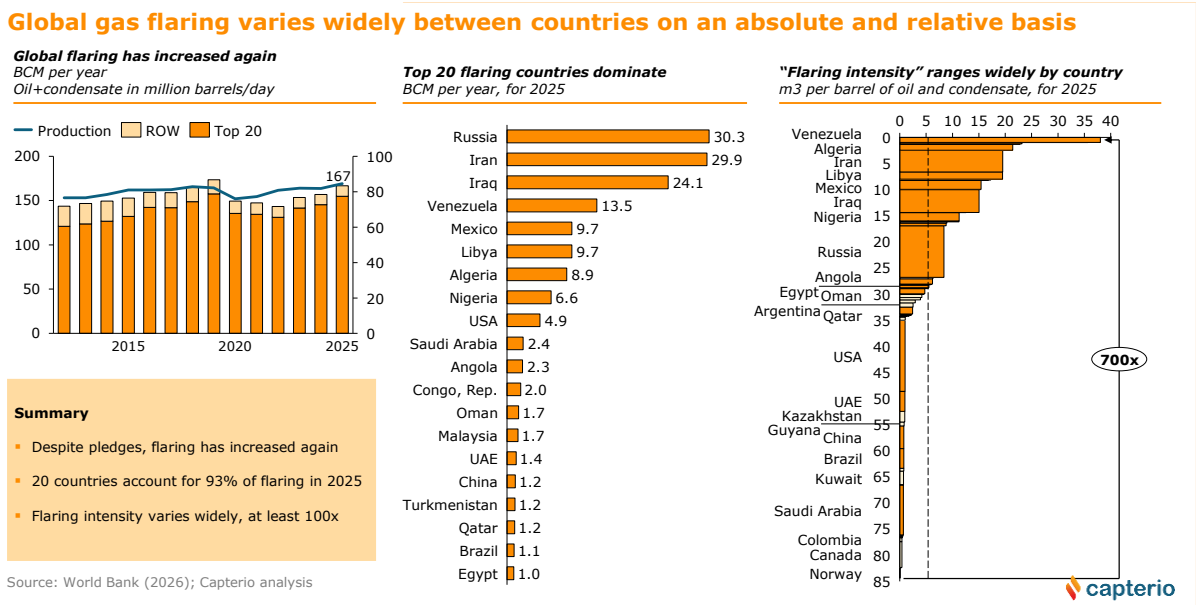

Figure 10: Flaring timeseries, league table and intensity. The flaring intensity metric uses a denominator of oil and condensate production (since this is the primary driver of gas flaring – which is dominated by the oil supply chain).

Whilst the data above is from the World Bank, Capterio's proprietary FlareIntel platform, incidentally, gives a very similar global picture[24]. Our main difference is that our platform is designed to impact day-to-day operations through daily flaring tracking for every asset worldwide (with data released at 0600 local time). Our high-frequency data (which also incorporates data on license blocks, field boundaries, power lines and pipelines – and more) helps companies and countries to improve visibility, drive operational excellence and identify and prioritise investment cases.

A CO2-equivalent intensity metric

As discussed above, we believe integrating all waste data delivers considerable value by providing a complete picture of the combined impact of flaring, venting and leaking. To compare these very different sources on a common basis (complementing the volumetric comparison – and hence *waste intensity* metric above), we express the combined emissions from flaring, venting and leaking in CO_2-equivalent terms, applying a 20-year global warming potential (GWP20) of 82.5 for methane on a mass basis. This allows us to see not only where gas is being wasted, but where that waste has the greatest near-term climate impact – see Figure 11. We use GWP20 because our analysis focuses on near-term climate impact. GWP100, while widely used for reporting, places substantially less weight on methane's strong warming effect over the coming decades.

[24] See our upcoming peer-reviewed paper, expected to be published in October 2026

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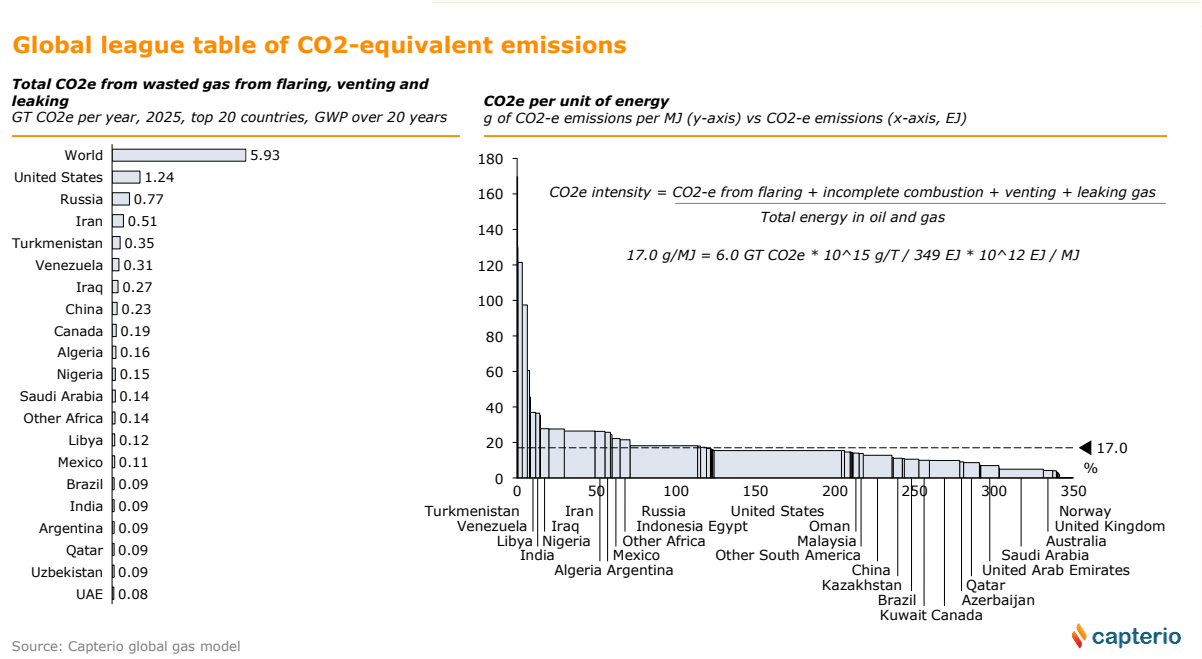

Figure 11: An integrated view of emissions as CO2 and methane from flaring, venting and leaking, expressed on a CO2-equivalent basis and reported on an absolute (left) and relative (to total oil and gas produced energy) basis.

The data, when reported in this joined-up way, is striking. Globally, CO2-e emissions are some 17 g/MJ[25]. Yet again, the most challenged countries include Turkmenistan, Venezuela, Libya, Nigeria, Iraq, and Iran, whereas the best-performing countries are Norway, the UK, Australia, Saudi Arabia, and the UAE.

A summary of competing metrics

Fundamentally, there are a wide range of metrics which could be selected to measure wasted gas, methane, and derived properties such as waste intensity, methane intensity and emissions intensity. The choice of numerator and denominator depends on the intent. Figure 12 has a summary of most of the metrics discussed above – focused on the two primary design choices of "*what is in the numerator – wasted gas or just methane?*" and "*what is in the denominator – all energy, or just gas?*" But as discussed above, there are numerous other complexities, plus also choices around units and more.

Returning to the conceptual framework introduced in Figure 3, we can now populate the principal metric families with the global results.

[25] Incidentally, a recent paper by Zhu et al[25] notes a figure from their LNG operations in a similar range to that calculated for the United States (*"measurement informed GHG emissions intensity ranges from 13.8 to 17.2 g of CO2-equivalent per MJ or energy produced"*), although we note they use a GWP of 29.8 for methane vs CO2, rather than our standard of 82.5. Using a 100-year GWP, we calculate a methane intensity of 7 g/MJ

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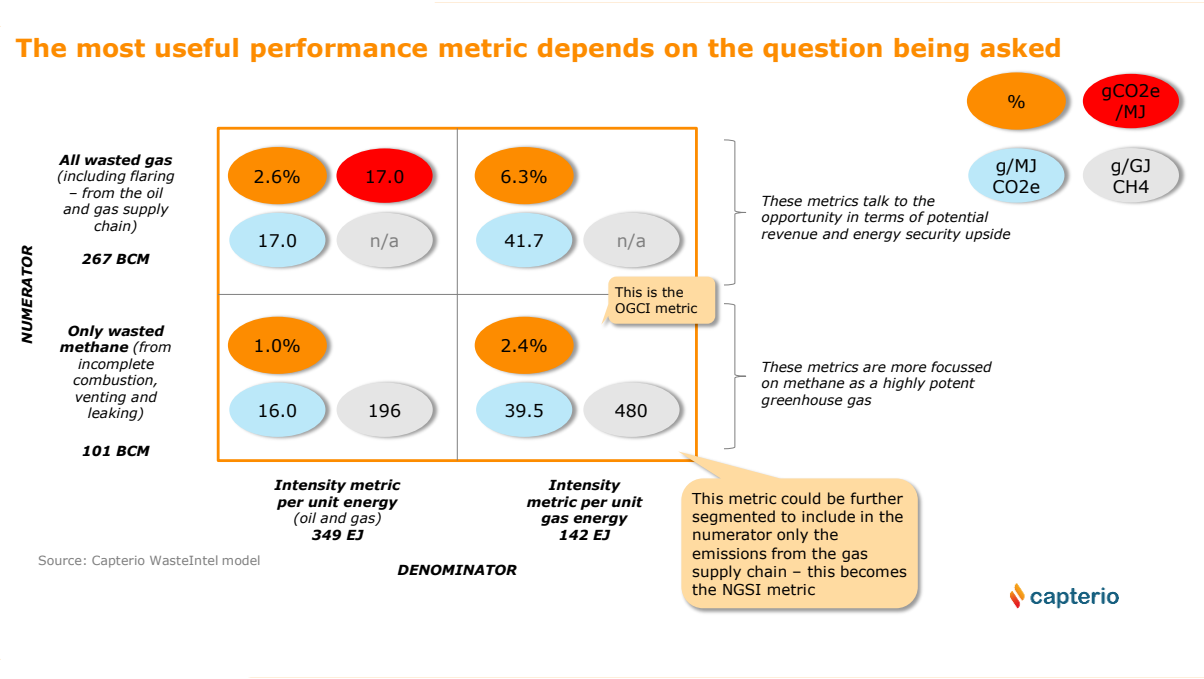

Figure 12: A summary of the metrics presented above.

Part 2: What are the implications of the large scale of the waste, the plethora of possible intensity metrics and the large span of performance between countries?

- First, the scale of the opportunity is enormous. 267 BCM of gas is lost each year through flaring, venting and leaking. At around 7% of global *gas* consumption, this is not a rounding error: it is a material source of energy that is produced but never reaches a customer. Put another way, flaring, venting and leaking waste 2.6% of all oil and gas (primary) energy collectively.

- Second, poor performance is not inevitable. Perhaps the most striking finding from the country-level analysis is the enormous range in performance. Countries producing broadly the same commodities can have radically different levels of waste and methane intensity. The best performers therefore provide an important benchmark for what should be possible elsewhere. OGCI companies report that – collectively – their methane intensity for gas (specifically measured as methane divided by marketed gas, for *operated* assets) is less than 0.2%. This is far superior to the global average of 1.4% (calculated on the same basis, however debatable), which (if true) demonstrates the output of concerted leadership. It also shows the world, on average, has a long way to go.

- Third, the choice of metric for waste intensity and methane intensity is critical. Especially so as the EU ramps up its methane regulation and looks to define its preferred metrics. A balance must inevitably be sought between pragmatism and do-ability vs alignment with the intended spirit of the legislation. Our perception of performance depends materially on what we choose to measure. Metrics therefore aren't just accounting conventions – they influence which countries, companies and assets appear to perform well, and ultimately where policy and capital are directed.

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- Fourth, we need to look at flaring and methane together – and consider both the gas and the oil supply chains. The extraordinary policy focus on methane is justified, but flaring risks becoming its neglected bigger sister. Flares are large, concentrated and readily detectable; fugitive methane emissions can come from thousands of individual pieces of equipment. If the industry cannot tackle the large, visible sources first, it is difficult to see how it will solve the more diffuse ones. Especially since in many cases recovered methane may (if there is no route to market) end up being flared (albeit with lower climate-forcing impact).

- Finally, this is increasingly about opportunity and competitiveness, not just emissions. As buyers, regulators and investors pay greater attention to the emissions intensity of energy supply, the provenance and performance of gas will increasingly matter. This is particularly relevant for countries in North Africa[26], where energy security, growing gas demand and maintaining access to the core European markets remain central concerns. Producers that eliminate waste can simultaneously sell more gas, increase revenues, lower emissions, improve operational performance and attract more inward investment and accelerate their own energy transitions.

The opportunity, therefore, is not simply to produce more gas. It is to produce better gas: with less waste, lower emissions and greater value from every molecule already being produced.

* * *

This work was conducted for the public good, funded by Capterio and we declare no conflicts of interest. We are grateful to many industry leaders across many conversations for lively discussions.

To find out more about Capterio's service, please visit www.capterio.com. In addition to our real-time flare tracking platform *FlareIntel*, we have developed *WasteIntel*, which is the underlying model supporting this analysis.

[26] See on the opportunity to capture flared, vented and leaked gas from North Africa: https://flareintel.com/insights/north-africa-can-reduce-europes-dependence-on-russian-gas-by-transporting-wasted-gas-through-existing-infrastructure

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