MAZE ENVIRONMENTAL

(512) 402-2683 info@mazeenviro.com media@mazeenviro.com

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WHO ARE WE?

MAZE Environmental's system costs less, reduces emissions, and yields more oil in the tank than traditional systems.

STABILIZERS
TOWERS
VAPOR RECOVERY UNITS
PUMP SYSTEMS
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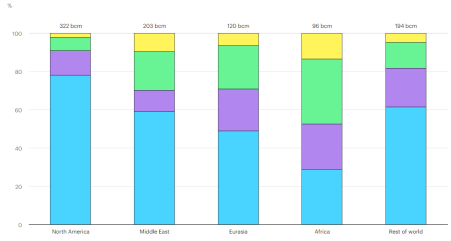
Brooks Pearce, CEO
Matt Flanagan, COO
Sherif Dweek, President-International
Alex Duka Senior Financial Advisor



Use of associated gas by region, 2019

Putting gas flaring in the spotlight

New perspectives on a persistent challenge

Natural gas flaring has been a longstanding problem for the oil industry. The most recent data indicate that around 150 billion cubic metres (bcm) of natural gas was flared globally in 2019, as much gas as Japan and Korea together imported in the same year. Despite rising awareness of the problem, and a number of initiatives aiming to curb flaring, the amount of gas flared globally each year has been edging higher in recent years and the world is now flaring as much as it did ten years ago.

The problem arises because most wells that are drilled to target oil also produce a mixture of other hydrocarbons such as condensates, natural gas liquids and natural gas. If there is no productive outlet for the natural gas, either because of poor planning, a lack of infrastructure or a lack of incentive, then this gas – known as "associated gas" – can end up being flared or (even worse from an environmental perspective) vented to the atmosphere.

New IEA analysis, incorporating the latest satellite data and insights, highlights the continued misuse of a large proportion of the world's associated gas. Of an estimated 935 bcm of gas that was extracted in association with oil in 2019, we find that only around 75% ended up being used on-site by the operator, or re-injected into the well, or marketed to consumers. Of the remaining 25%, we estimate that around 55 bcm was released as methane to the atmosphere, and the remaining 150 bcm flared. This commentary digs further into the data to understand where and why these wasteful practices are taking place, and what can be done about it.

A major economic and environmental loss

The non-productive use of associated gas comes at a significant cost. Gas that is flared has potential market value, and it is especially jarring when flaring occurs in countries or regions – such as sub-Saharan Africa – with large populations without access to electricity or where electricity supply is unreliable. The environmental consequences are severe. We estimate that the 150 bcm flared in 2019 was responsible for around 300 million tonnes of CO2 (MtCO2), roughly the same as annual emissions from Italy, as well as the release of other pollutants that can worsen local air quality.

Associated gas (which is primarily methane) released directly to the atmosphere has a much stronger warming effect on the climate than CO2. The 55 bcm of vented or fugitive emissions is equivalent to a massive 1 180 Mt of CO2. Of this sum, we estimate that at least 5 bcm (or 105 MtCO2-eq) escaped because flares are not 100% efficient in combusting the gas. The efficiency at which flares operate is subject to a wide degree of uncertainty, especially if they are poorly maintained or are flaring in windy conditions.

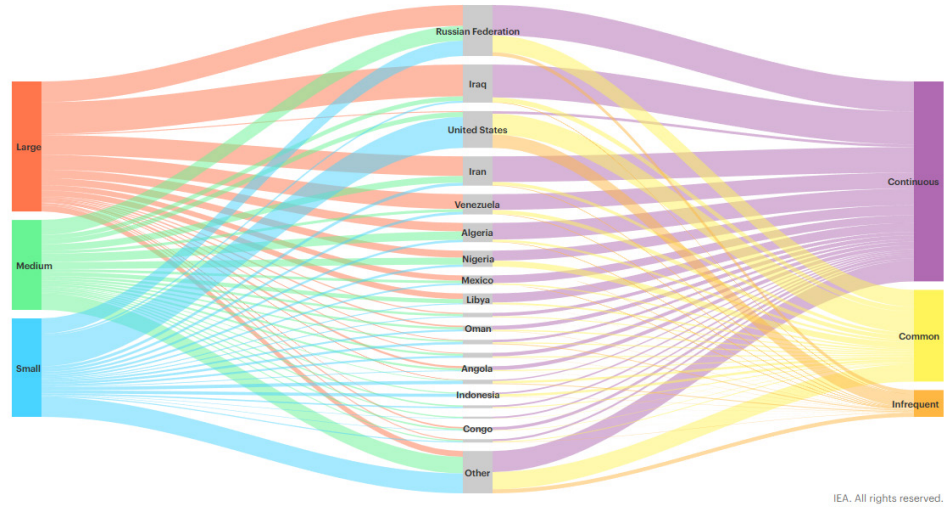
IEA (2020), Putting gas flaring in the spotlight, IEA, Paris https://www.iea.org/commentaries/putting-gas-flaring-in-the-spotlight

One recent study by the Environmental Defense Fund in the Permian Basin found that 11% of flares were unlit or malfunctioning and so venting methane to the atmosphere.

Reductions in flaring and venting of associated gas need to go hand-in-hand to ensure effective management of emissions; if a clampdown on flaring were to increase venting, that could quickly lead to a worse outcome.

Where is flaring occurring and why?

Size and utilisation of flares by country, 2019



The data on flaring and venting of natural gas are largely derived from satellite data rather than company or national reporting. Lit flares have been readily visible from space for some time, and – more recently – the plumes from major leaks of methane from oil and gas facilities are being detected too.

These flaring data show that, in 2019, almost half of global gas flaring occurs in four countries: Russia, the United States, Iraq and Iran; these countries are also some of the world's largest oil producers, accounting together for almost 40% of global output. Not all of the world's major producers flare large volumes: Saudi Arabia, for example, has a flaring intensity around ten times lower than Russia.

Satellite observations allow for a more detailed understanding of the size of flares and how often they are in use. Of the 150 bcm of gas flared in 2019, around two-thirds was from flares that were operating more or less continuously, known as "routine" flaring (defined as operating more than 85% of the time). Russia, Iraq, Iran, Venezuela and Algeria are some of the main sources of large, continuous flares. In Russia, this is often the case for remote oil fields or in areas where oil companies face difficulties in securing access to Gazprom's pipeline network.

There are also instances of flares that are more intermittent and of shorter duration. This is the case in many of the unconventional basins in the United States, where production has grown very quickly over the last decade. US output of associated gas has doubled since 2010, but flaring has increased by more than four times. Each unconventional oil well produces relatively small volumes of associated natural gas, but there are a large number of these wells, and the associated gas (as with the oil) sees high initial flow rates followed by relatively rapid declines and a long tail of low production. Incidences of flaring occur because operators argue that it is uneconomic to bring this gas to market, because operators begin oil extraction prior to the development of a gas pipeline connection, or because gas infrastructure is not sized to handle the short periods of peak production.

Shorter-duration flaring can also be for safety reasons, for example if gas pressure has built up due to a change in operating conditions.

Bringing associated gas to consumers via a connection to an existing gas network, wherever possible, is clearly a preferable way to avoid flaring, but it is not the only way. As noted above, operators can also utilise gas onsite, either to power operations, to be reinjected into the reservoir for pressure support or potentially for enhanced oil recovery. In addition, there is a host of other options to make productive use of the gas. Modular solutions have found increasing uptake in onshore applications including portable CNG or mini-LNG facilities, small-scale gas-to-methanol or gas-to-liquids conversion plants or onsite direct-to-grid

More than half of flaring occurs within 20 km of existing pipelines

One reason often put forward for flaring is that the oil extraction occurs far from existing gas infrastructure, but new geo-spatial analysis is casting doubt on this claim.

In practice, according to Capterio, some 54% of all volumes flared in 2019 took place at sites that were less than 20 km from existing natural gas pipelines (and at least 87% of these flares were located onshore).

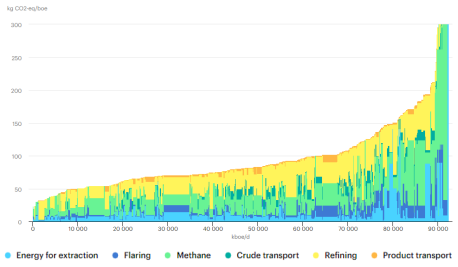
(or microgrid) power generation. New market entrants are increasingly providing novel solutions to use natural gas, such as powering high-intensity computing and mining cryptocurrency.

There are good examples of how integrated planning and operational measures can minimise flaring. In Saudi Arabia, for example, policies since the 1970s have focused on ensuring the timely build-out of gas infrastructure to direct associated gas resources to power, petrochemical and desalination plants. Continuous site flare monitoring systems, tracking of performance indicators, internal guidelines and annual assessment of site-specific flare minimisation plans have also helped.

There are also examples of countries that have managed to reduce flaring over time. As recently as 2000, Nigeria was flaring more than half of its associated gas output, more than 20 bcm per year. The latest data for 2019 give a figure of just under 8 bcm. There is still some way to go to reach the government's objective of eliminating routine flaring entirely, but this 70% reduction since 2000 is nonetheless noteworthy. A combination of regulatory pressure and fiscal incentives have encouraged investment in infrastructure to bring the gas to domestic users as well as to LNG export facilities.

What needs to be done?

There is increasing attention not only to the emissions from the final combustion of fossil fuels, but also the emissions that occur along the supply chain to the consumer. There is a wide spread of these "well-to-tank" emissions intensities for global oil production: our updated analysis for 2019 shows that the most-emitting sources of oil produce more than four times the indirect emissions than the least-emitting sources (indirect emissions from oil, which include flaring, are between 10% and 30% of its full lifecycle emissions).



Producers who can demonstrate that their output is at the lower end of this spectrum – and of a similar one for natural gas – can credibly argue that their resources should be preferred over higher-emitting options. There are signs that some consumers and regulators are ready to start differentiating between different sources of oil and gas on this basis.

A rapid reduction in gas flaring levels, and in oil and gas methane emissions, is necessary for all pathways out of the current crisis and it is integral to the design of the IEA's Sustainable Development Scenario (SDS). The SDS sees flaring levels quickly reduce by 2030 as a result of regulatory and industry action to less than 10% of the levels seen in 2019.

Eliminating routine flaring would already be a major step towards this goal. Successful strategies to reduce flaring have certain common elements. Effective measurement and reporting systems are in place. Any new projects incorporate productive use of associated gas at the planning stage, prior to the start of operation. For existing projects that flare gas, a mixture of obligations and incentives encourage operators and midstream companies to seek productive outlets for the gas. Strong, uniform regulatory oversight is essential, with flaring and venting treated in tandem to ensure continuous improvements in performance on both.

The advent of more transparent monitoring and reporting, via satellites or via site specific processes, should also allow regulators to track and enforce improvement plans or penalty measures. Within ten years, flares – except where unavoidable for safety reasons – need to disappear from the oil and gas landscape.

IEA (2020), Putting gas flaring in the spotlight, IEA, Paris https://www.iea.org/commentaries/putting-gas-flaring-in-the-spotlight