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# Gas Flaring and Venting

## A Regulatory Framework and Incentives for Gas Utilization

**Every year oil producers flare and vent gas equivalent to the combined gas consumption of Central and South America. Africa flares and vents gas equivalent to half its power consumption. To reduce this practice, governments need to develop and enforce an appropriate legal and regulatory framework. They need to reform the gas market, getting rid of subsidies for competing fuels and making room for private operators to develop gas infrastructure. And they need to avoid tax and royalty systems that discourage operators from using the gas associated with oil production.**

Most developing countries that produce oil also flare and vent large volumes of associated gas, a blend of hydrocarbons released when crude oil is brought to the surface. This practice of burning gas or releasing it into the atmosphere not only harms the environment, including by adding significantly to greenhouse gas emissions. It also deprives developing country consumers of an energy source that is cleaner and often cheaper than others available and reduces potential tax revenue and trade balances.

The World Bank estimates the annual volume of natural gas being flared and vented worldwide at about 110 billion cubic meters (bcm), enough to provide for the annual gas consumption of Central and South America or that of Germany and Italy. The gas flared annually in Africa (37 bcm) could produce 200 terawatt-hours of electricity, about half the power consumption of the

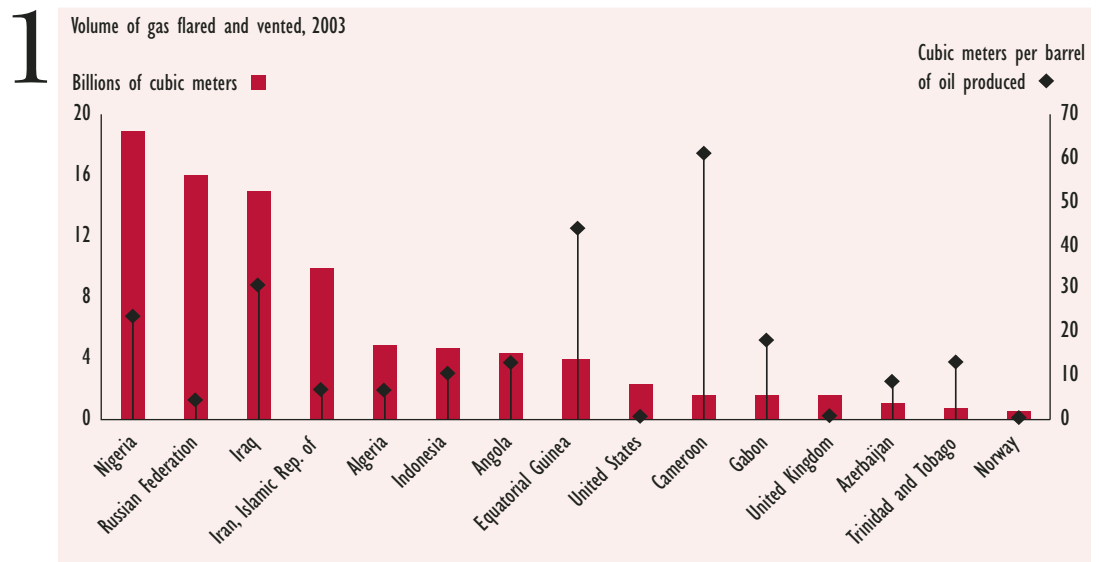
continent and more than twice that of Sub-Saharan Africa (excluding South Africa). While the value of gas differs in every market, exporting the volumes flared and vented annually to U.S. or European markets today would fetch around US\$20 billion (based on a natural gas price of US\$4 per million Btu, or British thermal units).

Developing countries account for more than 85 percent of gas flaring and venting, with Nigeria, Iraq, and the Islamic Republic of Iran each flaring or venting 10–20 bcm of associated gas annually (figure 1). The Russian Federation flares about 16 bcm a year. Conversely, the utilization of associated gas tends to be low in developing countries, as shown by the volume of gas flared and vented relative to oil production. It is particularly low in Cameroon, Equatorial Guinea, and Iraq, which flare or vent 31–61 cubic meters of associated gas for every barrel of oil produced.

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**Figure** Flaring and venting per barrel of oil reveals some large utilization capacities

Source: World Bank data.

In contrast, gas utilization is much higher in such countries as Norway, the United States, and the United Kingdom, which flare or vent less than 2 cubic meters for every barrel of oil.

Flaring and venting is an important safety measure at oil production facilities, safely disposing of gas during emergencies, power and equipment failures, or other upsets in oil production that might otherwise pose hazards to workers or nearby residents. But in most oil-producing developing countries the practice goes far beyond normal operational and safety levels.

In theory, the economics of associated gas dictate that operators will reduce flaring and venting until the marginal costs of gas utilization in a field exceed the marginal benefits. But many other factors bear on operators' decisions about what to do with associated gas. A recent study identified three main barriers to its utilization: lack of an efficient regulatory framework, poor access to local and international energy markets, and financing constraints for projects that reduce gas flaring (GGFR 2002).

Governments can help reduce flaring and venting in developing countries by increasing its opportunity costs and by creating a legal, regulatory, and financial environment that encourages operators to utilize gas. Operators can also help, by adopting best practices in oil production and by evaluating all alternatives to gas flar-

ing, including reinjecting associated gas into oil fields and developing infrastructure to export gas or supply domestic markets.

### Regulations on flaring and venting

Another recent study investigated the role of regulation in gas flaring and venting in 44 oil-producing countries (GGFR 2004a). It found that most developing countries in the group lack efficient, effective regulations on flaring and venting. And in many of these countries institutions have inadequate capabilities and overlapping responsibilities, and companies that are supposed to be regulated are often themselves responsible for regulatory functions.

The biggest problem in most developing countries is the lack of clear and transparent operational processes and efficient regulatory procedures. Operational processes, designed to limit the health, safety, and environmental impacts of flaring and venting gas, typically include required burn technologies and practices for flaring, limits on the timing and duration of flaring, guidelines on the location of flaring stacks, and limits on smoke, heat, and noise generation. Regulatory procedures include those for approving flaring and venting permits, monitoring flaring and venting volumes, and enforcing operational standards. Where effective operational processes and regulatory procedures are

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lacking, operators tend to follow their own operational practices, often based on vague references in production contracts to international best practices for oil production.

### **Contractual rights to associated gas**

Oil production contracts affect the volume of gas that is flared and vented through provisions governing the rights and obligations of operators and governments with respect to associated gas. While contractual provisions vary among developing countries, most contracts recognize that operators can use associated gas in their oil field operations to optimize oil production, by reinjecting the gas into fields or using it to generate power or fuel equipment. But their right to sell associated gas to third parties has traditionally been constrained by “preemptive rights,” which give the host government exclusive rights to associated gas not used for field operations, often at no cost or a greatly reduced price. Yet governments and state-owned utilities in developing countries often lack the financial means or technical know-how to build the gas networks needed to use the gas.

Although many of these traditional contractual arrangements have been modified in recent years, preemptive rights are still common in many developing countries.

### **Energy markets and prices**

Where operators have the right to sell associated gas, they will decide in favor of that option rather than flaring or venting only if they have access to domestic or international energy markets and if energy prices are favorable. Many developing countries lack both a domestic gas market and the infrastructure (liquefied natural gas facilities, export-oriented pipelines) for selling associated gas in international markets. Moreover, domestic sales are often hindered by distorted energy pricing, monopolistic behavior by vertically integrated state-owned utilities, and lack of a transparent legal and regulatory framework allowing third parties to build and own a network for selling gas to industries and power generators.

In many developing countries the relatively low financial returns developers can expect from investing in the construction of a gas network have undermined the prospects for developing a gas market. Part of the problem is often

subsidies for competing energy sources (oil, coal, nuclear, hydropower), which lead to low prices for competing fuels.

But in many oil-producing countries the perceived value of associated gas has changed with the rise in international natural gas prices since the early 1970s and as economic and budgetary pressures have led governments to abolish energy subsidies. Higher gas prices have encouraged many governments and companies to develop gas infrastructure, eventually providing opportunities to market associated gas domestically or internationally. Some oil-producing countries, such as Algeria and the Arab Republic of Egypt, have developed domestic gas markets and earmarked a substantial share of domestic production for export. Even so, many operators in developing countries continue to view associated gas, and the requirement to develop gas infrastructure, as a hindrance to increasing oil production.

### **Financing and incentives**

Fiscal incentives can do much to reduce flaring and venting. Such incentives as taxes, duties, royalty payments, and the government share in production sharing contracts can directly affect gas flaring and venting or indirectly affect the practice by promoting gas production and the development of gas markets and networks. But fiscal incentives tend to be effective only if they are sufficiently large compared with the overall value of oil production.

Traditionally operators tended to look at the economics of associated gas in isolation from oil production. But some operators have adopted a more integrated approach in the development of new oil fields, determining the economics of associated gas jointly with those of oil production. Flaring and venting of associated gas is considered a negative externality of oil production, and the costs of this externality are taken into account in assessing the viability of an oil field. Other operators as well as regulators may also adopt this approach.

Still, projects aimed at reducing gas flaring compete with other projects for major oil companies, so host governments will need to enact policies and regulations that increase their financial attractiveness. A large share of such projects are located in some of the least credit-worthy countries, where commercial financiers

are unwilling to take the full commercial risk. Smaller international companies and some national oil companies may have difficulties self-financing or borrowing from private capital markets for these projects. Since the projects will reduce greenhouse gas emissions and thus have an element of global public good, they may need to be evaluated in a global context, with concessional financing considered in this light.

One possible source of financial incentive for projects that reduce gas flaring is carbon credits under the Kyoto Protocol's Clean Development Mechanism. Such countries as Algeria and Indonesia are preparing methods for measuring reductions in carbon emissions and building institutional capacity to establish eligibility for trading carbon credits with industrial countries.

### A global standard

Voluntary standards, though legally nonbinding, can also play an important part in reducing gas flaring and venting in developing countries. In May 2004 the Global Gas Flaring Reduction Public-Private Partnership endorsed a voluntary standard for reducing global gas flaring and venting, developed by operators, governments, and nongovernmental organizations (GGFR 2004b). Aimed at pushing the oil industry beyond prevailing practices in many countries, the standard focuses on reducing barriers to the utilization of associated gas in developing countries. It emphasizes collaboration among stakeholders to achieve reductions by:

- Encouraging an integrated approach, including developing markets and infrastructure, commercializing associated gas, strengthening regulations, and trading carbon credits.
- Providing a framework for governments, companies, and other key stakeholders to consult with one another and take complementary actions.

The standard is now being implemented by members of the partnership, which covers more than 70 percent of global flaring and venting.<sup>1</sup>

### Lessons for developing countries

Countries that have substantially reduced flaring and venting—such as Canada, Norway, the United Kingdom, and the United States—introduced a combination of regulatory and nonregulatory measures and their operators had access to domes-

tic or international gas markets. The measures included establishing an efficient legal and regulatory framework, reforming and restructuring natural gas markets, allowing private participation in the development of gas infrastructure, and creating financial incentives that encouraged operators to utilize associated gas. Equally important, governments, regulators, and operators collaborated closely in developing policies and strategies that were consistent with the country's resource management and environmental objectives and the operators' objectives of ensuring that projects were commercially viable and did not jeopardize future oil production.

No single approach to reducing flaring and venting is best for all countries. Every developing country has distinct characteristics—in its legal, political, and institutional framework and in its oil production—and thus needs to develop its own mix of regulations, energy market reforms, and other measures.

### Note

1. Besides the World Bank, the partnership includes the governments of Algeria, Angola, Canada, Chad, Ecuador, Equatorial Guinea, Indonesia, Nigeria, Norway, the United States, and the region of Khanty Mansiysk in the Russian Federation. It also includes oil companies (BP, ChevronTexaco, ENI, ExxonMobil, Norsk Hydro, Shell, SNH, Sonatrach, Statoil, and Total) and the Organization of Petroleum Exporting Countries (OPEC). The partnership started operating on January 1, 2003. For more information, visit <http://www.worldbank.org/ggfr>.

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## viewpoint

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