GLOBAL GAS FLARING REDUCTION INITIATIVE

REPORT ON CONSULTATIONS WITH STAKEHOLDERS

World Bank Group in collaboration with the Government of Norway
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1 Executive Summary

Abstract

The Global Gas Flaring Reduction Initiative, led by the World Bank Group in collaboration with the Government of Norway, aims to support national governments and the petroleum industry in their efforts to reduce the flaring and venting of gas associated with the extraction of crude oil. This report presents the results of a consultation process with stakeholders involved in flaring issues. Based on these consultations, the report suggests activities on which the Initiative might focus. A conference held in Oslo, Norway, on April 15–16, 2002, discussed these suggested activities, as well as possible next steps to be taken under the Initiative.

Background

The Global Gas Flaring Reduction Initiative (the Initiative) is led by the World Bank Group in collaboration with the Government of Norway. It aims to support the petroleum industry and national governments in their efforts to reduce the flaring and venting of gas associated with the extraction of crude oil. It is increasingly recognized that flaring and venting waste valuable resources and are a significant anthropogenic source of greenhouse gas (GHG) emissions.

A number of initial projects to prepare the Initiative’s informational background needs have already been determined (see Annex 2). These include consultations with stakeholders—oil companies, government officials, and other parties—on the role of the Initiative. This report discusses stakeholders’ views and suggests how the Initiative can supplement and strengthen ongoing efforts to reduce flaring.

Consultations

The consultation team (the Team) of six petroleum industry and development assistance experts visited national governments, international oil companies, international organizations, industry associations, and nongovernmental organizations (NGOs).

The Team sought information on the status of gas flaring from the consulted countries and the involved companies. The Team discussed national and corporate targets and policies as well as the available instruments to reduce gas flaring. The Team also sought to determine stakeholders’ views on how they evaluate the Initiative, how the Initiative could add value to actions under way by companies and national governments, how stakeholders might benefit by participating in the Initiative, and how various stakeholders view and might take part in the Initiative’s initial projects.

The Team observed that many key stakeholders have taken a number of significant steps to reduce flaring. Some governments have set targets to eliminate routine flaring and have introduced fiscal and other incentives to help achieve these targets. Several companies have committed to zero flaring for new projects, and while others have refrained from setting explicit public targets, they have embarked on
programs designed to more systematically develop markets to exploit associated gas.

In general, the stakeholders believed that the Initiative could help address barriers to investments both upstream in the petroleum sector and downstream markets. Based on stakeholders’ comments, the report presents specific activities through which the Initiative could address identified barriers.

**Does a problem exist—and can the Initiative make a difference?**

Despite commitments by governments and companies, and many successes in reducing flaring, global flaring levels have remained virtually constant since 1983. It is possible that new reduction projects (e.g., in Nigeria) will bring down the level of flaring, but it is also possible that these reductions will be neutralized by increases from new production. Global oil production capacity is forecast to increase by 60 percent from 2000 to 2020, and a similar trend can be expected for associated gas production. Much of the incremental oil production will come from countries and regions that currently have large flaring problems. Therefore, companies and countries face a major challenge in finding outlets for this gas that otherwise will be flared.

The stakeholder consultations made it clear that major constraints that hinder viable flaring elimination projects exist. The Team also received a clear message that many of these efforts will not succeed unless other key stakeholders take complementary and supportive actions. Therefore, a collaborative approach will be essential if the petroleum sector is to see a substantial reduction in flaring over the next decade.

The existence of constraints means that win-win opportunities exist, if such constraints are removed: (i) companies can form new business opportunities; (ii) by saving costs in reducing flaring and other environmental targets, “flaring countries” can obtain substantial financial gains through enhanced cost-efficiency in flaring reduction policies; and (iii) when access to a cheap, reliable, and clean fuel is improved, the global community will benefit from the provision of public goods such as lower GHG emissions, poverty reduction, and diversity of energy supplies.

The consultations with stakeholders have provided the Team with a broad overview of the main constraints and ideas on how these could be removed.

**Constraints and solutions**

Reducing gas flaring will depend critically on three broad alternatives for handling the associated gas from future flaring reductions: international markets, domestic markets, and reinjection. Of these, stakeholders indicated that international markets will have the biggest role to play. While market risks for export projects generally will be outside the control of the exporting countries’ governments, these governments can still significantly affect the project’s economics through investment conditions, including royalty, tax, and depreciation rates. However, some governments may lack experience in developing appropriate investment frameworks for gas export projects and therefore will need help in improving their institutional capacity to develop appropriate policies.
Difficulties in domestic markets include prices and taxes for gas, especially vis-à-vis those of competing fuels, whose prices may be distorted by subsidies or special tax benefits.

Developing new gas markets usually requires one or more large “anchor” customers. In practice, these customers are often power plants, implying that reforms in the electricity sector, particularly pricing, may be essential for expanding the local demands for natural gas.

The reasons for low market penetration by liquified petroleum gas (LPG) in developing countries are not entirely clear but appear to include affordability issues regarding customers’ initial investments, difficulties in designing and implementing appropriate distribution networks for small quantities, and pricing policies, including subsidies to competing fuels.

Upstream, oil company stakeholders pointed out that references to natural gas in petroleum development contracts often are vague, which creates uncertainty. The contracts also frequently impose conditions that give the operator little incentive to utilize the gas. Another important barrier in a number of countries appears to be local institutional capacity for effective monitoring. Moreover, where fines are imposed, they sometimes have been insufficient.

Typically, the availability of financing for commercially viable flaring reduction projects is not an issue for the major oil companies. However, local downstream investments can pose special risks, as they are particularly vulnerable to regulatory, political, and expropriation risks, and some comfort will be required if the investment is to go ahead. It is also apparent from the consultations that the smaller international companies and some national oil companies face special financing issues, particularly upstream.

“Green” financing could play a role in some projects, but given the lack of attention flaring has received in the context of the Kyoto mechanisms, it is somewhat unclear how flaring reduction projects would need to be designed. More work may also be needed to clarify the rules of the various green funds for flaring reduction projects, to ensure that adequate funds are available for projects that qualify.

**Recommendations—next steps**

The stakeholder conference, held in April 2002 in Oslo, marked the end of the consultative phase of the Initiative. Based on the results of the discussions summarized in this report and the deliberations during the conference, a consensus on the Initiative’s overall direction and a specific agenda of activities going forward will emerge. To help define these priorities and guide the discussion, the Team has developed a suggested approach and set of topics, which are listed below and described in detail in Chapter 5. While the Team believes that this list provides the basis for a coherent collaborative effort to reduce flaring and broadly reflects what the Team heard during the stakeholder meetings, further guidance was provided during the Oslo conference. The results of this conference can be found in Chapter 6, and future priority projects may include technical assistance and policy advice on domestic and local market creation, improvement of data collection and monitoring, and investigations of the need for a specific carbon fund for flaring reduction activities and for the development of voluntary flaring standards. A public-private
partnerships was proposed to guide the Initiative. The partners would consist of stakeholders from government and industry.

The Team believes that the Initiative could best supplement existing efforts by companies and governments by:

- Improving natural gas flaring and venting data gathering and dissemination, including the development of international measurement and reporting standards;

- Collecting and disseminating upstream regulatory “best practices”;

- Providing (or helping to target) bilateral and multilateral technical assistance (TA) for upstream regulation and incentives, monitoring and enforcement, and downstream regulation and incentives;

- Developing common international flaring and venting standards, and a possible voluntary flaring “certification” scheme based on these standards;

- Providing (or helping to target) bilateral and multilateral TA for market studies and the development of local and regional natural gas markets, particularly for small-scale gas use;

- Promoting elimination of barriers to the import of liquified natural gas (LNG) in major markets, by means of a public-private consultation process;

- Providing (or helping to target) bilateral and multilateral TA to design a favorable regulatory environment and mitigate risks for regional gas pipelines;

- Promoting the use of World Bank Group and other multilateral and bilateral insurance and risk mitigation mechanisms for gas flaring reduction and related downstream projects;

- Encouraging traditional donors and private funds to mainstream support for flaring reduction projects by smaller international and national oil companies. This would include significant project identification and preparation assistance;

- Helping to design financing mechanisms for carbon credits to be realized through gas flaring reduction projects;

- Investigating any possible needs for subsidies for flaring reduction projects at remote fields, in the context of providing “global public goods.”

Success in any effort to reduce gas flaring typically will depend on consistent and complementary actions by key stakeholders, therefore it is further suggested that governments, industry, and representatives of civil society commit to work together to support each others’ efforts to reduce flaring, in a public-private global partnership. Such a partnership would not be a formal mechanism but rather a forum and platform to exchange ideas on such matters as described in the suggested activities listed above. Given the difference in approaches that some of the
companies and governments have adopted, it is probably premature for such a partnership to commit to specific reduction targets for existing or new projects, but this could be considered at a later stage.

The Oslo meeting can be considered the first meeting of such an informal partnership. The World Bank or another suitable agency could act as the secretariat. Most of the meetings of such a partnership would be virtual, with members generally participating in the exchange of ideas on only those matters in which they have particular expertise or interest. More formal meetings could take place when deemed necessary by the partners, perhaps on an annual basis. Financing for the various initiatives to be sponsored by such a group might be secured from participating governments and international institutions and companies, with much of the latter’s contribution being made in kind. Perhaps a few key donors would commit to funding the modest administration and management costs of the overall Initiative.
2 Introduction

Background

The Global Gas Flaring Reduction Initiative (the Initiative) is led by the World Bank Group in collaboration with the Government of Norway. The idea for this Initiative was put forward during a June 2001 Oslo seminar hosted by Anne Kristin Sydnes, who was then the Norwegian Minister for International Development. Subsequently, the Initiative was launched during the Conference of the Parties (COP-7) under the United Nations Framework Convention on Climate Change (UNFCCC) in Marrakech. The Initiative aims to support national governments and the petroleum industry in their efforts to reduce the flaring and venting1 of natural gas associated with the extraction of crude oil.

Flaring of natural gas wastes resources. Available statistics show that the volume flared is at least 108 billion cubic meters (bcm) per annum (see Table 3.1). Flaring is also increasingly recognized as a serious global environmental problem; and in some cases may have harmful effects on human health and ecosystems near the flaring sites.

While the petroleum industry and national governments have already achieved impressive results in reducing gas flaring, this Initiative aims to supplement and strengthen those efforts by mobilizing the stakeholders—the petroleum industry, national governments, and bilateral and multilateral development agencies—in joint actions. The Initiative will establish an arena for dialogue on flaring reductions, with an emphasis on identifying areas where common approaches and collective action can offer further impetus to existing efforts.

The Initiative’s main focus is to identify ways to overcome the barriers that currently inhibit flaring reduction investments and to find practicable solutions that will generate investments.

The Initiative aims to improve the political and regulatory framework for investments in flaring reductions, improve market access for natural gas, and disseminate information on international best practices, by implementing its key activities.

A number of initial projects to prepare the Initiative’s informational background needs already have been determined (see Annex 2). These include consultations with relevant stakeholders, such as government officials and oil companies. This report is the product of those consultations. It was presented at an April 15–16, 2002, conference in Oslo, Norway. The conference provided participants with an opportunity to further discuss the Initiative’s activities.

1 Throughout this document, “flaring” can be assumed to refer to venting as well.
Consultations with stakeholders

The Team included six experts with extensive work experience in the petroleum industry and development assistance. From December 2001 to February 2002, Team members visited international oil companies, international organizations, national governments, industry associations, and NGOs. (For further details see Annex 3.)

The Team sought information on the status of gas flaring in the consulted countries and from the involved companies. The Team discussed national and corporate targets and policies as well as the available instruments to reduce gas flaring. The Team also inquired about:

- How various stakeholders evaluate the Initiative and its possible outcomes;
- How various stakeholders believe the Initiative could add value to what companies and national governments already are doing, and how the stakeholders could benefit from participating in the Initiative;
- How various stakeholders perceive the Initiative and might take part in its initial projects.

All stakeholders showed interest in the Initiative. However, while some had clear ideas as to how it could contribute, others were less lucid, though generally receptive to the views of the Team and of other stakeholders. The Team met with some environmental NGOs but, despite repeated attempts, was not received by a number of these groups. The Team considers it important to establish better contact with environmental NGOs during further development of the Initiative’s role and focus.

After the stakeholder visits, the Team concluded that all the major oil companies and many host governments are taking significant, proactive steps to eliminate gas flaring. Therefore, it was agreed that the Initiative should focus its efforts on areas where it could supplement and strengthen work under way by companies and governments. In that vein, the Team sought to identify the existing barriers to flaring reduction investments. The challenge is to find practical solutions that will generate investments.

In general, the stakeholders believed that the Initiative could help address barriers to investments both upstream and downstream in the petroleum sector. Based on stakeholders’ comments, the report presents specific activities by which the Initiative could address identified barriers. Given the relatively small number of countries and companies involved in flaring, it should be possible to bring together relevant players in cooperative actions. Therefore, an early task of the Initiative will be to establish a forum where, with the Initiative’s support, ideas can be exchanged and joint activities identified.

Finally, while this report does not intend to give an absolute analysis of the scale of flaring and its causes, the Team believes that the stakeholder consultation process has provided an adequately clear picture of major constraints and challenges to form the basis for a detailed discussion of the Initiative’s future role.
3 Does flaring constitute a problem?

3.1 The nature of flaring

Associated gas (sometimes called solution gas) is a blend of different hydrocarbons that is released when crude oil is brought to the surface. The composition and amount of such gases vary from one oil field to another. In certain circumstances, such as emergency shutdowns, nonplanned maintenance, or disruptions to the processing system, flaring serves a vital safety purpose. However, this report focuses on routine flaring, that is carried out to dispose of unwanted associated gas.

Other than flaring and using the gas for energy purposes at the wellhead or nearby production facilities, there are two alternatives for the management of associated gas:

- Reinjecting the gas into the reservoir to maintain pressure and enhance oil recovery, or into other underground formations for possible later use;
- Collecting, processing, and marketing the gas in domestic or international markets.

Choosing the appropriate option depends on upstream conditions, such as field characteristics and the oil-to-gas ratio; downstream market opportunities for the recovered gas; and the legal and fiscal frameworks, which may include various incentives and penalties.

Why flaring is a problem

Flaring of gas in association with crude oil production presents a problem for the following reasons:

- **It wastes resources:** The estimated 108 bcm of natural gas flared globally per year is a significant waste of energy resources that could be used productively. The amount being flared is at the same level as the combined gas consumption of Germany and France. Flaring in Africa (37 bcm in 2000; see Table 3.1) could, if used for power generation in efficient power plants, produce 200 TWh, which is approximately 50 percent of the current power consumption of the African continent, and more than twice the level of power consumption in sub-Saharan Africa (excluding the Republic of South Africa).

- **It harms the environment:** Carbon dioxide (CO₂) emissions from flaring and methane emissions from venting have high global warming potential and contribute to climate change; methane is many times more potent a GHG than CO₂ (see Box 3.1). Flaring may in some places have harmful effects on human health and ecosystems near flaring sites. Global CO₂ emissions from flaring are nearly 10 percent of the emissions that Annex 1 countries
Box 3.1: Impact of flaring of natural gas on climate change

Flaring produces the primary GHGs, CO₂ and methane (CH₄). In addition, flaring of gas rich in liquids can produce smoke, with aerosol effects that also contribute to global warming.

One of the key problems in assessing the impact of flaring on GHG accumulation is the lack of information not only about the quantities involved but also about the types of gases emitted. Key issues include:

- The ratio of gas vented to gas flared is crucial because the impact of methane on global warming is about 21 times greater than that of CO₂, so a small change in the ratio of flaring to venting makes a disproportionate change in the impact on the global environment. For example, if 90 percent of the associated gas volume is flared and 10 percent is vented, the amount vented would have approximately twice the global warming effect as the amount flared.

- Gas flares vary greatly in the efficiency with which they burn methane and thus convert it into CO₂. The least efficient flares still frequently used may convert only 90 percent of the methane to CO₂, while the most efficient flares convert 98 percent. The global warming impact of the least efficient flares is twice that of the most efficient.

- The composition of the gas being flared can vary greatly. Some gas is rich in hydrocarbons heavier than methane (propane, butane, pentanes plus) and thus produces more carbon, as well as smoke and aerosols. In other cases, gas may contain significant proportions of inert gases (nitrogen, helium) and sulfur compounds (H₂S), as well as CO₂. Incineration of such “impure” natural gas will have a different impact on the climate change than that of pure hydrocarbons.

Because of these uncertainties, the impact of flaring on global warming could be larger than normally assumed. A possible means of reducing uncertainty would be to measure a representative sample of flaring sites and assess the likely range of average characteristics of flaring on a regional basis, using improved figures on flaring volumes to arrive at a global estimate of the impact of flaring on global warming.

(including the United States) have committed to reduce under the Kyoto Protocol for the target period 2008–2012.²

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² According to the Kyoto Protocol, Annex 1 countries, consisting of industrialized countries of the Organization for Economic Cooperation and Development (OECD) and Central and Eastern Europe, including Russia, are committed to reducing greenhouse gas emissions within the commitment period 2008–2012. Reduction requirements vary by country, but for Annex 1 countries as a whole, greenhouse gas emissions should be approximately 5 percent below 1990 levels by the end of the commitment period. Assuming a 10 percent business-as-usual growth in emissions from 1990 to the commitment period, the actual reduction to meet the Kyoto requirements translates to 2.3 billion tons of CO₂ in 2010. It should be noted that the United States has stated it will not ratify the Kyoto Protocol. This means that the overall target of a 5 percent reduction is likely to translate to a 2–3 percent overall reduction, assuming the United States remains outside the Protocol during the first commitment period.
3.2 National policies and corporate strategies

As environmental issues attained a larger role on the international energy policy agenda during the 1990s, developed and developing countries alike began to pay more attention to gas flaring’s detrimental effects. Major international oil companies also began giving the flaring problem high priority. During its consultations the Team was left with the clear impression of a strong commitment among governments and companies to find the means to reduce and eventually eliminate routine flaring.

National policies

Today, flaring as a resource management problem is explicitly being addressed by petroleum sector policies in a number of countries. In addition, the environmental consequences of flaring are being addressed in environmental impact assessments and through the integration of flaring into environmental policy strategies. There has been a decisive move toward more stringent regulation of flaring, in some cases combined with ambitious phase-out targets. In Nigeria, petroleum companies have been mandated to stop routine flaring by 2008. Countries have chosen a variety of policy instruments to address their flaring problems, and these policies’ effectiveness and cost-efficiency have varied greatly.

Most countries have instituted direct regulations, although with great variety in regulatory approaches and practices. In almost all countries flaring may take place only after authorization by a regulatory body. When authorized, flaring is subject to a variety of conditions, such as emission standards (Egypt, Nigeria, Qatar) or technical requirements.

Nigeria’s and Indonesia’s experiences with gas flaring reduction policies indicate that overlapping jurisdictions between petroleum and environmental agencies can be an obstacle to the effective implementation of antiflaring policies. Moreover, a report reviewing regulatory practices for gas flaring notes that there is “no assurance that regulatory agencies in less well resourced countries are in a position to monitor compliance with regulations effectively and to enforce their provisions in the event of breach.”

Taxation and emission fees have been introduced in only a few countries, often with little effect. In Nigeria this proved to be the case because the fee was too low to have an impact on gas flaring; in Norway because the CO\textsubscript{2} emission tax was introduced when oil companies’ flaring reduction measures were already well under way; and in certain other countries because of lack of enforcement. Other fiscal incentives have tended to be more effective; one example is Nigeria’s favorable petroleum tax incentives. These have spurred a series of gas utilization investments.

A third category of policies is represented by negotiated or voluntary agreements between the authorities and the industry on flaring practices, and targets for flaring reductions. These measures, together with various schemes involving public-private partnerships, have established themselves as an important supplement to other policy actions taken in Canada (Alberta), Norway, and the United Kingdom. For example, in Alberta voluntary targets were agreed upon by stakeholders (Clean Air Strategic Alliance) for companies to reduce gas flaring by 25 percent between 1996
and the end of 2001. The regulator threatened to impose regulations if the targets were not met. In fact, companies ended up reducing flares 38 percent by 2000, before the target date. The objective for gas flaring management is the elimination and reduction of flaring of associated gas, and the improvement of the efficiency of flaring. To accomplish this objective, the regulator adopted a decision tree process to be used by operators as a means of implementing the gas flaring management objectives. All existing associated gas flares must be evaluated using the decision tree by end 2002. If conservation is determined to be economically viable, the regulator requires that the gas flare be eliminated. If flaring cannot be eliminated, the operator should then consider alternatives for minimizing the volumes of gas that are flared, such as the generation of electricity. Remaining flares must meet the flare performance requirements.

Another example of a negotiated/voluntary agreement is the United Kingdom’s pilot scheme for offshore emissions trading, introduced in 2001. Operators will be able to sell “surplus” emissions savings (flaring amounts below those allowed by the government for a particular field) through the United Kingdom’s Emissions Trading System (ETS), beginning in April 2002.

Specific measures to regulate gas flaring cannot be isolated from the broader policies pursued by governments to promote gas use, particularly through gas and power sector reforms. As one example, gas flaring reduction in Russia is closely related to the restructuring of the Russian gas industry. The main obstacle to using gas that would otherwise be flared is lack of access to processing facilities and gas pipelines. Gazprom has been using its monopoly to restrict oil companies’ access to its network by demanding “pipeline quality” gas and restricting access to its network. The Government of Russia is pushing to dismantle Gazprom’s monopoly, including ensuring access to Gazprom’s pipelines on reasonable terms. In addition, the oil industry is taking remedial measures on its own accord, by buying gas processing facilities to ensure that the right quality of gas can be produced. The main remaining issues are the price of associated gas and access to the export market. Even though Gazprom currently needs more gas supplies to fulfill its commitments and is experiencing capital shortages to develop new gas fields, rather than providing access to its network for low-cost associated gas, the company plans to develop its own new gas fields.

Consultation with national governments and review of their policies reveal encouraging signs of commitment and willingness to act on the flaring problem. However, it is also noted that a number of these countries are likely to face difficulties in implementing policies and monitoring compliance, due to lack of administrative resources or jurisdictional or organizational problems within administrations. Therefore, this constitutes an area where joint efforts, as proposed by the Initiative, could make an important contribution.

Since the characteristics and challenges of flaring tend to differ from country to country, as do the political and institutional contexts for addressing the problem, it may be difficult to identify a single “best regulatory practice.” Nevertheless, as a general principle country policies and regulations could be improved by enhancing their transparency, effectiveness, and cost-efficiency.

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Corporate policies and strategies

Most of the major international petroleum companies have active policies on flaring and flaring reduction. Many of these companies now consider routine flaring from new production sites to be unacceptable. This means that companies developing new oil fields seek project designs that include solutions to avoid gas flaring when possible. This may represent an additional cost in field development, but often the economic gains from gas utilization or reinjection outweigh these costs over the life of the projects. A number of oil companies also are more actively seeking solutions to flaring problems at their existing production sites.

The Team noted marked differences among oil companies’ public statements and targets for reducing and eliminating flaring. The Team has not been able to assess whether this has translated into different levels of effort to tackle the flaring problem. Rather, in general the Team observed broad commitment among oil companies to find effective and cost-efficient solutions.

**ExxonMobil** informed the Team that the company is working to eliminate flaring under its general policy to use resources (including associated gas) efficiently and evaluate gas utilization projects continuously. In West Africa, the company reports that its policy from the start has been full reinjection at its deepwater Angolan operations. In Nigeria, ExxonMobil used to flare 100 percent of associated gas production, but commercially viable reservoir management and reinjection projects have reduced flaring to 30 percent of associated gas production. ExxonMobil does not have an overall corporate target to eliminate gas flaring in Nigeria. ExxonMobil has not been developing gas utilization projects in Nigeria but has led a gas utilization study to define commercial domestic and export gas opportunities and is leading a joint industry study on LNG in the West Niger Delta (from Escravos), which will be finalized in 2003. Equatorial Guinea, as a new oil producing country, currently does not have outlets for gas; 85 percent of its gas is flared. ExxonMobil is also involved in efforts to market gas in Kazakhstan, Papua New Guinea, and Sakhalin (Russia). ExxonMobil does not have a general policy to avoid gas flaring in new oil developments; instead, it seeks to utilize resources efficiently.

**Shell** is an operator in 21 countries, including most of the countries identified as flaring “hotspots,” such as Nigeria. Shell has committed itself to cutting GHG emissions from all of its operations; this includes a commitment to eliminate all continuous venting by 2003 and all routine flaring by 2008. West Africa, particularly Nigeria, is at the center of Shell’s flaring reduction efforts. Shell Petroleum Development Company of Nigeria (SPDC) practices reinjection when possible, but according to the company most of its sites are considered unsuitable for reinjection. SPDC also collects gas for sale and currently supplies 95 percent of Nigeria’s domestic gas market (mostly from nonassociated gas). SPDC has stated that it is committed to eliminating routine flaring by 2008, either by collecting the gas for sale or by reinjecting it. Shell’s Health, Safety, and Environment (HSE) Performance Monitoring and Reporting contains information on GHG emissions and flaring activities by the Shell companies. HSE data are required to have an audit trail—a documented record of definitions, assumptions, aggregation, calculations, and references. This information must be contained in a verification file so that if external verification is performed, the data will be transparent and easily accessible.
In developing countries, **BP** holds strong interests in the Americas, notably Colombia and Venezuela, in addition to Azerbaijan and countries in Africa (Angola and Egypt) and Southeast Asia (Indonesia). In Azerbaijan, plans to use flared gas are being implemented. In offshore Angola, the company plans to reinject all gas. Environmental considerations are an integral part of BP’s activities. By 2010, GHG emissions will be reduced 10 percent from the 1990 baseline. BP has eliminated continuous venting (deadline was 2001) and intends to eliminate all routine, nonemergency flaring by 2003. All GHG emissions are audited.

**ChevronTexaco** is active in most countries, with its key operations in the Caspian region, the Gulf of Mexico, and West Africa. While ChevronTexaco generally supports flare management, the company has not internally agreed on the best way to achieve this goal. The company considers controlling flare emissions to be part of its overall GHG emissions strategy, such as by incorporating a carbon price in its investment analysis. The company emphasizes the need for a verifiable and consistent approach to inventorying emissions from all of its operations and is currently deploying a data collection system, developed in-house. The company is committed to zero flaring in Nigeria by 2008 and plans to mitigate most routine flaring on its future projects in Angola by means of reinjection. Given the limits of the Nigeria domestic market, ChevronTexaco sees the export market as the key to the marketing of both associated and nonassociated gas from the country and as a means to eliminate gas flaring. The West Africa Gas Pipeline is a key component in this strategy, starting at 1.9 bcm per year (11 percent of Nigeria’s estimated gas flaring) and rising to 4 bcm per year. ChevronTexaco also operates a number of remote fields for which no economic solution to gas flaring has yet been identified. The company emphasized that the Initiative needs to create an environment in which the companies can talk to each other and identify viable solutions.

Europe (primarily the North Sea) accounts for close to 35 percent of **TotalFinaElf**’s production, while Africa represents around 29 percent. TotalFinaElf notes that it already ceased the routine venting of associated gas a number of years ago and avoids flaring by reinjecting gas into the reservoir, when this is technically feasible. The company has CO2 emission reduction targets for different business activities.

**Agip**’s operations in North Africa, West Africa, and the former Soviet Union face significant flaring problems. The company has a principle of zero flaring for new projects and plans to end flaring in its Nigeria and Congo operations by 2004. In Egypt it aims to reduce flaring by 85 percent from 2000 to 2005.

In Russia, **Sibneft**, like a number of other Russian companies, is actively acquiring its own gas processing facilities and developing local markets. Depending on the timing of the full implementation of third party access to Gazprom pipelines, the company hopes to significantly reduce flaring from its current facilities. Sibneft noted that it expects to have no flaring at its new fields. **Lukoil** is taking similar steps to utilize its associated gas and has stated that it does not expect its new field development to result in flaring. **Yukos** is planning significant reductions in its gas flaring, although the Team did not learn whether Yukos has a policy of no gas flaring in new projects. **TNK** permits 2 percent gas flaring in its new oil field development projects.
**PEMEX** introduced a gas flaring management system in 1998 and has also developed a health, safety, and environmental protection program. However, although PEMEX publishes an annual audit report, there are no explicit gas flaring targets against which to measure performance.

In Norway, **Norsk Hydro** has an explicit corporate policy of no flaring for new projects. In Angola, where Norsk Hydro has significant assets, reinjection has been employed. In Angola, Norsk Hydro is exploring LNG solutions as part of a joint venture with TotalFinaElf, ExxonMobil, BP, ChevronTexaco, and Sonangol; ChevronTexaco will be the operator. **Statoil** similarly has an explicit policy of no new flaring and generally has been in the forefront of finding solutions for its current operations.

**Conoco** has oil production with gas flaring issues in Asia (Indonesia, Malaysia, and Vietnam). The Team discussed Conoco’s gas flaring reduction project at its Polarlights JV site in northwest Russia. Gas is flared at these locations due to lack of infrastructure or markets and government policies that lack attractive incentives to reduce flaring. Conoco does not have a corporate policy on reducing gas flares from existing or new production. Its sustainable growth policy seeks to integrate economic, environmental, and social considerations into strategic planning and business decision-making processes, and to maximize resource efficiency and minimize waste in business activities.

Smaller and national oil companies also consider flaring reduction to be a priority. However, as these companies generally are minority holders in oil licenses and typically have only limited financial and technological means, they rarely play as active a role as the larger oil companies.

Naturally, the Team has not been able to discuss these issues with all oil companies or to cover the complexities of all projects; however, the summary gives a good indication of the range of industry responses to flaring. The Team hopes to gather additional information as the Initiative proceeds.

### 3.3 Size and location of flaring

**Historical trends and current flaring levels**

On a global scale, regular and reliable statistics on gas flaring do not exist. Discrepancies in flaring estimates from various sources suggest that there are major uncertainties about the total volume being flared, in both developed and developing countries. The lack of comprehensive and accurate statistics implies that the data should be interpreted with caution. Still, we consider that the broad trends in historical series and geographical distribution give a reasonably useful picture of actual developments.
The most comprehensive and authoritative statistical source is probably Cedigaz, which bases its estimates on figures provided by governments. According to Cedigaz’s 2000 survey, gas flaring accounts for approximately 3 percent of overall natural gas production (associated and nonassociated), amounting to some 100 bcm. However, this figure underreports the actual scale of flaring, due to lack of data from some important petroleum producing countries, most notably China and Russia. When including estimated data for these two countries and a revision to flaring data for the United States (see Box 3.2), global flaring in 2000 was about 108 bcm.

### Box 3.2: Flaring data for selected countries

Cedigaz, which bases its flaring figures on statistics reported by governments, lists zero flaring for Russia. The Russian government provided the review team with flaring figures for 2000 that are based on those reported by Russia’s largest oil producers. (An obligation to report flaring is included in licenses.) These official figures indicate that only 2.6 bcm was flared out of a total associated gas production of 27.2 bcm. The Russian Ministry of Energy acknowledged that these figures appear to be very low, especially in light of the large flares that are visible from satellite images.

IHS Energy Group estimated the amount of gas flared in a number of key countries for the Bank. In Russia, it bases its flaring estimates on information it has collected on Russian oil fields and their gas/oil ratios. IHS assumes that the gas from a particular field has been flared unless the operator is known to practice reinjection or gathering. Based on this, IHS estimates that Russia probably flared or vented some 11.5 bcm of gas in 2000, out of a total associated gas production of 33.4 bcm.

In the statistical tabulations of this report we have used the IHS estimate of 11.5 bcm for Russian gas flaring, recognizing that this is a conservative estimate.

IHS Energy Group estimates gas flares in China at 3.2 bcm in 2000. This estimate has been discussed with Chinese companies, who regard the estimate as high because associated gas produced in the eastern part of China is mostly utilized. Satellite images show only minor gas flaring in China.

For Nigeria, Cedigaz’s estimate for gas flaring is 17.2 bcm in 2000. However, the Initiative has also considered two other sources of gas flaring estimates for the country. IHS’s estimate is 5.2 bcm for the larger fields and 2.3 bcm for the smaller fields, a total of 7.5 bcm. Government data gathered from the companies operating in Nigeria show that 7.7 bcm gas is flared in the larger fields. The two largest companies operating in Nigeria, however, have published figures showing gas flaring around 11.9 bcm for the two companies alone. In the statistical tabulations of this report we have used the Cedigaz estimate of 17.2 bcm.

According to Cedigaz data, the United States flared 7.7 bcm in 2000. This information was based on the U.S. Department of Energy’s Energy Information Administration (EIA). However, the EIA has recently revised data showing that the United States had significantly overreported amounts of flared and vented gas, mainly due to misreporting by the individual states. According to the revised statistics, flaring in 2000 was 2.8 bcm, which is the number used in this report. The U.S. states with the most flaring (including offshore flaring) were Alaska, Louisiana, Texas, Utah, and Wyoming, accounting for 81 percent of total gas flaring in the nation. Pre-1998 data have not been revised, and therefore it is unclear to what extent flaring practices changed in the 1990s.
Based on Cedigaz data, revised data for the United States, and estimates for Russia and China, Table 3.1 presents our estimate of global flaring, broken down by regions. The table shows that Africa accounts for the largest amount of gas flaring by continent, and, together with the countries of the former Soviet Union (FSU), accounts for more than 50 percent of the global total. The estimate for the FSU, however, is conservative (see Box 3.2). Asia-Oceania, Central and South America, and the Middle East account for 34 percent, highest in the Middle East, with Europe and North America accounting for less than 14 percent, of which Europe is only 3 percent.

Table 3.1: “Best estimate” on regional breakdown of gas flaring (2000)

<table>
<thead>
<tr>
<th>Region</th>
<th>Flared gas (bcm)</th>
<th>Share of world total (%) (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>37</td>
<td>34</td>
</tr>
<tr>
<td>Asia-Oceania</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Europe</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>FSU</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>Central and South America</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Middle East</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>North America</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td><strong>WORLD</strong></td>
<td><strong>108</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: Cedigaz, OPEC, World Bank.

(a) Shares rounded.

Figure 3.1 shows Cedigaz’s global gas flaring estimates for the period 1980–2000. The great decline in the early 1980s (65 bcm between 1980 and 1983) is only partly explained by a decline in oil production (this share accounts for approximately 17 bcm). The main reason was a decline in flaring per unit of oil produced, largely associated with improvements in Middle East operations. Saudi Arabian gas flaring volumes dropped by 22 bcm between 1980 and 1983, while Iraq and the United Arab Emirates combined accounted for a fall of almost 11 bcm during the same period. Closer inspection of country-specific data shows that flaring now appears to be concentrated in a relatively small number of countries.
Figure 3.1: Trends in world gas flaring and venting (1980–2000)\(^{(a)}\)

Source: Cedigaz. Note: The spike in global gas flaring in 1991 is primarily related to the events surrounding the Gulf War, when oil output was increased in a number of countries to compensate for the loss of Kuwaiti and Iraqi oil production. This new production capacity included associated gas for which there was little or no infrastructure and which consequently was flared or vented.

\(^{(a)}\) Excluding China and Russia.

About two-thirds of flaring in the Middle East can be attributed to Iran. Looking back 10 years, the situation was different; Saudi Arabia also was a large contributor to the region’s flaring emissions (see Box 4.2). However, Saudi Arabia has implemented a plan to stop virtually all flaring by building a gas pipeline network and has developed a large domestic gas market that presently consumes 50 bcm per year.

As can be seen in Table 3.2, Algeria has seen its volume of flared gas rise during the past decade, from 4.5 bcm in 1990 to 6.8 bcm in 2000, having previously declined from 9.7 bcm in 1980. The ratio of Algerian gas flared to oil produced is one of the highest in the world, despite the country’s large domestic and export gas markets, which consume about 75 bcm per year. Angola has the third largest gas flaring in Africa, at 4.3 bcm.

In Central and South America, Mexico (5.6 bcm) and Venezuela (4.5 bcm) produced the region’s largest gas flarings in 2000. For most of the early 1990s, Mexico flared about 1 bcm of gas per year, but this figure increased rapidly, peaking at 6.8 bcm in 1998 due to bottlenecks in the gas system. In Argentina, another large regional gas market, flaring, after hovering around 3 bcm per year in the early 1990s, declined significantly, to 0.6 bcm. Brazil flared 2.1 bcm of gas in 2000.

Although the amount of gas flared worldwide has declined relative to oil production, the total volume of flaring has shown only a modest decline since the early 1980s, despite substantial flaring reductions in some countries. Successful flaring reductions in the Middle East and Europe have been offset by increased
flaring in other parts of the world, while little is known about historic flaring trends in the FSU and China.

Table 3.2: “Best estimate” of gas-flaring trends in selected countries (2000)

<table>
<thead>
<tr>
<th>Country</th>
<th>Flared gas</th>
<th>Share of world total (%)(a)</th>
<th>Ratio gas flared to oil produced (m³/toe) (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1990</td>
<td>2000</td>
</tr>
<tr>
<td>Algeria</td>
<td>6.8</td>
<td>6</td>
<td>79</td>
</tr>
<tr>
<td>Angola</td>
<td>4.3</td>
<td>4</td>
<td>n/a</td>
</tr>
<tr>
<td>China</td>
<td>3.2</td>
<td>3</td>
<td>n/a</td>
</tr>
<tr>
<td>Egypt</td>
<td>0.9</td>
<td>1</td>
<td>37</td>
</tr>
<tr>
<td>Indonesia</td>
<td>4.5</td>
<td>4</td>
<td>66</td>
</tr>
<tr>
<td>Iran</td>
<td>10.5</td>
<td>10</td>
<td>70</td>
</tr>
<tr>
<td>Nigeria</td>
<td>17.2</td>
<td>16</td>
<td>250</td>
</tr>
<tr>
<td>Mexico</td>
<td>5.6</td>
<td>5</td>
<td>n/a</td>
</tr>
<tr>
<td>North Sea(c)</td>
<td>2.7</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Russia</td>
<td>11.5</td>
<td>11</td>
<td>n/a</td>
</tr>
<tr>
<td>Venezuela</td>
<td>4.5</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>United States</td>
<td>2.8</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Other countries</td>
<td>33</td>
<td>30</td>
<td>—</td>
</tr>
<tr>
<td>WORLD²</td>
<td>107.5</td>
<td>100</td>
<td>—</td>
</tr>
</tbody>
</table>

(a) Shares rounded.
(b) Oil data from BP Statistical Review of World Energy (2001).
(c) North Sea = Denmark, Norway, and the United Kingdom, as Germany and the Netherlands do not flare according to Cedigaz 2000.

n/a Not available.

Future flaring trends

According to oil forecasts by the EIA, world incremental oil production capacity by 2020 is expected to be about 45 million barrels per day (mbd) above 1999 levels, a 60 percent increase. Africa (8 mbd), the FSU (7.5 mbd), Latin America (6.5 mbd), and the Middle East (22 mbd) account for almost all of the increase, whereas the other regions (Asia, Europe, and North America) will have largely constant production (see Figure 3.2).
A major portion of incremental oil production is expected to come from Saudi Arabia, where the flaring ratio is one of the lowest in the world. Large increases will also come from other Middle East countries, including Iran, which has a high flaring ratio, and from Africa and the FSU; flaring ratios in some of these countries are among the world’s highest. Given the expected production increases in the Siberian and Caspian regions in the FSU’s forecasted growth, this uncertainty could have a large impact on the overall volume of flared gas. Additional production capacity will also come from some new oil-producing countries, in particular those in West Africa, where there is no gas flaring history and markets for associated gas are not easy to develop.

If existing regional ratios of gas flared to oil produced are maintained, the EIA’s forecasts for incremental oil production imply increased levels of annual flaring by about 60 percent during the period 1999–2020. This is illustrated in the “no action” scenario in Figure 3.3. However, given the national and corporate policies and strategies designed to reduce flaring discussed earlier, substantial reductions in flaring during the next 20 years are entirely possible (“optimistic scenario”). Figure 3.3 shows possible reductions in gas flaring due to gas utilization in international and domestic markets and site use and re-injection. While the Team believes that such a scenario is feasible, it is apparent from the consultations that there is no reason to be sanguine. The fact that flaring declined only modestly in the past decade, despite achievements by such major players as Saudi Arabia, requires that projections be treated with caution.

Source: EIA base case forecast
Successful implementation of flaring reduction projects will depend critically on complementary policy and regulatory actions designed to remove international and domestic market barriers. This is especially important for projects designed to use associated gas, where the economics are often marginal. In such cases easing market constraints can often change investments from marginally negative to marginally positive.

Based on the above discussions, Figure 3.3 illustrates the three broad options for the use of flared gas; it is in these areas that the solution to the gas flaring problem must be found. International markets are the primary outlet for associated gas that otherwise might be flared. Specifically, flaring in Nigeria and Angola is extremely sensitive to the demand growth and price prospects in the Atlantic Basin LNG market. Domestic markets in flaring countries generally can absorb significantly more associated gas than they do at present, but their relative importance is smaller, due to generally moderate local energy demand. Finally, site use and reinjection will continue to be important alternatives if gas cannot be brought to market economically.

In West Africa, flaring ratios are expected to decline significantly over the next two decades, mostly due to improvements in Nigeria and Angola. Both countries have large projects in development to reinject associated gas or bring it to market (see Chapter 4 for projects in Nigeria). However, many of these projects will have to contend with policy and market barriers that could delay or undermine their execution.

North Africa is increasingly linked to the European gas market through new pipelines. There are also plans to expand LNG exports from this region. LNG
imports to Europe and prospects to use gas locally or regionally can also help to absorb some portion of associated gas production by the Middle East.

Flaring rates eventually could come down significantly in Russia as well. Apparently Gazprom previously had been able to discourage many applications for pipeline transport by the low (regulated) prices in the domestic market, and by insisting that the gas meet Gazprom’s quality standards while denying access to its processing facilities. Russian companies seem to be making some headway in tackling the flaring problem by developing gas markets close to their fields and investing in their own gas processing facilities to meet Gazprom’s quality demands. Also, domestic gas prices have been increased recently. Still, a number of policy and market barriers (including Gazprom’s monopoly position and access to export markets) threaten to hold back improvements in flaring rates.

These examples show that a radical decline in flaring is conceivable but would be highly sensitive to market developments and the removal of barriers that currently hinder beneficial uses of the gas. Consultations with stakeholders have made it clear that unless these barriers are removed it will prove difficult and unnecessarily costly to reduce flaring in many cases.

The Initiative as a supplement to efforts under way

Although governments’ and companies’ commitments and the current strong momentum in flaring reduction efforts give reason for optimism, the constraints on viable flaring reduction investments should not be underestimated. The Team believes that complementary and supportive actions by the Initiative could help reduce these constraints, because many of the constraints will require joint efforts by national governments, the petroleum industry, and bilateral and multilateral development agencies. The Initiative could be a catalyst and coordinator of such efforts. Moreover, the stakeholders made it clear to the Team that collaborative approaches would be important to achieve substantial flaring reductions.

Figure 3.4 shows that we have identified three groups of projects. A number of projects are identified as viable projects, i.e., financially viable to private entities under existing regulatory/incentive frameworks. A number of projects are termed “Win-win”. These projects are economically attractive when market barriers and constraints are removed and domestic, social, and environmental externalities are internalized. Finally, global public goods projects would be economically attractive only when market barriers are removed and global externalities internalized.
The projected rate of return for most of the projects in the win-win category is low or marginal, and barriers to their implementation must be removed, often through collective action, to realize the potential benefits. If removed, there may be the opportunity for win-win situations:

- Companies will benefit from new business opportunities by marketing their associated gas production and saving the costs associated with meeting flare reduction and other environmental targets;

- Countries are expected to realize substantial financial benefits and government budget improvements through enhanced cost-efficiency in flaring reduction policies and a number of other economic and social benefits, including improved access to a cheap, reliable, and clean fuel;

If global externalities are internalized the global community will benefit from the increased global provision of public goods—lower GHG emissions, contributions to poverty reduction, and greater energy supply diversity.

The consultations with stakeholders provided the Team with a broad overview of the main constraints and some suggestions for their mitigation. The constraints and suggested solutions are reviewed in the next chapter.
4 Constraints and solutions

As illustrated by Figure 3.3, three outlets will be critical for handling associated gas that might otherwise be flared: international markets, domestic markets, and reinjection. Stakeholders indicated that international markets would be the most important, because of the difficulties in developing domestic and regional markets in and near many of the countries where significant flaring occurs. Reinjection will also play an important role in oil fields that are far from markets or lack the infrastructure to bring the gas to market.

Based on the Team’s consultations, it is apparent that achieving significant reductions in flaring from existing fields will pose a special challenge. Until recently, industry’s and governments’ main focus has been on using associated gas produced from incremental oil production at new fields. These parties appear to have assumed that flaring from current oil fields would decline as these wells reached the end of their lives. However, this assumption may no longer be valid, as new technology has extended the lives of many older fields. Moreover, the problem is compounded by the fact that the return on investments in flaring reduction for such fields is often marginal or negative.

This chapter examines the main constraints that may hinder investments in solutions that would reduce the flaring of associated gas.

4.1 International markets

Stakeholders made it clear to the Team that international gas markets are the most important potential outlet for associated gas. In North Africa, West Africa, and parts of the Middle East, local demand in the near future is unlikely to be sufficient to reduce gas flaring significantly. Thus, apart from reinjection, exports of LNG, and transport by means of regional pipelines probably will be the most important alternatives to flaring.

4.1.1 Liquefied natural gas (LNG)

The Atlantic Basin (see Figure 4.1) is likely to be the principal market for LNG, fully or partly based on associated gas production in West Africa. On the supply side, the number of projects that could supply the Atlantic Basin are plentiful (see Table 4.1). Projects totaling 67–86 Mill.t per year (92–118 bcm per year) have been planned; some of these are under construction. These amounts include 11 Mill.t per year from the two Qatar projects but not from other potential Middle East projects. As the world map shows, the Middle East is in the periphery of both LNG basins.
LNG imports into the United States have seen a rapid growth over the past few years, attributed mainly to the start-up of the LNG project in Trinidad and to higher projected natural gas prices in the United States. The EIA projects a significant increase in natural gas demand—8 percent annual increases in LNG imports during the next two decades. LNG imports into the United States are expected to reach about 0.8 trillion cubic feet (Tcf) (22.6 bcm) by 2020, accounting for about 2 percent of U.S. gas consumption. The main reason for the moderate average growth rate is projected low U.S. natural gas prices in the medium term. LNG can be delivered from existing plants in Trinidad and Tobago and from Nigeria at a price below the cost of many of the supply options for new “frontier” natural gas sources in North America.

Figure 4.1: LNG, a global competitive landscape

A challenging problem in the U.S. LNG industry has been citizen protests against reopening mothballed import terminals on environmental and safety grounds; it would be difficult to obtain approval for new terminals. One conclusion of an LNG Conference in Houston in July 2001 was that “new terminals will be difficult to build in the United States primarily because of local citizen opposition.” The Federal Energy Regulatory Commission (FERC) advised potential terminal developers to “do a lot of local education before dropping a large stack of FERC filings on the table.” In the view of the Team, cooperation between key stakeholders to help alleviate these potential trade barriers will be critical.

According to Cedigaz (World LNG Outlook, 1999), other Atlantic Basin LNG markets with growth potential include Brazil, Israel, Italy, Portugal, Spain, and Turkey. In Europe, the chief uncertainty is natural gas prices, as a result of ongoing

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4 EIA Energy Brief, October 2001
market liberalization. On the other hand, a number of countries are studying LNG imports as a means to increase supply diversity.

The Asian LNG market (see Figure 4.1) is still somewhat marked by the 1997 Asian crisis, in terms of both decreased demand and difficulties financing new import schemes. Nevertheless, Cedigaz expects LNG imports by the world’s three leading importers (Japan, South Korea, and Taiwan) to rise to 116–144 bcm by 2010, compared with 85 bcm in 1998. Two new importers, China and India (China is scheduled to begin imports in 2005), could add another 20–40 bcm to annual regional demands by 2010. However, as in other markets, new LNG export projects will have to compete with existing exporters, many of which may be able to supply these countries at lower cost than grassroots projects by expanding production at existing trains or by adding new ones. In addition, pipeline projects could provide competition in China and India, as well as the important Japanese market.

Table 4.1: Atlantic LNG projects: Extensions and new projects

<table>
<thead>
<tr>
<th>Extensions</th>
<th>Start-up date</th>
<th>Annual capacity (Mill. t/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trinidad and Tobago: trains 2 and 3</td>
<td>2002–2003</td>
<td>6.6</td>
</tr>
<tr>
<td>Trinidad and Tobago: trains 4 and 5</td>
<td>n/a</td>
<td>Min. 5</td>
</tr>
<tr>
<td>Nigeria: train 3</td>
<td>2002</td>
<td>3</td>
</tr>
<tr>
<td>Nigeria: trains 4 and 5</td>
<td>2005</td>
<td>9–10</td>
</tr>
<tr>
<td>Nigeria: train 6</td>
<td>n/a</td>
<td>4</td>
</tr>
<tr>
<td>Qatargas: bottleneck and train 4</td>
<td>2005</td>
<td>6.3</td>
</tr>
<tr>
<td>RasGas: trains 3 and 4</td>
<td>Phase 1: 2005</td>
<td>Min. 4.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>New projects</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria: 2 projects</td>
<td>n/a</td>
<td>10–15</td>
</tr>
<tr>
<td>Venezuela</td>
<td>2004</td>
<td>4–8</td>
</tr>
<tr>
<td>Angola (ChevronTexaco)</td>
<td>2005</td>
<td>4</td>
</tr>
<tr>
<td>Egypt: 2 projects</td>
<td>2005</td>
<td>7–9</td>
</tr>
<tr>
<td>Norway</td>
<td>2006</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Source: Consultations, Cedigaz 2000 survey, and LNG Observer.

The economic difficulties of LNG investments are in part due to the substantial risks attached to such projects. Economic, regulatory, and political factors in the importing countries add to these risks. For example, in India there has been uncertainty over the status of some independent power producers (IPPs) and the creditworthiness of some state electricity boards that are to be important LNG customers. On the other hand, siting problems for LNG import facilities appear to be less of an issue in Asia than in North America.

While market risks for export projects will generally be outside the control of the exporting countries’ governments, these governments can still significantly affect project economics by investment conditions, including royalty, tax, and depreciation rates. These policies will need to take into consideration market conditions in targeted importing countries and costs to competing exporters. Some governments may lack experience in developing appropriate investment...
frameworks for gas export projects and therefore will need institutional capacity to develop appropriate policies, based on best practices and international market conditions.

4.1.2 Regional pipelines

A number of regional pipeline systems that could carry associated gas are under development or being considered. The West Africa Gas Pipeline Project (WAGP) is probably one of the most important planned export projects for flaring reduction. Chevron and its partners plan to build a 620-mile offshore line capable of initially shipping approximately 1.9 bcm per year for sale to power plants and other major gas users in Benin, Ghana, and Togo. Besides helping reduce flaring, the WAGP could help create the basic infrastructure to alleviate the region’s energy crisis. Project plans were first developed in 1991, and conceptual feasibility studies funded by the World Bank were initiated in 1992. However, the project has faced a number of difficulties, including coordination between the governments concerned; political, market, and regulatory uncertainties in the potential importing countries; and NGO opposition. Detailed design work has been held up by the need to finalize a number of long-term contracts, offtake agreements, and sovereign guarantees. Moreover, several NGOs have opposed the project, alleging a lack of adequate environmental and social impact assessments and stakeholder consultations. Although the international partners plan to finance the project themselves, they might consider political guarantee instruments.

New gas pipelines from North Africa to Europe might help to absorb some of the region’s expected increases in associated gas production. In 2001 Cepsa and Sonatrach signed an agreement to construct the Medgaz undersea pipeline, to deliver 8–10 bcm of natural gas per year between Algeria and Spain. A feasibility study will be completed in early 2003. Other new gas pipelines in the region include the Egypt-Jordan pipeline, with possible extension to Lebanon, Syria, and Turkey, and proposals for Libya-Italy, Algeria-Nigeria, and trans–North Africa pipelines. Similarly, plans are under way to link the Caspian region with the gas markets in Turkey and Europe, to provide an outlet for the rapid growth in associated gas production in the Caspian.

The long lead times for building regional pipeline systems reflect the risks, which will be substantial for such capital-intensive investments. The risks and planning and construction time required can be reduced by, and often will depend on, joint efforts by national governments, the petroleum industry, international organizations, and NGOs. Issues that need to be addressed include negotiations on intricate legal and contractual matters, social and environmental concerns related to pipeline routes, and financing and risk mitigation.

4.1.3 Gas-to-liquids (GTL)

Gas-to-liquids (GTL) technology, based on Fischer-Tropsch synthesis, can produce a number of liquid products that could be exported. Some, such as synthetic diesel, might also be marketed locally, using existing product distribution infrastructure, thereby avoiding the costly additional investments that would be needed to distribute gas via new pipelines. The major disadvantage of GTL technology, which
is still relatively new to the world market, is that construction and operating costs remain high.\(^5\)

In West Africa, a factor that may compensate for high production costs in many neighboring markets is high costs for imported products, primarily due to the small size of imported cargoes. However, barriers may include local distribution monopolies and subsidies for competing products.

The only major GTL project to date in West Africa’s major flaring regions is Chevron’s Escravos Gas to Liquids plant (EGTL), which is attached to the company’s planned LNG project. EGTL is scheduled to start operations in 2005, producing an anticipated 23,400 barrels per day (bpd) of liquid synthetic fuels and 1,000 bpd of LPG.

### 4.2 Domestic markets

Stakeholders emphasized to the Team that lack of regulatory clarity and stability and the impact of price distortions often hinder local penetration by natural gas. The nature of these constraints is generally well known and in most cases calls for broad-based economic and energy sector reform.

**Box 4.1: Gas flaring in Mexico**

In the past, Mexico has flared large volumes of natural gas in successive cycles, in which the gas utilization infrastructure lagged crude oil output development. Barriers to infrastructure developments seem to have been the low value of flared gas compared to heavy oil, and the fact that gas-gathering systems had developed bottlenecks.

For most of the early 1990s, the amount of flared gas in Mexico hovered around 1 bcm per year, but it increased rapidly thereafter, peaking at 6.82 bcm in 1998. In 2000, Mexico flared 5.65 bcm, mostly (77 percent) in the Northeast Marine region in offshore Campeche. This was caused by limited compression capacity in this region. However, additional compression capacity and new desulfurization facilities are expected to eliminate routine gas flaring in this region in 2002.

No gas is reinjected; due to the traditional preferred practice of water reinjection. Also, awareness of the costs and environmental impacts of flaring has developed only recently. Furthermore, Mexico does not regulate natural gas flaring, meaning that the upstream regulatory framework does not address this issue. Mexico’s overall goal is to eliminate routine gas flaring within a reasonable time frame; its main objectives are to reduce nonroutine gas flaring and to increase the combustion efficiency of flares.

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\(^5\) Nevertheless, indicative estimates by the World Bank show that a small-scale GTL plant of about 5,000 bpd in West Africa could produce diesel oil/gas oil economically, provided that the price of crude oil was US$20–24 per barrel or above. (ESMAP: *Africa Gas Initiative Main Report*, volume I, February 2001).
Although many of these constraints are general rather than flaring specific, many stakeholders thought the Initiative could help play a role in reducing constraints to more manageable levels.

Specific difficulties in domestic markets include gas prices and taxes, especially relative to competing fuels. State-regulated gas prices may be too low to create adequate incentives for operators to supply the market. Moreover, even if gas prices are at market levels, subsidies or special tax benefits provided to competing fuels could undermine the development of gas markets. Market pressures will require prompt and decisive attention.

The regulatory framework will need to address issues relating to a strategic framework for gas development, as part of a clear gas policy or “Master Plan” (see box 4.2 below). More specific power and other end-use sector regulatory and institutional issues also need to be addressed.

### 4.2.1 Gas master plan

Gas utilization and development generally requires significant up-front investments in pipelines and other infrastructure. It is difficult to make the required investments, unless one is reasonably sure of demand. It is also difficult to create lasting demand if customers are not certain that there will be a reliable gas supply over the long term. This implies that both upstream (exploration and development) and downstream (market) policy must be well coordinated.
Box 4.2: Gas Master Plan: Saudi Arabia

Saudi Arabia has virtually stopped flaring natural gas; today, less than 0.6 bcm of gas is flared per year. This is a dramatic reduction from the early 1980s, when as much as 38 bcm per year was flared.

The reduction of gas flaring was the result of a government policy to apply the gas to large industrial uses, including electricity, water desalination, and feedstock for in-Kingdom production of chemicals that then competed in world export markets. Added economic benefits were derived from the extraction of ethane and natural gas liquids (NGLs) from the associated gases.

Reducing gas flaring required large investments to develop a major gas and liquids transportation and processing infrastructure known as the Master Gas System. This was located mainly in the Eastern Province, close to oil and gas production centers, but included east-to-west NGL transportation capacity, in order to supply Western Province industrial centers. In 1999, the Master Gas System was extended to Riyadh to provide gas for power generation and industry. Gas prices were maintained at a uniform US$0.50 per MMBtu throughout Saudi Arabia during the early 1990s and were increased to US$0.75 per MMBtu in 1998.

Today, gas consumption in Saudi Arabia has reached almost 50 bcm per year and is expected to increase substantially over the next several years. To enable the country to meet this demand, Saudi Arabia embarked on the Gas Initiative in 1998 as a part of a broader economic program to increase investments from foreign oil companies, stimulate industrial development, and expand the use of environmentally friendly natural gas throughout the Kingdom.

Downstream, the role of natural gas in the country’s development must be thoroughly considered. For example, if the government decides that developing gas (including associated gas) will provide the country with certain environmental and developmental benefits, these should be clearly defined in a policy statement, so that legislation and regulations can be developed based on these policy goals. For example, such a policy might state that prices and taxes of other fuels should be reviewed in such a way as to maximize gas’s environmental benefits.

A number of industry representatives with whom the Team met stressed that it is important that the host government:

- Prepare a gas “Master Plan” that harmonizes upstream and downstream policies and incentives and provides a consistent, long-term vision for the sector. Companies repeatedly complained that the ad hoc approach taken by some governments created confusion and uncertainty, which deterred upstream and downstream investments.

- Conduct a stakeholder consultation process early in the development of the gas policy. Not only would this process help to better define and identify market opportunities, but it would add legitimacy to the policy framework. It also would diminish the chance that the policy would be changed significantly later, in response to changes in government or pressure from interest groups that had not been consulted at an earlier stage.
Consultation helps ensure stability, and a stable policy framework will be necessary to provide the assurances private investors will require to make the large upstream and downstream up-front investments that will be needed. Unfortunately, a number of host governments may not have the experience or capacity to undertake the necessary stakeholder consultation processes. This is where the Initiative could play an important role.

It is important that host governments conduct stakeholder consultations early when developing gas policies. Such consultations will help uncover market opportunities, add legitimacy to the policy framework, diminish the likelihood of significant alterations later in the process, and help ensure stability. A stable policy framework will be necessary to provide the level of assurances needed by private investors to undertake the large upstream and downstream investments that will be needed. Unfortunately, some of the host governments may not have sufficient experience in and capacity to undertake the necessary stakeholder consultation processes.

4.2.2 Small-scale use of gas

Associated gas could be used locally or regionally in various small-scale applications, including LPG, in GTL technology applications (see Section 4.1.3), reticulated natural gas, and particularly small-scale distributed power generation. However, the most promising and proven small-scale application is probably bottled LPG.

LPG is increasingly recognized by the Bank as a suitable transition fuel from traditional biomass and charcoal to more modern energy sources. However, in many countries LPG penetration rates are low, due less to consumers’ inability to afford it than to supply constraints. However, LPG would provide attractive environmental benefits by reducing unsustainable wood fuel and charcoal use. Despite these advantages, LPG markets in many developing countries remain undeveloped, including notably in West Africa, where much associated gas is flared. The reasons for this are not entirely clear but appear to include barriers posed by the need of customers to make initial investments in LPG burners and large cylinders and the difficulties of designing and implementing appropriate distribution networks for small bottles. Smaller cylinders and locally produced burner-cookers, adapted to African culinary traditions, have had some success in being accepted by low-income populations. Other measures would include taking advantage of scale economies in procurement, sea transport, and receiving terminals. This also might include innovative, open access policies to import and use of bulk storage facilities. ESMAP’s Africa Gas Initiative suggests that pricing policies, including subsidies for competing liquid fuels (e.g., kerosene), unfavorable fiscal terms for imported bottles and equipment, and insufficient accounting for the negative externalities of unsustainable wood fuel use present another barrier in some countries.

In Nigeria, an ESMAP-financed proposal seeks to investigate the LPG sector’s failure to capture a significant market share. Nigeria presently produces more than 3

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6 See, for example, the case of state-owned Petroci in Côte d’Ivoire, which was able to expand the overall LPG market with new supplies without crowding out existing private sector suppliers, in ESMAP: *Africa Gas Initiative Main Report*, February 2001, p. 37.
million tons of LPG per year from its refineries and associated-gas streams; most of this is exported in bulk as a low-value butane-propane mix. Production is expected to reach 4 million tons per year by 2004. The country consumes only 60,000 tons of LPG a year, a fraction of what neighboring LPG-importing countries (with a tenth of Nigeria’s population) consume annually. Growth potential is immense, with important health and environmental benefits in urban, periurban, and rural areas, especially in the North, where demand for biomass fuel is depleting the meager remaining forest cover. The study proposes to investigate the reasons for this apparent market failure, locate the blockage, and find out what policies need to be revisited to solve these issues and help the local and regional LPG markets reach their full potential.

4.2.3 The power sector

Developing a new gas market usually requires one or more large “anchor” customers to make upstream investments worthwhile. In international experience, the likeliest candidate would be the power sector, either supplying gas to new plants or converting existing plants from more expensive or more polluting primary fuels such as oil to natural gas. Moreover, gas-fed power generation, especially in combined cycle, has reached very high levels of efficiency, delivering electricity at extremely competitive prices. Oil replacement can be greatly advantageous, not only for environmental reasons, but also because it enables a country to reduce expensive oil imports or increase oil exports.

Converting power plants to natural gas can be an important means of providing gas’s benefits to the population at large, especially in countries where the climate creates a low demand for space heating, thus making the economics of reticulated gas supply for household and other small customers marginal. It should be noted that demand for gas for air conditioning is creating a market niche in certain countries’ (e.g., Côte d’Ivoire) urban areas; this also could be an attractive gas development support segment in other countries.

Converting gas into electricity implies that the power sector is a part of the “gas chain”; any difficulties in that sector would pose problems for the development of a gas market. In many developing countries where the state owns and operates most of the power sector, experience has shown that electricity utilities often face serious financing problems stemming from low consumer prices or poor billing and collection systems. This is usually caused by the political desire to keep end-user electricity prices low. Therefore, expanding the market demand for natural gas may require pricing and other power sector reforms.

It has been pointed out that in many developing countries local demand for energy (both gas and electricity) is too low to consider developing new supplies. Low use of modern fuels corresponds to low income levels. However, low income levels also are in part caused by low availability of modern fuels. This underlines the need to eliminate market barriers for both gas and electricity, including prices that are too low to make it attractive to finance a more adequate supply. Eliminating such barriers could help begin a “virtuous circle” based on sustained energy demand, realistic pricing, and market-based policies.

Introducing private investment into the power sector can be an important step in creating an adequate electricity supply and gas demand. This raises the same
questions for the power sector about creating a stable regulatory and investment framework as those mentioned earlier for the gas sector.

As in the gas sector, some governments may benefit from technical assistance in creating an appropriate regulatory and investment framework for the electricity sector. The Initiative might provide such assistance, in order to help create and increase local and regional markets for associated gas by means of conversion to gas-based power.

4.2.4 West Africa

Consultations have taken place between the World Bank and several African governments on how to reduce gas flaring in their countries and on how to put the associated gas to productive use.

Nigeria

Despite Nigeria’s role as Africa’s major hydrocarbon producer, the country is also the continent’s largest contributor to gas flaring, as described in Section 3.3. Meanwhile, the domestic energy market remains inadequately supplied and a significant part of the urban and rural energy service market is unserved or underserved. This especially affects poorer households, which can ill afford the multiplicity of fuels or the independent power generation that is considered essential to commercial and industrial enterprises and the wealthier households. In the countryside, far too much time is spent collecting fuel instead of engaging in productive household work and study. These latter activities are in turn disrupted by frequently intermittent or nonexistent power supplies, imposing severe hardships and impeding economic growth.

Under an ongoing World Bank/International Monetary Fund Petroleum Sector Reform Program, the government is drafting a comprehensive Gas Strategy to enable it to launch an integrated Gas Master Plan. This seeks to integrate the international oil companies’ (IOCs’) individual gas development plans and to investigate in depth why the LPG market has not developed to its true potential. The power sector, the largest potential gas consumer, is not included in the plans because of the Nigerian Electric Power Authority’s (NEPA) ongoing financial and operational problems. The Bank’s program will help the government design and propose to industry a sound gas strategy and a comprehensive National Gas Policy. Both projects will also investigate the existing institutional, legal, and regulatory framework and propose adequate reforms, and define a clear and realistic long-term gas development strategy, in order to meet the government’s stated goal of ending gas flaring by 2008.

Angola

Bank missions to Angola have concluded that natural gas market development has been hindered by three major factors: increased political risks as a result of more than 20 years of civil war, minimal economic development in the country, and obstacles in the contractual framework for oil development (see Section 4.3.2). Most planned new oil field development schemes consider reinjection to be the best way to address gas flaring issues.
However, in 2000 Angola commissioned a National Gas Master Plan, presuming a full utilization of associated gas from any current and future oil field developments. The plan also will include an evaluation of gas field developments on their own merit. If the LNG project (see Table 4.1) goes ahead, a pipeline would be created near the capital, Luanda, making it possible to supply gas for power generation and cement and other industries. However, gas for power generation in Angola would have to compete with Angola’s existing hydropower resources.

**Equatorial Guinea**

Offshore oil and gas fields constitute Equatorial Guinea’s largest energy base, and gas production from the Alba field is the first to come onstream. Together with anticipated feeds from larger, offshore oil fields, the resulting volumes of associated gas would need an outlet to avoid flaring. Previous investigations concluded that the main domestic markets for flared gas would be the power sector and LPG extraction. Other potential uses of flared gas would be export projects, in which gas would be used as a feedstock in GTL projects. However, such projects would compete with export projects by other flaring countries.

**Cameroon**

The options for recovering associated gas for liquid extraction or commercial uses have never been effectively assessed. Currently, reduction of gas flares should be evaluated as a means to foster the development of domestic gas production for use in the power sector and industries. This should include an evaluation of LPG extraction for the domestic market.

**Chad**

Gas recovery from the planned Sedigi oil field development for power generation would enable LPG and NGL extraction. The production of local petroleum products would allow substitution of expensive imports, and gas production could be utilized for power generation for N’Djamena’s growing market.
Box 4.3: Gas flaring in West Africa

The matrix below summarizes the amounts of gas flared, policies and legal and regulatory framework, and possible West African regional gas outlets. It includes the main existing and potential gas markets, including exports by pipeline or LNG, and whether there is potential to produce, consume, and export LPG.

<table>
<thead>
<tr>
<th>Country</th>
<th>Gas flaring in 2000 (bcm)</th>
<th>Legal framework in place</th>
<th>LPG market</th>
<th>Export options</th>
<th>Reinjection</th>
<th>Main domestic outlets for flared gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>4.3</td>
<td>No</td>
<td>Yes</td>
<td>LNG planned</td>
<td>Yes</td>
<td>Power, petrochemicals, industrial parks</td>
</tr>
<tr>
<td>Cameroon</td>
<td>2.1</td>
<td>In preparation</td>
<td>Yes</td>
<td>LNG planned</td>
<td>Possible</td>
<td>Power, industry</td>
</tr>
<tr>
<td>Chad</td>
<td>0.4</td>
<td>No</td>
<td>Planned</td>
<td>No</td>
<td>No</td>
<td>Power, small-scale gas use; GTL possible</td>
</tr>
<tr>
<td>Congo</td>
<td>1.4</td>
<td>No</td>
<td>Yes</td>
<td>Planned</td>
<td></td>
<td>Power, refinery fuels, industry</td>
</tr>
<tr>
<td>Côte d'Ivoire</td>
<td>Minimal</td>
<td>In place</td>
<td>Yes</td>
<td>Pipeline planned</td>
<td></td>
<td>Power, refinery fuels, industry</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>0.9</td>
<td>No</td>
<td>Planned</td>
<td>GTL?</td>
<td></td>
<td>Power, chemicals; GTL possible</td>
</tr>
<tr>
<td>Gabon</td>
<td>1.8</td>
<td>No</td>
<td>Yes</td>
<td>LNG pipeline planned</td>
<td>Yes</td>
<td>Power, refinery fuels, industry</td>
</tr>
<tr>
<td>Nigeria</td>
<td>17.2</td>
<td>In preparation</td>
<td>Yes</td>
<td>LNG pipeline planned</td>
<td>Yes</td>
<td>Power, petrochemicals, industrial parks, small-scale gas use</td>
</tr>
</tbody>
</table>

4.3 Upstream regulation

While policies and incentives in downstream markets will be crucial to enabling many flaring reduction projects to take place, upstream policies and incentives also have an important role. Upstream considerations include the overall petroleum development fiscal package (the government’s “take”), special fiscal arrangements for associated gas, and the terms of the petroleum contract between the government and the oil company, particularly the rights to market associated gas. Other important factors include the regulatory framework, particularly the circumstances under which flaring will be allowed, technical requirements, emissions standards, reinjection requirements and regulations, penalties and fines, and monitoring and enforcement procedures.

The reinjection contractual framework will be important, especially for remote offshore fields or those far from routes to viable gas markets. Many countries require operators to use the associated gas to optimize oil production; this is usually done by reinjection (or else by using the gas to power oil production operations).
Although reinjection often pays for itself in the long run in the form of enhanced oil recovery, the relatively short time frame of some production contracts, which may not allow the operator enough time to benefit from the reinjection, may be considered a disincentive. Some financial incentives may be required in the case of remote fields where reinjection is not economically feasible.

Stakeholders pointed to the difficulty of identifying flaring reduction “best practices,” due to the considerable variations in geologic, market, and other factors across countries and fields (for example, some offshore Nigeria fields apparently are unsuited to reinjection). Nevertheless, host government collection and dissemination policies that have successfully reduced flaring levels could be instructive to governments that seek guidance. However, even if such “best practices” are identified, the lack of institutional capacity to implement, monitor, and enforce improved policies may be a significant barrier in some countries.

### 4.3.1 Fiscal incentives and penalties

Measures to regulate gas flaring cannot be isolated from total petroleum fiscal packages, including royalties, taxes, and other government take, as well as the broader policies governments pursue in order to develop gas markets.

The petroleum fiscal system is used to give incentive to the production and marketing of gas in most countries with large gas reserves relative to production, that is, where gas markets are small or absent. The fiscal terms for natural gas are often based on a lower government take than for oil, often directly proportional to the difficulties of marketing the gas. Differences in the government take between oil and gas are considerable. In North America and Western Europe, the government take for oil and gas is approximately the same, while the difference is around 15 percentage points in Australia and Trinidad and Tobago, 30 percent in Indonesia, and 45 percent in Qatar.\(^7\)

A number of governments give special tax concessions that reduce the government’s take on marketed associated gas and/or NGL products. For example, in December 1999 the Canadian province of Alberta announced a waiver of the royalty on solution gas that otherwise would have been flared.

Taxes and royalties need to account for products’ anticipated end-market prices, so that companies will still be able to sell them effectively. New export projects’ competitiveness, for example, will depend in part on how aggressively exporting governments keep their tax takes at a reasonable level.

Direct taxes on gas flaring are not widely used, although other financial penalties have played an important part in flaring reduction strategies by countries such as Norway and the United Kingdom. In some countries these penalties ended up being too low to provide appropriate disincentives, such as the flaring tax Nigeria introduced in the 1980s. Consultations with various stakeholders in Russia revealed that this is also the case there. Part of the problem may be that the revenue raised by such penalties gives the host government a disincentive to set them high enough to

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actually eliminate this revenue stream. Another problem may be a lack of monitoring and enforcement.

4.3.2  Contractual framework

Oil company stakeholders pointed out that most petroleum development contracts and agreements between oil companies and host governments address only oil. If references to gas are vague, this will create uncertainty. In addition, the petroleum development contracts and agreements frequently impose conditions that give the operator little incentive to utilize or reinject the gas.

To provide more details, a consultant examined regulatory regimes for the Initiative in 38 countries, representing a cross section of the world. The legislative and contractual provisions governing the rights of the operator and the government to associated gas, in almost all cases, recognize that associated gas may be used by the operator for oil field operations. Most of these countries expressly declare the operator’s duty to use associated gas to optimize oil production, whether to improve oil recovery by reinjection, to generate power for operations, or to fuel equipment. However, the operator’s right to market excess associated gas traditionally has been constrained by the government’s preemptive rights to secure supplies for domestic use. This is reflected in the large number of cases, particularly developing countries, in which the marketing of gas and the establishment of sales contracts must be carried out on a joint-dedicated basis with the national petroleum company, such as in Algeria, China, Egypt, and Venezuela. In such cases, gas may be exported only if domestic requirements have been fulfilled.

Difficulties in developing local gas markets and constraints on oil companies’ rights to market the gas can result in host governments needing to develop markets, even if they have little experience in such activities or limited financial resources to make the large up-front investments involved. Moreover, depending on their priorities, governments may have an incentive to avoid costly gas utilization investments if this implies a near-term reduction in oil production revenues.

In recent years, this scenario has been replaced in some developed countries by an alternative in which the operator is no longer subject to government preemptive rights and enjoys the rights to sell associated gas directly to domestic or export markets. However, such conditions are still relatively uncommon in contracts in developing countries.

4.3.3  Regulatory framework

Governments have an important role to play in establishing a regulatory framework that will give incentives to oil producers to minimize gas flaring and encourage investment in gas market development. One purpose of the consultations was to understand better what mix of regulatory policies and instruments might be regarded as “best regulatory practice” to reduce and eventually eliminate routine flaring.

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As mentioned above, the stakeholder consultations indicated the difficulty of identifying a single “best practice.” Nevertheless, a closer look at the wide variety of experiences could reveal general guidelines. At a minimum, the collection and dissemination of experience in other countries could assist a number of governments in examining and dealing with these issues.

The study of gas flaring regulations in 38 developed and developing countries, mentioned earlier, provides a starting point. It examined the following aspects of regulatory frameworks:

- Permission to flare and vent gas;
- Technical requirements and emission standards imposed on flaring and venting operations;
- Monitoring and enforcement procedures, including penalties.

**Permission to flare and vent gas**

In all 38 countries (with the exception of Brazil), flaring can be carried out only on the basis of authorization by the competent authority. Unauthorized flaring, other than in emergency situations, is generally prohibited (see Table A1 in Annex 4).

In most cases, flaring is permitted under the following circumstances:

- For safety reasons (e.g., safety-flare pilots, flaring contaminated gases that cannot be reinjected or treated);
- For unavoidable technical reasons (e.g., purge venting);
- In emergencies; or
- During well testing and start-up operations.

Argentina, Nigeria, Norway, and the United Kingdom issue separate gas flaring permits under specific legislation addressing this issue. Although the approach has been the same, the impact on flaring obviously has been very different in these countries, due, among other reasons, to different enforcement practices (see section on Monitoring and Enforcement).

In Argentina, flaring regulation is somewhat different from flaring regulation elsewhere. Permits to flare or vent gas are related, in the first instance, to an objective measure that is applied across the board. Wells that exceed a specified gas-to-oil ratio are prohibited from flaring. Beginning in 1994, the government introduced a phased program of increasingly stringent restrictions, starting with a maximum gas:oil ratio of 75:1. This ratio was then reduced over a six-year period. This method has successfully reduced gas flaring.

Most countries authorize gas flaring by means of development and production plan approvals (see Table A1 in Annex 4). These typically are one-time approvals but often contain provisions for review in the event of a change in the scope of approved operations. For example, in Russia each oil field development license assesses the planned oil production and associated gas production, how much gas will be utilized, and how much gas the operator will be allowed to flare. If the volume of gas flared is above that stated in the license agreement, the company will be penalized. The penalties vary from region to region and are progressive (e.g., if the operator exceeds the gas flaring limit once, the company pays 5 times per unit;
if the operator exceeds the limit five times, the company pays 25 times per unit). However, the Team was told that penalties are still too low to provide sufficient incentive to curb flaring and that enforcement is lacking.

Finally, in a small number of countries, permission to flare is issued separately from the license to operate or from the approval of the development plan. In Brazil, Colombia, Italy, and Venezuela, flaring permitting is under the jurisdiction of the environmental authority, separate from the ministry for petroleum or the national oil company.

**Technical requirements and emission standards**

Authorized flaring operations generally are subject to a variety of conditions, which may include:

- Limits on the amount of pollutants emitted into the atmosphere as a result of flaring;
- Operational restrictions, to ensure safety and minimize other types of environmental harm.

Among developing countries, Egypt, Nigeria, Oman, Peru, and Qatar have prepared emission standards either as regulations or as guidelines (see Table A2 in Annex 4), but only a few countries have prepared specific technical requirements for gas flaring operations. In a small number of cases, emission standards and other technical restrictions are backed up by guidelines or codes of conduct issued by the oil industry. An example is the United Kingdom’s Offshore Operators Association.

In the absence of their own specific Exploration and Production (E&P) standards, government authorities may employ guidelines developed at regional or international levels. For example, the World Bank’s *Pollution Prevention and Abatement Handbook* (1998) includes standards relevant to onshore operations. Emissions levels must be acceptable to obtain World Bank Group financing, and the handbook provides guidelines. These and other standards could offer guidance to countries lacking guidelines, or inform the development of standard international guidelines.

**Monitoring and enforcement**

As mentioned earlier, one important barrier in a number of countries is the lack of local institutional monitoring capacity. If measurements and flaring levels are not controlled and fines not imposed, any rules become little more than guidelines that companies may have no incentive to follow.

In developed countries, monitoring and enforcement measures often involve a strong element of government and industry consultation and joint effort. In Argentina and Norway, computerized databases are used to maintain common, nationwide monitoring. The United Kingdom is also developing a program of this nature.
Gas flaring legislation and contractual provisions normally impose sanctions on noncompliant operators. These take the form of either penalties or revocation of the operator’s production rights. However, prescribed fines sometimes have been insignificant relative to the operation’s commercial value. Stakeholder consultations indicated that this may be a particular problem in Russia.

Latin American countries feature some of the strictest regulations; in some cases penalties may be applied to individuals as well as companies. However, enforcement still appears to be a problem.

It is also important that governments assess reported statistics in order to ensure their accuracy, since good policy must be based on accurate data. Government comparisons between reported data and actual flaring at some sites in Alberta, Canada, for example, revealed significant discrepancies, particularly underreporting of vented associated gas.

**Collection and dissemination of “best practices”**

Examples of innovative regulatory practices, including some of those mentioned above, could be instructive to a number of host governments. Collecting and disseminating such practices would be one of the ways the Initiative could contribute to gas flaring reduction efforts.

However, the review of regulatory practices in this chapter indicates that the selection of a regulatory model is not sufficient in itself to ensure flaring reductions. Argentina, Nigeria, Norway, and the United Kingdom apply a similar regulatory model but get different results. As described in other sections of this chapter, other factors are at play and, most important, monitoring and enforcement differ widely from one country to another.

### 4.4 Financing

The oil and gas industry has developed special financing capacities to deal with the unique requirements and risks associated with exploration and production. However, it is apparent from the Team’s consultations that additional financing and risk mitigation mechanisms may be necessary if flaring reduction projects are to proceed.

Typically, financing for commercially viable flaring reduction projects is not an issue for major operators. However, these projects still must compete with others for available corporate funding, and therefore it is important that host governments enact policy and regulatory actions that will increase the financial attractiveness of such investments (e.g., reducing market barriers for associated gas). The donor community’s willingness to support the technical assistance needed to design policy changes and develop gas master plans will be critical.

Sales to local markets and associated downstream investments pose special risks, even for major operators. These markets are particularly vulnerable to regulatory, political, and expropriation risks, and some degree of comfort may be required if the investment is to go ahead. A good example of a guarantee instrument was the recent issue of a US$100 million guarantee by MIGA against expropriation, war,
and transfer restrictions for an oil and gas project in Russia, targeted entirely to the domestic market.

These risks increase considerably when sales are targeted to regional markets, as in the case of the West Africa pipeline. Access to risk mitigation mechanisms will thus be essential for some of the needed investments. The Azerbaijan/Georgia project (see Box 4.4) is an example of an instrument designed to mitigate cross-border risks.

A large portion of the gas flaring problem is located in some of the world’s least creditworthy countries. Even with appropriate policy and regulatory reform, commercial financiers will not be able to assume the sovereign risk associated with these projects. In such cases, access to concessional financing will be crucial. The World Bank Group provides a combination of instruments to finance projects that would be available for gas flaring reduction projects. Box 4.4 shows examples of how the financial instruments can be combined for international oil and gas pipelines. Although none of the projects shown in Box 4.4 are gas flaring reduction projects, similar combinations of instruments would be possible to finance the regional pipelines based on flared gas discussed in Section 4.1.

The other major group of projects discussed in Section 4.1 is LNG projects. Current LNG trade flows take place from developing countries to industrialized countries. Import projects are, however, being implemented in developing countries, such as China. Also, imports are planned in India, as well as in some smaller countries. Traditionally, the production and liquefaction plants in exporting countries have mostly been equity and debt financed, and sometimes with political risk guarantees, while asset-based financing is common for the ships transporting the LNG.

A main issue in the financing of LNG projects based on flared gas is whether the use of associated gas (as opposed to nonassociated gas) will bring additional risk to the project. Other important issues are related to the importing countries, particularly as LNG begins to penetrate emerging markets in such countries as China and India; investors are likely to demand some protection against adverse changes in downstream regulatory regimes. However, the issues of risk allocation and mitigation and buyer creditworthiness are not different from gas pipeline projects.

It is also apparent from the consultations that the smaller international companies and some national oil companies face special financing issues. These companies’ modest, less-diversified cash flow make it more difficult for them to self-finance or to attract needed resources from private capital markets. Moreover, it was evident that several national oil companies would not be able to meet their contingent financial obligations if a large number of the currently planned joint venture gas processing and marketing projects were to go ahead. Smaller downstream domestic gas utilization projects in rural areas (especially the establishment of distributor networks for bottled gas) pose special financing issues even when such investments are economically viable. For example, long-term credit is often not available in many of the countries with high flaring rates. In these underdeveloped financial markets investors often must rely on short-term credit, which they regularly roll over. Thus, the investors and their projects are overly vulnerable to macroeconomic fluctuations and credit squeezes. The obvious long-term answer is financial system reform and strengthened financial institutions. However, in the short and medium
term, specially tailored instruments may be necessary. The Uganda Energy for Rural Transformation Project, approved by the World Bank in 2001, contains some innovative financial instruments designed to cover small investors against such risks.

Most of the needed financing instruments are already available from most of the multilateral and many of the bilateral financing institutions. However, it is not always easy to access these. Given the understandable concentration on delivery of energy services to the poor, the donor community often gives oil and gas projects low priority, even though relatively modest support by these organizations could prove to be catalytic on private resource mobilization. These projects also can raise substantial revenue for social sector spending. These institutions’ single-country focus tends to favor national investments over regional ones, such as pipelines. Large gas projects also tend to attract a lot of attention and criticism from key elements of civil society, even though gas flaring reduction projects specifically often have highly positive environmental effects. The net result is that donors are often, perhaps rightly, hesitant to take on the great administrative and political cost of supporting such investments. There appears to be a clear role for the stakeholder community and the Initiative to encourage international and bilateral financial institutions to use their financial capacity more aggressively to promote flaring reduction.

Even if financing mechanisms tailored to the special needs of commercial gas flaring reduction projects become available in sufficient quantity, many projects still will not cross the financial viability threshold, even though some of these projects may have an acceptable economic rate of return when the social costs of CO₂ reduction are factored in. In these cases, green financing will be necessary.
Box 4.4: Examples of Financing of Oil and Gas Projects with various combinations of World Bank Group instruments (not based on flared gas)

**Azerbaijan-Georgia—Early Oil Project**

- Joint financing with EBRD of US$2 billion project (US$0.5 billion for pipeline element) for Amoco, ExxonMobil, Lukoil, Turkish Petroleum, and Unocal.

- Creates precedent for multilateral financing of large deals in this region.

- Mitigation of political and cross-border risk.

- International Finance Corporation (IFC) investment: US$100 million A loan, US$100 million B loan.

**Chad-Cameroon Pipeline**

- US$1.5 billion development of oilfields in Chad by a consortium led by Exxon and US$2.0 billion pipeline.

- World Bank lending to the Governments of Chad (US$40 million for Petroleum Development and Pipeline, US$17.5 million for Petroleum Revenue Management and US$24 million for capacity building) and Cameroon (US$53 million for pipeline).

- IFC: US$100 million A loan and US$300 million (later reduced to US$100 million) B loan.

- IBRD/IFC key in mobilizing funds; country and cross-border risks were perceived to be high.

**Bolivia-Brazil Pipeline**

- Pipeline from gas fields in Bolivia to Brazil.


Source: http://www.ifc.org/ogc/eirprojects

4.4.1 Green financing

An additional source of financing that could help lower the costs of effective upstream and downstream gas flaring projects may be the various green funds, such as the World Bank’s Prototype Carbon Fund and those run by a number of OECD governments and other entities. These funds have been designed to finance projects that can be expected to receive salable credits for reducing GHGs under the various “Kyoto mechanisms,” notably the Clean Development Mechanism (CDM) and Joint Implementation (JI). In return for financing, project entities must transfer an appropriate number of credits. The Team discussed these financing opportunities with stakeholders, and a number of issues were raised as to their significance and eligibility for gas flaring projects.
Most oil companies stated that the impact of these financing mechanisms on project economics would be marginal, but in some cases the mechanisms could enable the project to meet the required threshold.

To be eligible for most green funds’ financing, the project must qualify as or meet the standards of an emissions reduction project under one of the Kyoto mechanisms. Since flaring reduction projects have received little attention in the context of the Kyoto mechanisms, it is not clear how different types of flaring reduction projects would need to be designed. The toughest hurdle is probably the “additionality” test. This means that the project’s sponsors would have to show that emissions reductions engendered by the project would not otherwise have occurred. This could be difficult (but not impossible) in the context of countries or companies that already have established policies to end all flaring.9

The uncertainty surrounding how flaring reduction projects could qualify for “carbon” credits or green financing presents a potential barrier for projects that might qualify and might not otherwise be undertaken. More work needs to be done to clarify the status of various flaring reduction projects and how such projects would need to be designed to be eligible to receive credits. This information should then be forwarded to the CDM Executive Board, which is defining the methodologies that projects will need to apply; this will ensure that it will also feed into the JI processes that have yet to be established. Further, more work is needed to clarify the rules of the various green funds vis-à-vis flaring reduction projects, and, where necessary, engage in outreach, to ensure that adequate funds are available for projects that qualify.

Finally, some projects will not be viable, even with green financing.

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9 When establishing the project’s baseline, national policies and the country’s ability to meet those policies should be taken into consideration. Therefore, if a country has a policy that it is unable to meet, it might be possible to establish the additionality of the project.
5 Next steps

5.1 Introduction

The stakeholder conference, held in April 2002 in Oslo, marked the end of the Initiative’s consultative phase. Based on the results of the discussions summarized in this report and the deliberations of the Oslo meeting, it is hoped that a consensus on the Initiative’s overall direction and a specific agenda of activities going forward will emerge. The Team has developed a suggested approach and list of topics (detailed below) to help define these priorities and guide the discussion. The Team believes that this list provides the basis for a coherent collaborative effort to reduce flaring and broadly reflects what the Team heard during its stakeholder meetings. Further guidance was provided during discussions at the Oslo conference (see Chapter 6).

As noted earlier in this report, many key stakeholders already have taken a number of steps to reduce flaring. Some governments have set targets to eliminate routine flaring and introduced fiscal and other incentives to help achieve these targets. Some companies have committed to zero flaring for new projects; other companies have refrained from setting explicit public targets but have embarked on programs designed to develop markets more systematically to exploit associated gas. However, the Team also received a clear message that many of these efforts will not succeed unless other key stakeholders — including host governments and companies, undertake complementary and supportive actions. A collaborative approach will be essential for a significant reduction in flaring during the next decade to occur.

Not only can collective actions to reduce flaring result in a substantial reduction in GHG emissions, they can also contribute to increased energy diversity; enhanced regional cooperation, trade, economic development, and poverty reduction; local environmental improvements; enhanced public revenues; increased energy security; and attractive returns to energy companies and investors. The possible elements of such a cooperative program are listed below. The list is not exhaustive, as discussions with stakeholders will continue.

5.2 List of topics

Improved data gathering and dissemination

As noted earlier in this report, the quality of gas flaring data is uneven and deficient. As part of the Initiative’s initial phase, consultants were engaged to help establish a more accurate and consistent base of data. This work is being reviewed, but it is clear that more needs to be done in this area to improve the quality of gas flaring data, and these efforts should be coordinated with efforts under way by UNFCCC/IPCC to develop rules for measuring and reporting GHG inventories.
Targeted upstream technical assistance

The consultations have highlighted the importance of eliminating deficiencies in upstream contractual arrangements and regulatory practices, and the need to collect and disseminate best practices. The Initiative has begun some work on this agenda item and will disseminate it shortly. However, more needs to be done in this area.

There is clearly a role for additional targeted bilateral and multilateral technical assistance to help governments improve upstream regulatory practices, including best practices in drafting petroleum contracts to encourage optimal associated gas use and in designing fiscal incentives.

There is also a need to support technical assistance to strengthen the monitoring and enforcement of flaring regulations. This may include building the institutional capacity to enforce onshore and offshore gas flaring regulations.

There are also a number of technological issues surrounding flaring efficiency best practices and the separation of associated gas that would benefit from more systematic best practice dissemination and targeted bilateral assistance. Again, the Initiative could facilitate such exchanges.

Standards

Standards for reporting data across countries and companies need to be developed. Based on some of the data gathering work carried out already, the Initiative could articulate common international standards for measuring gas flaring. These standards vary significantly across and within countries and from company to company.

Flaring certification scheme

Based on the above standards, the Initiative could develop a voluntary certification scheme by which companies could demonstrate that they have taken all practical steps to reduce gas flaring to acceptable levels consistent with international best practices. When local circumstances justify this, this system might include certification that there are no economically viable alternatives to flaring. The scheme would be voluntary, similar to “corporate social responsibility” and environmental schemes that have been developed or are being studied in other sectors. The public-private partnership suggested below could be the forum in which to develop and review such a scheme.

Development of local gas markets

As discussed in the report, eliminating a large number of policy and regulatory constraints on the development of local gas markets will be critical to reducing gas flaring. This is particularly true for smaller quantities of gas for which large LNG or GTL projects are not viable. Many of the countries in which flaring is concentrated still lack energy policies, making it difficult, for example, to market gas for power generation. The World Bank and other multilateral and bilateral donors are currently supporting energy and power sector reforms in several of these countries; moreover, broad support for such reforms is clearly beyond the scope of a more focused initiative such as this one. However, some selected efforts directly targeted
at developing the local gas markets suggest themselves for support under the Initiative. These include:

- Technical assistance to develop and implement gas master plans. Several companies the Team visited highlighted the importance of developing such a coherent framework, if they were to find commercial outlets for associated gas.

- Developing markets for small-scale gas uses. The Initiative has commissioned a study along these lines. It will explore the potential for expanding small-scale utilization of gas for power generation, gather best practices for small-scale gas utilization schemes, examine the financing issues related to such projects, and propose a series of pilot projects that should have a high potential for replication.

**Developing the market for bottled gas**

With few exceptions, bottled gas markets are not well developed in the emerging economies, including those with high rates of gas flaring. This is despite the fact that LPG is a suitable fuel of transition from traditional to more modern energy sources; that large population segments, even in the poorest countries, can afford such fuels; and that introducing LPG would have a positive environmental impact by reducing deforestation. The reasons that these markets are underdeveloped are not entirely clear, but they include the difficulties of designing a distribution system for small quantities of gas, and credit and affordability issues regarding the up-front costs of burners and cylinders. The Initiative is developing terms of reference for studies and demonstration cases for two or three African and middle-income countries that will seek bilateral or multilateral support.

**Development of export markets**

A clear message from the consultations is the critical importance of international markets to any efforts to reduce gas flaring. For example, at least in the medium term, about 90 percent or more of West Africa’s associated gas will have to be absorbed by the international markets in the form of LNG, LPG, or GTL, or through the proposed West Africa pipeline. To help tackle these issues, the Initiative could:

- Support targeted technical assistance designed to develop appropriate regulatory and policy structures to promote the development of gas export projects;

- Use the public-private partnership consultative mechanism to promote the elimination of barriers to importing LNG into major markets.

For example, in the Atlantic Basin, access to the North American and Southern European markets will be critical if the planned LNG projects are to be financed and implemented. It may also be necessary for the World Bank Group and other multinational and bilateral agencies to offer their risk mitigation instruments to help secure funding of regasification facilities in emerging markets such as China and India, both of which are expected to see dramatic increases in their domestic gas markets.
While regional pipelines are a key part of the market solution, they pose special problems. In particular, they require that the regulatory regimes be synchronized across all the countries traversed by the pipeline; that market reforms proceed in concert so that the major anchor users (typically power generators) can simultaneously take up supply; and that special risk mitigation mechanisms be used to help mobilize the necessary finance. The Initiative could help address these issues by promoting technical assistance to help design the regulatory environment to promote such projects and encourage bilateral and multilateral agencies to make their risk mitigation instruments available to these investments.

**Development of special financing mechanisms**

Gas projects, particularly those intended to reduce gas flaring, often require specially designed financial instruments. While the major oil companies typically have sufficient funds to finance large projects, they often require support from risk mitigation mechanisms. The smaller international companies and many of the national oil companies face even greater constraints in mobilizing the necessary financing. Finally, special financing mechanisms drawing on carbon credits and other environmentally based funding mechanisms may need to be developed.

Several of the companies the Team visited indicated that such facilities would be needed to bring marginal gas flaring reduction projects over the financial threshold. It is therefore recommended that the Initiative include:

- Promoting the use of World Bank Group and other multilateral and bilateral insurance and risk mitigation mechanisms for gas flaring reduction and related downstream projects. It is also vital that these donors be prepared to commit to financing viable small and downstream projects that may emerge from technical assistance in this sector. Traditional donors sometimes have been reluctant to support gas projects, believing that financing should be secured from the private sector. While it is clear that the majority of financing for energy investment must come from private sources, official support for some of the smaller innovative projects may be necessary during the pilot and development phases. Given these investments’ potential beneficial poverty and environment impact, they should be attractive to Overseas Development Aid (ODA).

- Encouraging traditional donors (including the World Bank, IFC, and other multilateral and bilateral lenders), together with private funds, to mainstream support for flaring reduction projects to be implemented by national and smaller international oil companies. This task must include a substantial project identification and preparation effort.

- Designing financing mechanisms for carbon credits to be realized through gas flaring reduction projects. This undertaking might include developing guidelines for carbon credit trading and identifying financing sources and target countries for such projects. Such a study, supported by the government of Norway, is currently being executed under the Initiative.

Closely related to the above is the special problem of remote fields lacking commercial options (including reinjection) for the use of associated gas. The Team believes that more work will be needed to determine the extent of this problem and
identify possible remedies, including an estimate of the amount of any subsidies that may be needed.

The outcome of these studies should determine whether there is a need, as well as realistic prospects, for a new flaring fund. If the result is in the affirmative, the Initiative could then proceed to operationalize the idea.

5.3 A public-private global partnership to reduce gas flaring

Given that success in any effort to reduce gas flaring will depend critically on consistent and complementary actions by many of the key stakeholders, it is suggested that governments, industry, and civil society representatives commit to work together to support each others’ efforts to reduce gas flaring. This would be a forum and platform to exchange ideas on matters such as best practices; promote and support key studies or projects; contribute ideas for policy or regulatory actions designed to promote flaring reduction; cooperate to reduce barriers to entry in key associated gas markets; promote the development of special finance and risk mitigation mechanisms as needed; and cooperate to develop standards. Given the different approaches adopted by some companies and governments, it is probably premature for such a partnership to commit to specific reduction targets for existing or new projects, but this could be considered at a later stage.

The Oslo meeting might be considered to be the first meeting of such an informal partnership. The World Bank or another agency might act as the partnership’s secretariat. Most of the partnership’s meetings would be virtual, with members normally participating in the exchange of ideas on only those matters in which they have particular expertise or interest. More formal meetings might take place when deemed necessary by the partners, perhaps on an annual basis. Participating governments, companies, and international institutions would then be the logical sources of financing for the various initiatives that such a group would sponsor (including contributions made in kind). It is hoped that a few key donors would commit to funding the modest costs of the overall administration and management of such a partnership.

The Bank and the Government of Norway plan to announce the partnership at the World Summit on Sustainable Development in Johannesburg August–September 2002 to fund technical assistance to reduce gas flaring and to develop outlets for flared gas (domestic markets/exports) in specific countries. The Initiative is in the process of identifying up to 10 countries where gas flaring reduction is possible and ensuring cooperation from their governments and national companies to reduce gas flaring. This will take place in the period up to the Johannesburg summit, and the implementation of the program in these countries should be the main activity of the public-private partnership.
6 Global Gas Flaring Reduction Initiative Conference: Summary of presentations and discussion

The Global Gas Flaring Reduction Initiative Conference was held on April 15–16, 2002, at the Holmenkollen Park Hotel in Oslo, Norway. This conference represents the culmination of the stakeholder consultation phase of the Initiative.

Panel discussions focused on the following topics: international and local markets for otherwise flared gas, innovative financing mechanisms for flaring reduction projects, and best practices in flaring regulation. The final session focused on the immediate next steps for the Initiative.

About 120 participants attended the conference from over 25 countries, including those countries responsible for most of the current routine flaring of associated gas.

6.1 Opening session

Rashad R. Kaldany, director of the Oil, Gas, and Chemicals Department at the World Bank/International Finance Corporation, opened the conference and welcomed participants. He noted that the World Bank was ready to use the wide variety of financial and other instruments at its disposal to help address the flaring problem.

The Honorable Einar Steensnaes, Norwegian Minister of Petroleum and Energy, welcomed participants on behalf of the Government of Norway. Minister Steensnaes commented that the Initiative could be an important way for the petroleum sector to further demonstrate that it can be clean and socially responsible and a vital bridge to a long-term sustainable energy future.

In her remarks, World Bank Vice President Nemat Talaat Shafik noted that an important message from the stakeholder consultations was the necessity of a collaborative approach for unlocking potential win-win opportunities. These include opportunities for enhanced oil recovery, increased government revenues, and local and global environmental and developmental benefits. Ms. Shafik provided an overview of the proposed focus activities of the Initiative, noting that the World Bank is seeking a consensus among stakeholders for putting these into action. The proposed activities include the collection and dissemination of regulatory best practices, the improvement of flaring statistics and reporting, the development of common technical flaring standards, the enhanced use of World Bank mechanisms to help finance flaring reductions, and assistance in designing carbon credit schemes to unlock green financing.
The Algerian Minister of Energy and Mines, the Honorable Chakib Khelil, provided a practical introduction to the flaring issue with an overview of flaring problems and solutions in Algeria. Minister Khelil pointed out that Algeria is a significant exporter of natural gas and LNG. He noted that investment projects had lowered the amount of flared gas in Algeria to some 4.3 bcm in 2001 and that current and planned projects could eliminate flaring by 2010. However, financing these projects could prove an obstacle. Among possible future projects, Minister Khelil noted that the governments of Algeria, Nigeria, and Niger had recently signed an agreement to perform a feasibility study for a trans-Sahara gas pipeline that could bring Nigerian gas (as well as additional Algerian gas) to Europe.

Torleif Haugland, a partner at ECON Centre for Economic Analysis, explained the stakeholder discussion process and presented the resulting report. He said that the Team’s estimate of the current flaring range at 100–135 bcm per annum was highly uncertain. He noted that in practice some governments had found that amounts reported as flared had turned out to include vented gas, which implied significant uncertainties regarding actual climate effects. Mr. Haugland noted that, despite significant efforts by governments and companies, the amount of global flaring had remained relatively stable since the early 1980s. Moreover, he noted that continued flaring reduction efforts risk being neutralized by incremental oil production in countries where flaring remains a problem. Mr. Haugland said that the main role of the Initiative therefore likely would be in the area of win-win efforts to remove investment barriers. Mr. Haugland summarized the main barriers as identified during stakeholder consultations and emphasized that the aim of the Initiative is to find how joint efforts of governments, the oil industry, and international organizations can help remove the barriers.

6.2 Panel discussion 1: Are international markets the solution?

Adrian Lajous, president of Petrometrica and member of the stakeholder consultancy Team, moderated the discussion on international markets. He noted that, due to the current low development level of domestic gas markets in many oil-producing countries, international markets, including notably those for LNG, will play an important role in absorbing gas that would otherwise be flared.

Svein Harald Oeygard, partner at McKinsey, examined the ability of Atlantic Basin LNG markets to absorb currently flared gas. His scenarios indicate that access for 65 to 85 percent of aggregate LNG volumes is likely to come from Africa over the next decade. “Key levers” for the success of individual projects include LNG costs at the plant gate, company and country policies, market access, competing projects, risks and financing, and technology.

Andy Lane of BP gave an overview of the current LNG market. He noted that 25 percent of internationally traded gas is in the form of LNG. Long-term (20-year) contracts probably will remain the norm, although the small spot market is likely to grow, especially in the United States. Mr. Lane expected traded LNG volumes to double by 2010, though he cautioned that the number of competing projects in the planning stage far exceeds the market. Growth in established LNG markets will be driven by economic growth rates, government policies on supply security,
environmental concerns, and the approval process and regulatory framework for new import terminals. Key issues in new markets, such as India and China, will be conditions in the gas and power infrastructure markets, the creditworthiness of buyers, and the relative price of LNG compared to that of alternative fuels. These issues will necessitate active government participation to stimulate key anchor customers and to provide an appropriate regulatory framework for private investment and regulatory stability. Mr. Lane concluded that selling LNG was much more difficult than producing it and that success depended ultimately on price, including, significantly, the tax take of the producing country.

Audie Setters of ChevronTexaco provided an overview of world gas consumption. He noted that North America and Europe consume over 50 percent of the total, including over 90 percent of gas traded above US$2.50 per MMBtu, implying that the Atlantic basin market is an important prize for potential exporters. Mr. Setters noted that a number of trends, notably in technology, are driving up the intrinsic price of flared gas and thus could help make the flaring problem more manageable in the future. He pointed out that the cost of liquefaction is being driven down and noted new developments in pressurized natural gas (PNG) that could be cheaper than LNG in terms of required infrastructure. Mr. Setters felt that the most important role for industry to play was to “push the technology envelope,” while a crucial role for government and the financial community was to help stabilize markets. Mr. Setters concluded that “markets and economic fundamentals must drive gas flaring reduction initiatives.”

Rabah Nadir N. Alouani, Director of Safety and Environment at Sonatrach, provided additional insight on Algeria’s experience in gas flaring reduction. Although Algeria has a high ratio of flaring to oil production, he pointed out that its ratio of flaring to gross gas production was among the lowest in the world. He reiterated Minister Khelil’s concern about financing sources for Algeria’s continued flaring reduction plans and stressed the importance of finding funding mechanisms for marginal projects, suggesting an “environmental price premium” for gas.

Valery L. Petrakov, deputy general manager for Lukoil, explained that the construction of gas-gathering systems fell behind when oil production grew in Western Siberia. In response to difficulties in gaining access to Gazprom facilities, Lukoil, like many other Russian oil companies, is currently acquiring its own processing plants. Access to Gazprom pipelines exists in principle but has been difficult to implement in practice due to low prices offered by the pipeline monopoly for the gas, although prices are now rising. In 2001 Lukoil used some 80 percent of the associated gas it produced, mainly in on-site electricity generation. Further use will depend on market conditions in Russia. The company is planning to invest some $500 million in flaring reduction through 2010.

Dodi Hidayat of Pertamina provided an overview of gas utilization in Indonesia. Out of 2.66 Tcf of total gas produced in 2001, some 5 percent was flared. Approximately 55 percent was exported as LNG, while other consumption included electricity production, fuel, fertilizer, petrochemical production, and LPG. Pertamina sees the integration of Indonesia’s pipeline system as a key to developing new gas markets and increasing the flexibility of production and gas flaring utilization. It expects the government to make favorable loans available for such expansion.
During the ensuing discussion, it was pointed out that “medium-sized” volumes of associated gas generally pose the most problems, since they often are too large to reinject and too small to commercialize. However, some participants noted that new technologies such as PNG may help address this problem. It was also pointed out that, while the cost of utilizing associated gas can effectively be subsidized by related oil production, governments need to help reduce the complexity of implementing gas utilization projects; otherwise, companies will prefer to develop nonassociated gas. It was also recognized that the long-term nature of LNG contracts usually has necessitated that they be based on nonassociated gas deposits, though such projects could provide the basic infrastructure for associated gas projects.

There was some discussion of possible market access problems for LNG in the United States, related to public acceptance of LNG import terminal construction and expansion. (The United States is considered by some stakeholders to be the main potential market in the Atlantic basin for incremental LNG supply.) It was recognized that the industry needed to be more active in allaying the safety concerns of the public and that the Initiative could have a role in this regard, as well as in helping to eliminate other possible market barriers to LNG in important potential import markets.

6.3 Panel discussion 2: Can regional and domestic markets for the use of flaring gas be developed? Are small-scale uses a solution?

Richard Stern, managing director of Emerging Markets Partnership and a member of the Team, chaired the session. He began by reviewing possible ways in which the Initiative could help overcome market barriers for associated gas. These include assistance in formulating gas master plans for host governments; promoting anchor customers; developing special incentives for the use of associated gas; promoting and developing financial guarantee mechanisms against regulatory, expropriation, sovereign, and other risks; helping to reform regulatory frameworks; and promoting regional cooperation. Mr. Stern noted that the current World Bank emphasis on country-specific projects probably should be broadened to take into account regional market solutions for the flaring problem.

Peter Johansen of COWI presented an ongoing project under the Initiative to examine small-scale gas uses. The expected output is a study and several demonstration cases (probably in Africa), as well as an overall assessment of the potential for small-scale uses of gas to help provide environmental and economic development benefits, and thereby reduce poverty in flaring countries. Examples of small-scale uses could include add-ons to large-scale projects (e.g., power production at an oil field for the local community or to feed into the grid, supply of gas to large and small local consumers, and connection to an existing gas transmission line). Barriers to small-scale use include “free” traditional fuels and subsidies for other competing fuels, lack of cooperation by local institutions, and scarcity of anchor customers that can bear initial infrastructure costs. Mr. Johansen felt that the main way the Initiative could promote small-scale use solutions was by increasing awareness through demonstration cases and dissemination of best
practices; breaking down regulatory, financial, and institutional barriers; attracting donor financing by emphasizing the socioeconomic and local environmental benefits of small-scale use projects; and similarly developing modalities to attract green financing to capitalize on the CO$_2$ reduction benefits of such projects.

Youba Sokona, Executive Secretary for International Affairs and head of the Energy Program at Environnement et Development du Tiers du Monde (ENDA-TM), gave an overview of government LPG policies in Senegal, which have helped make LPG the main cooking fuel in urban regions in that country. The government began promoting LPG use in the 1970s to counter deforestation, land degradation, and related environmental problems caused by heavy wood and charcoal use. Successful policies developed over the years have included an awareness-raising campaign; the design of inexpensive stoves that accommodate traditional cooking techniques; removal of taxes on imported equipment; development of a differentiated pricing policy for three different sizes of standardized bottles, with subsidies for only the sizes aimed at low-income users; subsidies for bottles and infrastructure but not for the gas itself, and later subsidies only for gas in small size bottles; micro-credit schemes for the purchase of stoves; and the establishment of refilling centers in key regions to rationalize transport, packing, and storage networks.

Emmanuel Chantelot, managing director of the World LP Gas Association, noted that LPG is a popular household fuel in many developing countries, with the notable exception of sub-Saharan Africa. Countries with relatively large flaring problems but low LPG per capita in the residential sector include Nigeria, Indonesia, China, and Russia, implying possible growth potential for these markets. Mr. Chantelot drew attention to a recent joint study by the World Bank and the World LPG Association entitled *The Role of LPG in meeting the goals of sustainable development*. Policies to overcome market barriers identified by the study include rationalizing import and storage infrastructure and removing import duties; regulating and enforcing good business practices; targeting subsidies (on bottles and stoves); avoiding subsidies to competing fuels; providing microcredit financing; raising awareness of comparative benefits; promoting innovative public-private partnerships for retailing in rural areas; and developing innovative incentives to direct new LPG supplies from otherwise flared gas to markets with social and environmental and poverty reduction goals.

In the discussion it was emphasized that subsidies to LPG should be targeted and are most important in the start-up phase. It was also pointed out that some LPG markets had developed without subsidies. It was noted that development policy in the past had perhaps placed too much emphasis on rural electrification and not enough on general energy provision in rural regions, where the main need was for energy for cooking. In raising the issue of whether to favor small-scale local gas use over export schemes, it was recognized that there could be some tension between the goals of large-scale flaring reduction and local economic development and poverty elimination.
6.4 Panel discussion 3: Innovative financing mechanisms for gas flaring reduction projects

Bent Svensson of the World Bank chaired this session. He noted that the availability of financing for commercially viable flaring reduction projects is not likely to be an issue for the major international petroleum companies. However, it could be crucial for some smaller and national oil companies. Moreover, investments involving downstream consumption could pose risks even to the majors. Risk abatement measures and special funding facilities, such as green financing related to the Kyoto Protocol mechanisms, could help bring marginal projects above the internal profitability thresholds required by some companies. Mr. Svensson noted that green financing could be one way to provide the “environmental premium” for gas suggested earlier by Minister Khelil.

Kevin Bortz, director of natural resources at the European Bank for Reconstruction and Development (EBRD), provided an overview of the bank’s lending programs that could be relevant for flaring reduction projects. Mr. Bortz said that the EBRD welcomes the Initiative and is “prepared to consider, support and promote viable schemes that would achieve gas flaring reduction in its countries of operation.” He noted that the EBRD was interested in the Kyoto mechanisms and has an agreement with the Dutch ERUPT/CERUPT programs. The EBRD also has a “no venting” policy for projects.

Gert Looijenstein of the Dutch governmental agency Senter, which is responsible for the execution of the Dutch commitments under the Kyoto Protocol through their procurement tender system—ERUPT for JI, and CERUPT for CDM—provided an overview of projects it is financing through purchase of CO₂ reduction credits under JI and CDM. The Netherlands has committed to meeting 50 percent of its target under the Kyoto Protocol domestically, while the rest may be met using the Kyoto mechanisms. While noting that so far no reviewed projects had involved flaring reduction, Mr. Looijenstein felt it could be possible for such projects to qualify for funding. He provided a hypothetical calculation for a flaring reduction project involving an ethanol plant for which carbon credits provided some 25 percent of project costs. Important prerequisites for potential funded projects include a validated emissions baseline and approval by the host country. The average price paid by the Dutch government programs has been about 4.50 Euros per ton of CO₂.

Christine Zumkeller of the UNFCCC spoke about the Clean Development Mechanism and its potential to help fund flaring reduction projects. She noted that the market for CDM is still uncertain, hinging on actual emission reduction efforts in developed countries, U.S. participation, and the availability and price of excess emissions or “hot air” from transition economies. The key test for flaring reduction projects will be “additionality” (Article 12.5 of the Kyoto Protocol), meaning that the qualifying project must reduce anthropogenic emissions below the level that would have occurred in the absence of the registered project.

Kenneth J. Newcombe, fund manager for the Prototype Carbon Fund (PCF), gave an overview of the PCF, which buys carbon credits to help finance projects with emission reduction components. He noted that projects could borrow on international markets against the assurance of a PCF carbon purchase agreement. So
far the PCF has not sponsored a flaring reduction project, but several projects are under preparation. Mr. Newcombe observed that there appears to be a general reluctance in the carbon finance community to support reinjection projects. Projects involving reduction of methane are likely to be of most interest, though it is unlikely that venting could be taken as a baseline. Mr. Newcombe admitted that general lack of experience so far with flaring reduction projects means it is still unclear how such projects could best qualify for carbon credits. However, he felt that the potential for project financing via carbon credits was probably underestimated by the stakeholder report. He noted that the Initiative could play an important role in clarifying the modalities and smoothing the way for flaring reduction projects to receive credits.

In response to a question about the eligibility of projects aimed at increasing flaring efficiencies, it was noted that the efficiency of the gas flare (i.e., the percentage of the gas that is actually flared at each site and not emitted as methane) could have a very significant impact on the type of GHGs emitted and on global warming. In general, it was pointed out that any projects involving reduction of methane were potentially interesting but that such projects undoubtedly would have to involve very careful and sophisticated monitoring; ultimately the CDM Executive Board would have to rule on the eligibility of such projects. There was a discussion of how a country’s energy policy context would be taken into account in deciding the eligibility of projects; for instance, for a project involving a switch to natural gas, where the switch likely would have occurred anyway if the government simply had ended subsidies to the more polluting fuel. The PCF and Dutch carbon funds both noted that they take the underlying policy environment into account; moreover, the PCF noted that it has the right to cease payment if the underlying baseline situation changes. There was also discussion of whether stated policies of governments to ban flaring could effectively disqualify flaring reduction projects in those countries. Although this issue ultimately will have to be decided by the Board, there was general consensus among panel members that the Board probably would take into account the ability and not just the intention of a government to produce the agreed outcome.

The Honorable Victor Lichtinger, Mexico’s Minister of Environment, outlined in a dinner speech the progress Mexico has made in curbing emissions in the oil industry and presented future policy measures planned by the government. The flaring reduction program has as a target to reduce flaring by 90 percent between 2000 and 2005. This will be achieved through elimination of bottlenecks in the recovery systems, adoption of best available maintenance and operational practices, and investments in oil and gas handling infrastructure.

6.5 Country presentations

Bent Svensson of the World Bank showed a series of satellite photos comparing flaring in a number of locations between 1992 and 2002. (The presentation was prepared by Dr. Christopher D. Elvidge of the U.S. Department of Commerce National Oceanic and Atmospheric Administration’s National Environmental Satellite Data and Information Service, who was unable to attend the conference.) The satellite images demonstrated a noticeable decrease in flaring at a number of oil-producing sites in Mexico, India, and Indonesia, though there were increases at a number of other sites. The purpose of the presentation was to show one possible
way of monitoring flaring activity and to check the quality of traditional data. A monitoring program to document changes in gas flaring activity worldwide using satellite data is under consideration.

Sascha Djumena of the World Bank chaired a session on national policies and plans for flaring reduction. The Honorable Imeh Okopido, Nigeria’s Minister of Environment, provided an overview of the plans of the major international oil companies operating in Nigeria to meet the government’s target flaring phase-out date of 2008, as well as the government’s incentive package to promote domestic gas consumption in various industries. Hassan AbdelMoneim of the Gulf of Suez Petroleum Company (GUPCO) presented an overview of oil production and related flaring and flaring reduction efforts in Egypt, while Nasser Zokai of the National Iranian Oil Company (NIOC) presented the Iranian experience in this area. Roberto A. Vieira de Macedo of Petroleio Brasileiro (PETROBRAS) shared success stories in utilizing associated gas from Brazil’s Amazon state, though he noted that flaring problems remain in the Campos Basin. He expected that gas flaring will be reduced to 10 percent in the Campos Basin by 2006, meaning that the percentage of associated gas being flared in Brazil will come down to below 10 percent by 2006. Amin M. Alshibani of Saudi Aramco provided an overview of Saudi Arabia’s government-driven Master Gas System, which involved construction of a comprehensive and flexible gathering infrastructure with the development of large gas-consuming industries such as petrochemicals and power generation. Implementation of the Master Gas System has allowed Saudi Arabia to dramatically cut flaring since the early 1980s and to benefit from its associated gas resources, providing a potential model for other countries. Yan Liu of China Petroleum & Chemical Corporation (Sinopec) noted that much associated gas production in China takes place in the eastern part of the country, where there are ready markets for the gas (e.g., for power generation and fertilizer production), with the implication that little gas actually may be flared in China.

6.6 Panel discussion 4: Best practices in gas flaring regulation

Arve Johnsen of Arve Johnsen’s Law Office chaired the session. He noted that regulatory frameworks in host countries have a key role to play in decreasing flaring and in channeling otherwise flared gas into alternative end uses. He emphasized the important potential role of the Initiative in disseminating regulatory best practices.

Arden Berg of the Alberta Energy and Utilities Board shared the successful experience of the regulator in decreasing flaring in Alberta, Canada. He stressed the importance of building stakeholder consensus, which helps lead to broad acceptance of goals and initiatives. He noted Alberta’s preference for voluntary agreements with a regulatory “backstop,” that is, prescriptive maximum flaring limits for individual sites that would be imposed if voluntary goals were not met. Mr. Berg said that Alberta had used the voluntary approach to cut flaring by 50 percent between 1996 and 2001, doubling its target. Mr. Berg emphasized the importance of site-by-site evaluation and said that companies in Alberta were required to use “decision tree” analysis, with economic decision criteria clearly specified by the regulator to evaluate options for gas flaring reductions. Related to this, he noted that checks by the regulator had indicated that a significant amount of
the gas reported as flared was actually being vented, with the implication that this could be a problem in other countries as well. Mr. Berg advised that both compliance and enforcement could be enhanced by making requirements as clear and consolidated as possible. He also noted that public comparison of companies’ performance in a regular report published by the regulator provided companies with an important incentive to improve behavior. Finally, he drew attention to the need to regularly review national standards in order to maintain momentum in flaring reduction.

Stig Bergseth, vice president for health, safety and environment at Statoil, provided an overview of the Norwegian experience in pursuing flaring reductions. He noted that Norway had also had a positive experience with voluntary agreements. While taxes and fines had also played an important role, the effect of taxes in Norway was unclear because significant reductions had already been achieved by the time they were introduced.

Bernard Tramier, senior vice president for sustainable development and environment at TotalFinaElf, gave an overview of his company's policy, which includes no flaring for new developments and reduction of flaring “whenever possible” at existing facilities. Mr. Tramier commented that while emissions were a global issue, global companies were being forced to address them on a national, country-by-country basis. He stated that a system that allowed oil companies to address flaring reductions on a global basis would be more efficient and lead to greater reductions more quickly.

Mr. Javier Estrada, commissioner of the Mexican Comision Reguladora de Energia (CRE), explained that PEMEX, Mexico's national oil company, is implementing several measures to reduce gas flaring to less than 1 percent of total gas production before 2006. These measures are being adopted at PEMEX's own initiative. Although the proposed measures correspond with best recommended international practices, Mexico still lacks an all-encompassing legal framework and corresponding institutions to ensure the existence of, and full compliance with, mechanisms to eliminate unnecessary gas flaring. He also noted that the current fiscal regime for the oil industry does not sufficiently credit costs such as those involved in flaring reductions, providing little incentive to make such reductions. Mr. Estrada listed a number of measures that he believed could improve the control of natural gas flaring in Mexico and other countries. These included a clear policy statement by the government, a clear mandate for the regulator with appropriate powers, national standards, and a system of appropriately high penalties or taxes on flaring. On the demand side, Mr. Estrada stressed the importance of developing national gas markets and export opportunities.

6.7 The way forward: Immediate next steps

Robert Bacon, manager of the Oil and Gas Policy Division of the World Bank, chaired the final session.

Malcolm Brinded, managing director designate of the Royal Dutch/Shell Group, noted that flaring reduction provides a “double dividend” of climate improvement and use of the energy value of otherwise flared gas, including for economic
development. He welcomed the stakeholder report and emphasized the complementary roles that could be played by the World Bank, host governments, and the oil industry in the suggested next steps. He felt the main role of the World Bank should be facilitation, including sharing of best practices, capacity building, provision of capital and guarantees, and development of policies. He noted that host governments should be responsible for creating appropriate framework conditions, notably through regulation, promotion of commercial infrastructure, and appropriate pricing policies. Mr. Brinded said that the oil industry could offer financial strength, operational excellence, global best practices, advanced technology, local business opportunities, access to global markets, and experience in sustainable development.

The Honorable Chakib Khelil, the Algerian Minister of Energy and Mines, stated that he was optimistic that the oil industry was taking seriously its obligation to address the flaring problem, which has given the industry a negative image. He noted that the impact of future stakeholder meetings could be enhanced by holding meetings in countries where flaring is a significant problem, due in part to the large press attention that the issue would receive in the host country. He felt that a great potential use for otherwise flared gas lay in power production and that this issue needed further exploration.

Bent Svensson of the World Bank summarized the likely main roles of the Initiative (see Chapter 5) and gave a brief overview of the completed and ongoing initial research activities sponsored by the Initiative (see Annex 2). He noted that future priority projects may include technical assistance and policy advice on domestic and local market creation, improvement of data collection and monitoring, and investigations of the need for a specific carbon fund for flaring reduction activities and for the development of voluntary flaring standards. Mr. Svensson said that a public-private partnership probably would be formed to guide the Initiative, with membership ideally including a number of relevant existing stakeholder bodies. He noted that the Initiative’s “secretariat” could be based within an existing vehicle (e.g., ESMAP). Future financing for the Initiative is expected to come from stakeholders.

Although initially the need for the Initiative to promote international gas trade was questioned, subsequent comments by participants indicated that many felt the Initiative could play an important role in this area. In particular, it was noted that a significant amount of future LNG trade would involve flows between developing countries (e.g., to India and China), which the World Bank could promote via the financing of import infrastructure projects and assistance to improve local market conditions. A number of interventions also emphasized the important role the Initiative could play by promoting markets in producing countries and by developing international standards for the reporting of flaring.

The Honorable Hilde Frajord Johnson, Norway’s Minister of International Development, expressed her confidence in the success of the Initiative, given the relatively small number of key companies and countries involved in the problem and the fact that most were present at the conference. She stated that donor governments have an important role to play but should not inappropriately support the oil industry. She said that Norway had contributed so far by “initiating the Initiative” and by funding some of its initial research activities. Although Norway is
prepared to continue its support, it would expect other stakeholders to play a role. The minister emphasized that Initiative assistance was needed to promote “ownership” of the flaring issue in the countries where flaring is a problem and to avoid a case where “rich” countries were perceived to be pushing their own agenda. She said that an important way to do this is to take into account host countries’ development needs, including promotion of local gas markets. Finally, the minister emphasized the importance of promoting better statistics and monitoring, since they have important implications for the financing opportunities of flaring reduction projects under the Kyoto Protocol mechanisms.

Nemat Talaat Shafik thanked participants on behalf of the World Bank, observing that it was now time to move from the consultation phase of the Initiative to the collective action phase. Ms. Shafik expressed her confidence that, providing stakeholders work together, significant flaring reductions with important development ramifications could be achieved within a timeframe of five years. She noted that the next milestone would be a presentation of the Initiative at the World Summit on Sustainable Development in Johannesburg in August 2002.
Annex 1: List of Conference Participants

Algeria
Honourable Minister Khelil, Chakib; Minister, Algerian Ministry of Energy and Mines
Mr. Alouani, Rabah Nadir N.; Director of Safety and Environment, SONATRACH
Mr. Brahiti, Kamel; Director Protocols, Algerian Ministry of Energy and Mines
Mr. Khene, Djamel Eddine; Vice President, SONATRACH
Mr. Meziane, Mohamed; General Director of Hydrocarbons, Algerian Ministry of Energy and Mines
Mr. Zerguine, Abelhamid; Vice President, SONATRACH

Angola
Mr. Santos, Alcides; Director, Oil, Ministry of Petroleum
Mr. Orfao, Antonio; Director, SONANGOL GAS PROJECTS - SONANGOL

Brazil
Mr. Deierl, Hubert G.; Section Head, Petroleo Brasileiro S.A. – PETROBRAS
Mr. Viera de Macedo, Roberto; Engineer, Petroleo Brasileiro S.A. – PETROBRAS

Canada
Mr. Berg, Arden; Board member, Alberta Energy and Utilities Board
Mr. Gogolek, Peter; Research Scientist, CANMET Energy Technology Centre

China
Mr. Liu, Yan; Senior Manager, China Petroleum & Chemical Corporation - SINOPEC

Denmark
Mr. Christensen, Povl; Vice President, Dansk Olie og Naturgas A/S
Mr. Gregersen, Stig; M.Sc., COWI
Mr. Johansen, Peter; Project Director, COWI
Ms. Schwartzkopff, Frances; Reporter, Dow Jones Newswires

**Ecuador**

Ms. Peñaherrera, Samia; Viceminister, Ministry of Energy and Mines

**Egypt**

Mr. Hassan Syaed Mohamed AbdelMoneim, Chairman Assistant and Deputy General Manager Operations, GUPCO

Mr. Mohamed Refaat AbulSoud, General Manager Assistant, Gas Development, EGPC

**France**

Mr. Chantelot, Emmanuel; Managing Director, World LPG Association

Mr. Ferroukhi, Abdel; International Consultant,

Ms. Hanle, Lisa; , International Energy Agency - IEA

Mr. Muls, Jean-Michel; Exploration & Production Vice President Northern Europe Business Development & Norway, TOTAL FINA ELF

Mr. Swanson, Philip; Senior Economist, ECON

Dr. Tramier, Bernard; Senior Vice President Environment & Industrial Safety, TOTAL FINA ELF

Mr. Wright, Robert J.S.; Director, Policy and Projects, World LPG Association

**Germany**

Ms. Zumkeller, Christine; Deputy Coordinator, Cooperative Mechanisms - Secretary of the Executive Board of the CDM, United Nations - UNFCCC

**Indonesia**

Mr. Hidayat, Dodi;, Pertamina - MPS

Mr. Salim, Nasrullah; Energy Researcher, Pelangi

**Iran**

Mr. Zokai, Nasser; Expert in resources, NIOC

**Mexico**

Honourable Minister Lichtinger, Víctor; Minister for the Environment, Secretaría de Medio Ambiente y Recursos Naturales - SEMARNAT

Mr. Vargas, ; Ambassador, The Mexican Embassy in Norway
Miss Arendar Lerner, María P.; Directora de Cooperación Técnica y Científica, Secretaría de Medio Ambiente y Recursos Naturales - SEMARNAT

Mr. Estrada, Javier; Commissioner, Comision Reguladora de Energía

Mr. Lajous, Adrián; President, Petrométrica, S.C.

Ms. Ortiz, Ana Lilia; Assistant, The Mexican Embassy in Norway

**Nigeria**

Honourable Minister Okopido, Imeh; Honourable Minister of State, Federal Ministry of Environment

Mr. Achebe, Nnaemeka A.; Senior Corporate Adviser, Shell Exploration & Production International Ltd

Mr. Beka, Frances; Special Adviser, Federal Ministry of Environment

**Norway**

Honourable Minister Frafjord Johnson, Hilde; Minister of International Development, Norwegian Ministry of Foreign Affairs

Mr. Ask, Alf Ole; Journalist, Aftenposten

Mr. Berge, Sten Anders; Special Advisor, Norwegian Ministry of Foreign Affairs

Mr. Bergseth, Stig; Vice President - Health Safety Environment, STATOIL

Mr. Børsting, Georg; Advisor, Norwegian Ministry of Environment

Mr. Christiansen, Atle; Senior Research Fellow, Fridtjof Nansens Institute

Mr. Dahle, Øystein; World Watch Institute

Mr. Dahl Karlsen, Jostein; Advisor, Norwegian Ministry of Petroleum and Energy

Mr. Dovland, Harald; Deputy Director General, Ministry of Environment

Mr. Edvardsen, Trym; Environmental adviser, Shell E&P Norway

Ms. Engebretsen, Marit; Director General, Norwegian Ministry of Petroleum and Energy

Mr. Gjerde, Gunnar; Director General, Ministry of Petroleum and Energy

Mr. Glømmi, Øistein; Energy Adviser, NORAD

Mr. Gran Olsson, Olav; Journalist, Norwegian Broadcasting

Mr. Hagen, Per; Regional Director Nigeria and USA, INTSOK

Mr. Haugland, Torleif; Partner, ECON
Mr. Hellstenius, Cato; Project Manager, Business Development, Bergesen d.y. ASA
Mr. Johnsen, Arve; Attorney MNA, Arve Johnsen’s Law Office
Ms. Jonsen, Cathrine; Conference Organizer, ECON
Mr. Kristiansen, Øystein; Project Director, Norwegian Petroleum Directorate
Mr. Larsen, Rolf Magne; Vice President GEX, Statoil ASA
Ms. Mentzoni, Anne-Grete; Conference Organizer, ECON
Mr. Nore, Petter; Vice President, Norsk Hydro
Mr. Owren, Per Anders; PA Manager, Shell Oil Products Norway
Mr. Plisson-Saune, Stephan; Section Head Environmental Research, Total Fina ELF Exploration Norge AS - TFE EN
Mr. Rekdal, Ottar; Senior Vice President, STATOIL
Mr. Sande, Arvid; Programe Manager, Energy & Emissions, PB
Mr. Steen, Fredrik; Adviser, Norwegian Ministry of Foreign Affairs
Honourable Minister Steensnæs, Einar; Minister of Petroleum and Energy, Norwegian Ministry of Petroleum and Energy
Ms. Stowell, Deborah; Senior Economist, ECON Center for economic analysis
Ms. Sydnes, Ann Kristin; Special Adviser, STATOIL
Mr. Traaseth, Lars; Director, Bergesen d.y. ASA
Mr. Viste, John A.; Manager - Safety, Health & Environment, Norske Conoco
Mr. Walther, Arne; Director General, Norwegian Ministry of Foreign Affairs - MFA
Mr. Øygard, Svein Harald; Partner, McKinsey

Russia

Mr. Basnaryov, Edward Y.; Interpreter/Consultant, The Polar Lights Company
Mr. Brennan, Robert; Operations Manager, The Polar Lights Company
Mr. Khanykov, Alexander; Advisor to the Chairman of the Management Board RAO "EES Rossi", Promgaz Open Joint Stock Company
Mr. Khanykov, Ilya; United Oil&Gas and Chemical Company
Mr. Petrakov, Valery; Deputy General Manager, LUKOIL
Mr. Yelin, Vladimir; Safety & Environmental Manager, The Polar Lights Company
Saudi Arabia
Mr. Alshibani, Amin M.; Superintendent, Saudi Aramco
Mr. Law, Peter; Corporate Planner, Saudi Aramco

Senegal
Mr. Sokona, Youba; Head Energy Programme, Environment et Development

South Africa
Mr. de Klerk, Louis W.; Senior Project Manager, IDC - Industrial Development Corporation

The Netherlands
Mr. Hartog, Jan; Sr. Environment Adviser, Shell International Exploration and Production B.V. Health, Safety and Environment Department
Mr. Looijenstein, Gert; Project Officer, ERUPT and CERUPT

United Kingdom
Mr. Ball, James; Managing Partner, Gas Strategies
Mr. Bess, Mike M.; Director International Division, ESD Ltd.
Mr. Bortz, Kevin; Director, Natural Resources, EBRD
Mr. Brinded, Malcolm; Managing Director, Royal Dutch/Shell Group of Companies
Mr. Chukwueke, Tony; Business Development Manager Africa, Shell Gas & Power Shell International Gas Ltd
Mr. Gibson, Jeff J.; Project manager, National Engineering Lab - NEL
Mr. Gillett, Jim; Business Development Manager, Gaffney, Cline & Associates
Mr. Grant, Alan; Executive Director, OGP
Mr. Laing, Richard X.; Planning Advisor, ExxonMobil
Mr. Lane, Andy; Manager, BP
Mr. Levitsky, Michael; European Business Development, CONOCO Exploration Production Europe

USA
Mr. Dror, Yehuda; General Manager, Det Norske Veritas - Region Americas
Mr. Setters, Audie; General Manager, International Gas, ChevronTexaco Overseas Petroleum

Mr. Shinn, John; Sr Staff Advisor, Global Change, Chevron Texaco

Mr. Stern, Richard; Managing Director, Emerging Markets Partnership

**World Bank Group**

Mr. Bacon, Robert; Manager, World Bank Group

Mr. Belguedj, Mourad; Lead Energy Specialist, World Bank Group

Mr. Djumena, Sascha T.; Operations Officer, World Bank Group

Mr. Kaldany, Rashad R.; Director, World Bank Group

Mr. McPherson, Charles; Senior Adviser, World Bank Group

Mr. Muylle, Michel; Senior Gas Specialist, World Bank Group

Mr. Newcombe, Kenneth J.; Senior Adviser, World Bank Group

Ms. Shafik, Nemat T.; Vice President, World Bank - PSI

Mr. Svensson, Bent R.; Lead Energy Economist, World Bank Group

Ms. Tamakloe, Abigail; Executive Assistant, World Bank Group

**Venezuela**

Mr. Martinez, Anibal; Adviser for the Minister of Energy, Ministry of Energy and Mines
Annex 2: Initial Initiative activities

The first activities of the Global Gas Flaring Reduction Initiative are described briefly below:

1. **Conferences to provide a framework for international discussion and concrete agreements on flaring reduction.**
   - The Initiative was launched in Marrakech in November 2000.
   - A conference was held in Oslo, April 15–16, 2002, to discuss the preliminary results and next steps.
   - The results will be presented at WSSD in August 2002, in South Africa.
   - The results will also be presented at the 17th World Petroleum Congress in Rio de Janeiro, September 1–5, 2002.

2. **Consultation with key stakeholders.**
   - The first activity under the Initiative has been a consultation with international oil companies, host governments, and other stakeholders. Consultations were conducted by a team of senior experts on petroleum sector issues, supplemented by visits of Bank staff to national authorities in a number of developing countries. This report presents the findings of that process.

3. **Knowledge improvement and dissemination.**
   - A consultant report providing the methodology for bottom-up analysis of gas flaring data in the seven countries with the highest flaring rates has been carried out and is being reviewed.

4. **Maximizing the poverty reduction impact of gas utilization.**
   - The Initiative has implemented a study to assess the technical feasibility and economic viability of using flared gas in various applications, ranging from rural electrification to commercial and industrial use. This study will also assess the development of small-scale natural gas and distributed power generation opportunities from flared gas. The project will identify viable pilot projects. A primary pilot project selection factor will be the poverty reduction potential.
5. **Development of international flaring and venting standards.**

- The Initiative plans a study to evaluate the potential of developing industry standards for gas flaring.

6. **Incorporation of flaring management into petroleum sector governance.**

- The Initiative plans one study to evaluate the potential of developing industry standards and a second study to assess petroleum sector governance, including rights and rules regarding the ownership and use of associated gas as specified in oil production contracts.

7. **Introduction of improved flaring contractual and regulatory frameworks.**

- A consultant report analyzed current gas flaring regulatory frameworks in 38 countries. More studies of international best practices are under preparation.

8. **Design of financing mechanisms to reduce flaring by monetizing global externalities in projects.**

- The Initiative has implemented a study that involves analyzing, assessing, and designing financial mechanisms for gas flaring reduction projects, using carbon emission credits, related financial mechanisms, and other earmarked environmental funding.

9. **Identification of pilot projects for flaring reduction and elimination.**

- Gas flaring reduction projects will be identified in countries where flaring problems are expected to be greatest, particularly West Africa and Russia. Pilot projects will be designed to lead to greater understanding of the use of best practices in technology, government policy, and creative financing mechanisms.
Annex 3: Consultation Team and institutions visited

The core consultation Team consisted of Bent Svensson (Team Leader, World Bank), Sascha Djumena (World Bank), Torleif Haugland (Econ), Arve Johnsen, and Adrian Lajous. Bank country missions to Russia and West Africa discussed gas flaring reduction policies in these areas as a part of the mission’s agenda. Bill Porter participated in the Russian mission; Robert Bacon, Adegbite Adeniji, Mourad Belguedj, Charles McPherson, and Michell Muylle participated in the West African mission.

Companies the Team visited included Agip, BP, ChevronTexaco, Conoco, Enterprise Oil, ExxonMobil, Lukoil, Norsk Hydro, PEMEX, Shell, Sibneft, Statoil, TotalFinaElf, Tyumen Oil Company (TNK), and Yukos. Other stakeholders consulted by the team included Center for Sustainable Development in the Americas (CSDA, Washington, D.C.), Department of Trade and Industry (DTI, United Kingdom), environmental defense (Washington, D.C.), International Association of Oil and Gas Producers (OGP), United Nations Environment Program (UNEP), United Nations Framework Convention on Climate Change (UNFCCC), World Watch Institute (Washington/Oslo), and the governments of Canada (Alberta), Mexico, the Netherlands, Nigeria, Norway, Russia, and the United States.
## Annex 4: Procedures and standards in 38 countries

**Table A1: Procedures under which permission to flare is granted**

<table>
<thead>
<tr>
<th>Country</th>
<th>Permitting procedure</th>
<th>Specific flaring permit</th>
<th>Production license/development plan</th>
<th>EIA*/environmental license</th>
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*EIA = Environmental Impact Assessment.
### Table A2: Availability of specific E&P standards

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FOR FURTHER INFORMATION REGARDING THIS REPORT OR THE GLOBAL GAS FLARING INITIATIVE, CONTACT:

Bent Svensson  
Lead Energy Economist  
Phone: 202-473-6976  
E-mail: Bvensson@worldbank.org

Sascha Djumena  
Operations Officer  
Phone: 202-473-8146  
E-mail: Sdjumena@worldbank.org

The World Bank Group  
Oil, Gas, Mining and Chemicals Department  
2121 Pennsylvania Avenue, NW  
Washington DC 20036  
Fax: 202-522-0395

Webpage:  
http://www.ifc.org/ogc/global_gas.htm