

# Flaring management guidance for the oil and gas industry

## A summary

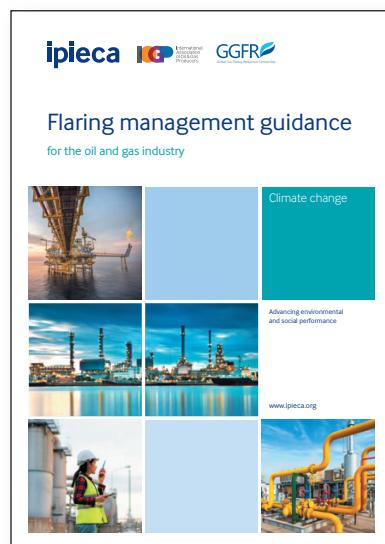
Flaring is used to manage the natural ('associated') gas produced as a co-product during oil extraction, routinely or as the result of an unscheduled event.

Routine flaring can be a significant source of greenhouse gas (GHG) emissions from upstream operations.

Managing flaring to reduce emissions, and convert associated gas into a source of energy, can provide many benefits but also presents challenges.

This *Flaring management guidance*, developed by IPIECA, IOGP and GGFR in partnership, outlines new developments in flaring management and reduction, and examines industry experiences with eliminating flaring, new technologies, business models, operational improvements and regulatory policy. It also features case studies and examples of positive change. It aims to:

- raise awareness and understanding, and drive the adoption of flaring best practices;
- identify and explore options for using technology to reduce flaring;
- explore market approaches and business models for monetizing associated gas;
- review and identify effective regulatory frameworks that facilitate reduced flaring; and
- document case studies and share best practices in flare reduction.



A key lesson is that a shared culture based on commitment to good environmental outcomes is essential, both for sustaining progress towards zero flaring and realizing benefits from associated gas. There are many practical steps that organizations can take to support this, such as:

- clear, consistent messaging combined with key performance indicators (KPIs) to drive progress;
- making flare reduction an integral part of field development plans;
- investing in technology to quantify flaring volumes;
- examining the root causes of flaring in operational practice; and
- tailoring solutions to fit actual problems—do not assume that one technology solution will fit every flaring situation.

The guidance contains three main sections, as follows:

1. An introduction presents core concepts, definitions and the wider context.
2. A section for oil and gas operators, outlines a framework for flaring management solutions that can be employed.
3. A section for governments and regulatory bodies shows ways to encourage and incentivize productive use of associated gas instead of flaring.

Case studies of successful flaring reduction projects, technical support material and an extensive list of references are also included in the appendices.

*Our generation's biggest challenge will be maintaining energy supply while reducing greenhouse gas (GHG) emissions ... finding ways to reduce or eliminate GHG emissions from flaring will be of paramount importance during the energy transition.*

# An introduction to flaring management

Routine flaring not only contributes to climate change, but also wastes an energy resource that could support sustainable growth and contribute to achieving the UN Sustainable Development Goals.

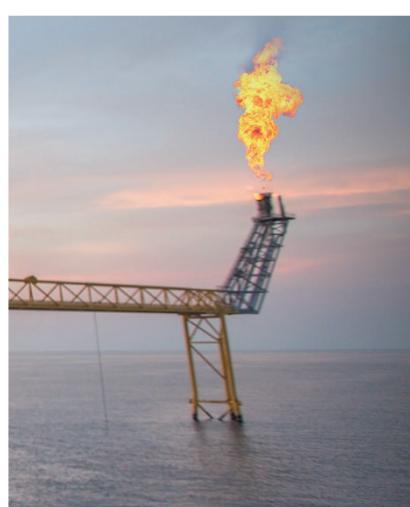
The introductory section in the guidance looks at the core concepts of flaring management and reduction, in particular:

- the natural gas value chain and reasons for routine (and non-routine) flaring;
- opportunities (and challenges) involved in monetizing associated gas, from the perspectives of the key players;
- technology options for flare reduction and market factors to consider when planning projects; and
- economic and technical drivers, plus social and environmental issues for projects connected with associated gas.

The amount of gas flared has not substantially declined over the past ten years, a reflection of the challenges that exist. These include, lack of infrastructure, distance to markets, availability of skilled labor, capital investment constraints, ownership arrangements, and the absence of an efficient and effective regulatory framework or a functional authority to enforce regulations.

Low gas prices have had a particularly adverse impact on the economic case for projects focused on flare reduction and monetizing associated gas. However, there are significant social, reputational and economic benefits that can be realized from using associated gas, for example:

- generating electricity on-site to improve reliability and avoid shutdowns;
- avoiding shut-ins caused by flaring in excess of authorized amounts;
- satisfying investor and stakeholder expectations by minimizing the GHG footprint of production operations;
- diversifying product offerings; and
- creating commercial advantage (such as preferred bidder status) on other energy sector projects sponsored by a host government.



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## ... An introduction to flaring management

Building a shared understanding of this wider range of potential benefits among all stakeholders—operators, owners, financiers and governments—is key to encouraging them to work together and overcome the barriers to reducing flaring and using the gas as an energy source.

### Sustainable Development Goals

The United Nations 2030 Agenda for Sustainable Development includes 17 Sustainable Development Goals (SDGs) addressing some of the world's pressing economic, social and environmental challenges. The SDGs highlight sustainability challenges for the oil and gas industry, in particular mitigating development impacts and minimizing the environmental footprint. Improving the utilization of associated gas and reducing flaring is relevant to several SDGs and related UN targets.

In 2017, IPIECA, the United Nations Development Programme (UNDP) and the International Finance Corporation (IFC) developed a shared understanding of the implications of the SDGs for the oil and gas industry, and how the industry can most effectively contribute, in the joint IPIECA/IFC/UNDP report, *Mapping the oil and gas industry to the Sustainable Development Goals: an atlas*.<sup>2</sup>

An estimated 142 billion cubic meters was flared globally in 2020 ... enough gas to power sub-Saharan Africa.<sup>1</sup> If this amount of gas was used for power generation, it could provide about 750 billion kWh of electricity—more than the African continent's current annual electricity consumption.



In 2021, IPIECA, with the World Business Council for Sustainable Development, launched *Accelerating action: an SDG Roadmap for the oil and gas sector*<sup>3</sup> (the Roadmap). The Roadmap aims to prioritize areas where the sector can significantly contribute to SDG progress by identifying key impact

opportunities for the most material SDG goals and targets, coordinating effort across the entire industry. The Roadmap includes specific actions on flaring.

<sup>1</sup> <https://www.worldbank.org/en/news/press-release/2021/04/28/seven-countries-account-for-two-thirds-of-global-gas-flaring>

<sup>2</sup> <https://www.ipieca.org/resources/awareness-briefing/mapping-the-oil-and-gas-industry-to-the-sustainable-development-goals-an-atlas>

<sup>3</sup> <https://www.ipieca.org/our-work/sustainability/supporting-the-sdgs/sdg-roadmap>

# A framework for the oil and gas industry

Addressing and reducing gas flaring requires project design solutions for new assets and for existing fields that can successfully bring the gas to more productive use.

This section in the guidance outlines a framework for action, showing how operators can progress from a commitment to addressing the problem via disciplined planning and organization towards execution, as shown in the figure on the right.

The framework emphasizes the importance of data gathering and analysis before developing policy and procedures for flaring. It describes various scenarios where associated gas flaring occurs, and the challenges involved in each, before listing approaches that can prove helpful in reducing volumes flared.

A seven-step iterative process, developed earlier by IPIECA, IOGP and GGFR, supports decision-making on flare reduction/gas utilization activity, identifying opportunities to reduce flaring, and tracking and supporting activities that deliver real and lasting emissions reductions.

This section also includes supplemental information on flaring from midstream operations (including liquefied natural gas (LNG) facilities), enhanced flaring measurements and monitoring, and a brief look at research and development.

## A framework for addressing gas flaring

- Historical and current data gathering and analysis
- Associated gas forecasts
  - Measurement versus estimation
  - Segregation of flare volumes

### Establishing company flaring and venting policy and procedure

- Unconventional and shale operations
- New field developments
- Early development facilities
- Well test and early production (first oil) flaring
- Legacy flaring
- Venting at upstream oil and gas facilities

### Management of routine flares

- Assessing local conditions and policies
- Reviewing associated gas forecasts
- Developing a utilization strategy
- Technology and economic assessment
- Green/climate change financing opportunities

### Management of non-routine flares

- Raising awareness and visualization of flared gas
- Flaring management during non-routine/upset scenarios
- Review of operational controls and processes
- Setting flaring targets at the station level
- Framework for variance and waivers
- Economic and technical risk assessment
- Root cause analysis and identification of 'bad actors'
- Focused strategy for addressing 'bad actors'
- Rotating equipment and sparing strategy

*GGFR's research has shown that the overwhelming majority of gas burned during the regular operation of a production facility is from the continuous flaring of associated gas.*

*Major capital investments in new equipment are often required to facilitate its management, processing and beneficial utilization.*

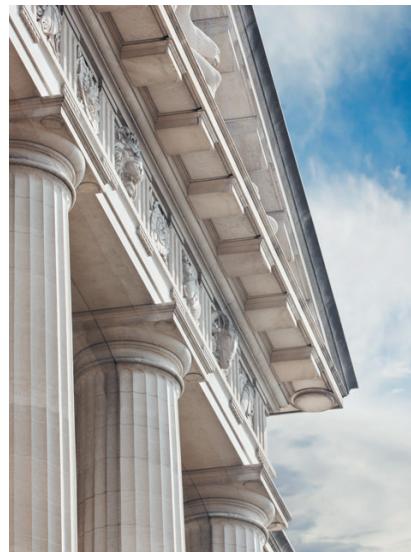
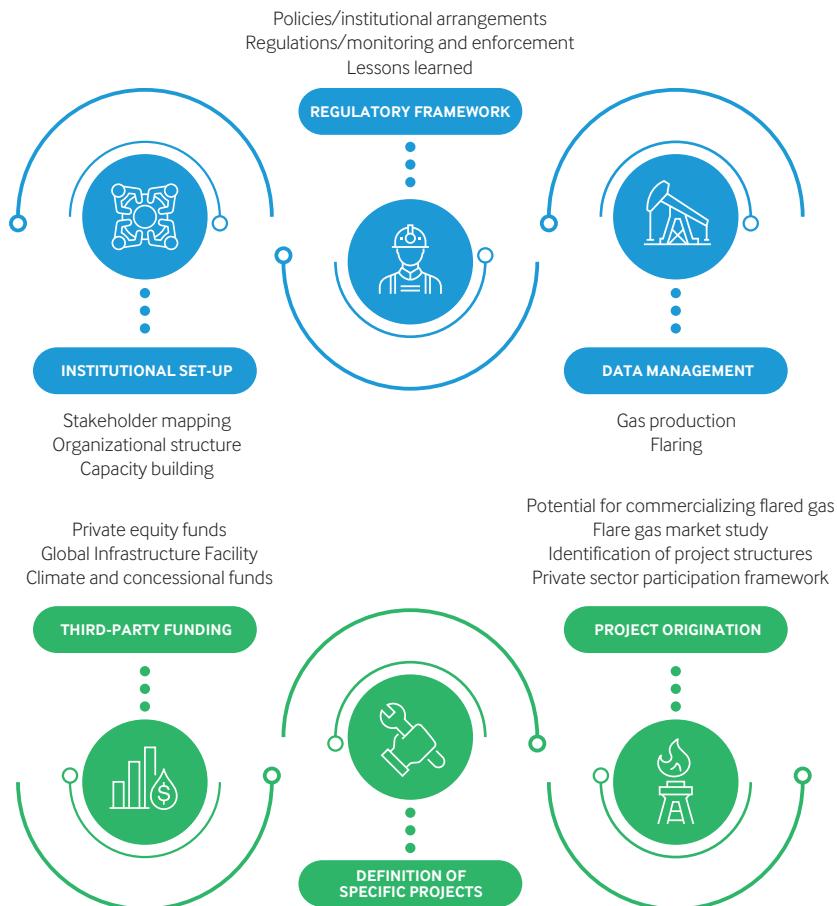
## A framework for government and regulatory bodies

This section provides a framework for national governments to address routine flaring. For new 'greenfield' hydrocarbon projects, this could require zero flaring from the outset—achieved through law, programs and incentives. For legacy operations, it can be more challenging since it involves existing laws, contracts and financial incentives.

In addition to considerations related to project vintage, ideas are offered on ways to monetize associated gas resources and catalyze utilization projects.

To meet the risk/reward expectations of developers and investors, the importance of a defined legal and regulatory construct is reviewed, along with the use of commercial structures to leverage public finance and attract private capital.

### The elements of a framework for government and regulatory bodies



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The framework is depicted graphically in the figure on the left, and includes the following elements:

- Institutional set-up: an agreed mandate and sufficient resources are essential to achieve sustainable flaring reduction program.
- Regulations and guidelines: defining the transactional and commercial structure, with implementation guidelines.
- Flaring and production data management system: so that actions are driven by well-defined and transparent data.
- Flare gas-to-market project origination: progress on reducing flaring relies on a host of actors that come together to effectively execute in-field gas utilization projects.

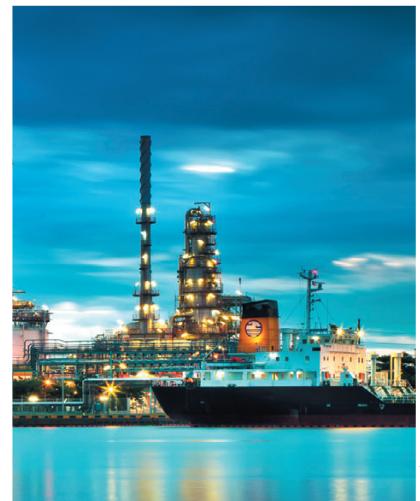
## *... A framework for government and regulatory bodies*

Starting with a robust stakeholder identification and engagement process will promote participation, capture 'hidden' stakeholders, and leverage professional, expert and other resources.

It will also support mapping key partners to engage in a capacity development process, and a discussion of development priorities.

Together these elements help to create a defined level playing field to develop projects, build development capacity and attract investment.

*Real progress on reducing flaring relies on a host of actors that come together to effectively execute in-field gas utilization projects. Defining needs and priorities is among the most important first steps in instituting a national framework for associated gas management and utilization.*



## Flaring success stories

### Turning onshore gas into power in the congo

Eni signed an agreement with the government of the Republic of Congo in 2007 to develop two electricity power stations and eliminate gas flaring. This included constructing an entirely new power station and revamping an existing station.

By utilizing more than 70 million standard cubic feet per day of gas that would formerly have been flared, the power stations now provide 60% of the country's installed capacity and give access to electricity for approximately 700,000 people.

### Reducing LNG boil-off gas flaring

Qatargas began flare reduction operations at the jetty boil-off gas recovery facility at Ras Laffan Port in 2014.

The facility collects boil-off gas from LNG ships, compresses it, and sends it to LNG producers to be consumed as fuel or converted into LNG.

By 2018 flaring had been reduced by more than 95%, relative to the 2012 baseline, saving 29 billion standard cubic feet of gas per year.

### Using innovative technology to upgrade flash gas

Shell installed technology in 2019 in its Permian Basin (Texas) asset to reduce oxygen concentrations in oil tank vapors. As a result the gas now meets pipeline quality specifications for off-site sales, allowing it to be monetized and reducing flaring by 40%.

Shell has now incorporated this technology in its standard design for central processing facilities in the Permian Basin, due to its proven performance, high reliability, low maintenance, modularity and great economics.

### Using new low-cost technology to capture offshore gas

PETRONAS introduced a novel, low-cost surface jet pump technology to capture associated gas in an offshore legacy field where using conventional booster compressor solutions was challenging due to limited deck space and not commercially viable.

Since 2019 the jet pumps have successfully captured 5–7 million standard cubic feet per day of associated gas that was previously flared routinely from the source wells.

### Integrating associated gas capture during field development

In 2020 Wintershall Dea successfully conducted production pilot projects in the onshore Vaca Muerta shale play in Argentina. The initial program began in mid-2020 with the drilling of 20 to 30 wells.

The company connected an extended (i.e. long-term) well-test facility to a third-party gas treatment plant, installed gas compression facilities and new pipeline capacity—all as an integral part of field development to eliminate routine gas flaring.

To find out more about the *Flaring management guidance*, and to download a free copy, visit:

[www.flaring-management.org](http://www.flaring-management.org)

The 2021 *Flaring management guidance* builds on earlier publications and advice published by IPIECA, IOGP and GGFR, namely the GGFR Voluntary Standard for Global Gas Flaring and Venting Reduction (2002) and the detailed flaring guidance document issued jointly in 2011.



IPIECA is the global oil and gas industry association for advancing environmental and social performance. It convenes a significant portion of the oil and gas value chain and brings together the expertise of members and stakeholders to provide leadership for the industry on advancing climate action, environmental responsibility, social performance and mainstreaming sustainability.

Founded at the request of the UN Environment Programme in 1974, IPIECA remains the industry's principal channel of engagement with the UN. Its unique position enables its members to support the energy transition and contribute to sustainable development.



The International Association of Oil & Gas Producers (IOGP) is the global voice of our industry, pioneering excellence in safe, efficient and sustainable energy supply—an enabling partner for a low-carbon future. Our Members operate around the globe, producing over 40% of the world's oil and gas. Together, we identify and share knowledge and good practices to improve the industry in areas such as health, safety, the environment and efficiency.



The World Bank's Global Gas Flaring Reduction Partnership (GGFR) is a trust fund composed of governments, oil companies, and multilateral organizations committed to ending routine gas flaring and venting at oil production sites across the world. The Partnership helps identify solutions to the array of technical, financial, and regulatory barriers to flaring and venting reduction by developing country-specific flaring reduction programs, conducting research, sharing best practices, raising awareness, securing commitments to end routine flaring through the 'Zero Routine Flaring by 2030' global initiative, and advancing flare measurements and reporting.

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