If there is one project that the oil and gas industry will probably remember for years to come, that is Angola Liquefied Natural Gas or Angola LNG.

What makes this project special is not that it takes place in Angola, a strategic and important oil-producing country in western sub-Saharan Africa, or that it is about LNG for that matter.

What makes it unique is that this project is poised to become the major gas flaring reduction project in the world. Comparing to other LNG projects around the globe, the primary source of supply during the early years of operation will be gas associated with crude oil production as opposed to supplies from non-associated gas fields. This is gas that is currently being flared due to the lack of a market, but now Angola and the companies operating in the country will commercialise it.

And in today’s climate change context – in which most companies or countries are looking for opportunities to increase energy efficiency and reduce greenhouse emissions – Angola LNG is no small feat.

This multi-billion project, located near the town of Soyo in northern Angola, will be on-stream in early 2012 producing 5 million tonnes of LNG per year (about 6.8 bcm/year) primarily targeted at Atlantic Basin gas markets.

The Angola LNG project will gather associated gas in water depths of up to 1,500 metres initially from five blocks, and it will also develop previously discovered non-associated gas fields in two blocks to supplement the associated gas produced with oil. The gas production from these seven blocks will be transported by three high-pressure pipelines to the LNG plant onshore for conditioning and extraction of natural gas liquids (NGLs) before the remaining gas is liquefied to LNG. The first cargoes of LNG are expected to be delivered in February 2012.
Angola LNG will also serve as the anchor investment for an industrial park and will provide energy and feedstock for an emerging petrochemical industry. Significant investment incentives – including a tax holiday of up to 15 years – are available for a variety of investments in Soyo, an undeveloped corner of the country which is being transformed by a massive world-class project.

The gas flaring challenge
It is estimated that globally about 150 bcm of natural gas are being flared and vented annually. This amount is equivalent to 25% of the United States’ gas consumption or 30% of the European Union’s gas consumption per year.

Gas flaring wastes resources and harms the environment, and that’s why it is important to step up the efforts in reducing flaring and increasing gas utilisation. Gas flaring also deprives developing countries of an energy source that is cleaner and often cheaper than others available, and reduces potential tax revenue and trade opportunities.

Gas flaring also has a global impact on climate change by adding the equivalent of some 400 million tonnes of CO₂ in annual emissions. Furthermore, it is estimated that some 100 bcm of methane is vented or lost through fugitive emissions in the oil and gas sector each year. As methane is a more potent greenhouse gas than CO₂, this adds the equivalent of over 1 billion tonnes of carbon dioxide annually.

Altogether, annual emissions from flaring and venting (1.4 billion tonnes) are equivalent to more than twice the potential yearly emission reductions from projects currently submitted under the Kyoto Protocol’s clean development mechanisms.

According to latest available satellite data (2008), the major flaring region in the world is Russia and the Caspian Sea (about 60 bcm), followed by the Middle East and North Africa (about 45 bcm). Sub-Saharan Africa (about 35 bcm) is the third-biggest flaring region, followed...
by Latin America with some 12 bcm of gas flared annually. And the ranking of flaring countries shows Russia leading the list, followed by Nigeria, Iran and Iraq. The other six countries that make up the top 10 flaring countries for 2008 are Algeria, Kazakhstan, Libya, Saudi Arabia, Angola and Qatar. (See Table 1 for more country data).

According to the satellite estimates, Angola flared about 3.1 bcm in 2008. This project will aim to reduce gas flaring in Angola by some 75% over the next few years, with a reduction in CO₂ emissions equivalent to 9 million tonnes per year.

**Project sponsors**

Angola LNG is an integrated gas utilisation project encompassing offshore and onshore operations to monetise gas resources from blocks located offshore of Angola.

The Angola LNG Project partners are Chevron (36.4%), Sonangol (22.8%), Total (13.6%), BP (13.6%) and ENI (13.6%). Chevron and Sonangol serve as co-project leaders. All current sponsors of Angola LNG are partners in the World Bank-led Global Gas Flaring Reduction partnership (GGFR), and have expressed a commitment to reduce gas flaring to minimum levels whenever economically possible.¹

Sonangol is the owner of all associated and non-associated gas for development purposes under Angolan law and will provide these resources to the project. Approximately 28 mcm per day of associated gas combined with non-associated gas will be collected and transported from offshore production facilities to an LNG plant to be built on a 240 hectare site south of the Congo River on Kwanda Island, near the town of Soyo, in the Zaire Province of northern Angola.

The gas (associated and non-associated) will be transported to onshore processing facilities through pipelines, which will be buried along their entire onshore length. The plant will initially have one train and the expected production will be 5 mtpa of LNG and related gas liquid products as well as supply of up to 3.5 mcm/day for Angola’s domestic gas needs. LNG will be exported via tankers to the Gulf LNG Energy (GLE).

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¹ See International Gas, April 2009, pp200-207 for an article on the GGFR.
regasification facilities in the United States with onward pipeline delivery to the US market.

The project is expected to facilitate continued offshore oil development by providing a long-term commercial regional solution for associated gas. It is expected to provide significant benefit and stimulus to the local and national economy and is accordingly of strategic importance to Angola. The project is also of substantial importance to the other sponsors as it will provide a long-term solution for surplus associated gas from several blocks which cannot otherwise be managed on-block.

Furthermore, the NEPAD (New Partnership for Africa’s Development) Spatial Development Initiative has identified the Bas Congo corridor (comprising northern Angola, the Bas Congo province of the Democratic Republic of Congo and southern Republic of Congo) as one of the most promising new development clusters in Africa. The reason is the region’s combination of rich energy resources, including the Angolan gas fields and the vast hydro-electric potential of the Inga site on the Congo River, combined with rich mineral deposits and the potential for the further development of industries such as aluminium smelting, magnesium, phosphates and fertilisers, petrochemicals and cement.

History and key milestones
In 1997 Sonangol and Chevron (then Texaco) initiated a joint feasibility study to assess utilisation of associated gas being flared or anticipated to be flared from the deepwater blocks under development south of the Congo River.

In late 1999 Sonangol selected the LNG project as the preferred option, after studying and considering other alternative potential gas utilisation opportunities such as gas-to-liquids and power generation.

Then, in 2004, the project sponsors to the Participation Agreement developed and entered into a Memorandum of Understanding on regulatory framework, corporate structure, fiscal matters and related project issues.

Finally in December 2007 the project sponsors – Chevron, Sonangol Gás Natural, Total, BP and ENI – reached a Final Investment Decision (FID), and signed an investment contract with the Ministry of Petroleum and Sonangol EP. At the same time the investors signed the agreements for the supply, sale and regasification of the gas.

Globally that same year at least 14 LNG projects were meant to reach FID, but only two did: Pluto in Australia and Angola LNG.

Project commercial structure
Angola LNG has established four independent companies, all with shareholdings in current working interest proportions. These companies are:

- Angola LNG Limited (ALNG): ALNG is the principal entity for executing the project. It holds the rights granted to the sponsors and owns the assets of the project.
- Angola LNG Operating Company (OPCO) or Sociedade Operacional Angola LNG: OPCO will develop and operate the LNG plant and non-associated gas fields, together with the associated gas and non-associated gas pipeline networks.
- Angola Gas Pipeline Company (SOMG) or Sociedade de Operações e Manutenção de Gasodutos: The right/obligation to operate the pipeline networks will be granted initially to OPCO and then contracted to SOMG under a Pipeline Service Contract to operate at cost on a no-profit/no-loss basis.
- Angola LNG Supply Services LLC (ALNGSS): ALNGSS will conduct the downstream activities for the project.


3 Presentation by KMPG Angola, February 2008.
In this section, we will briefly describe other major aspects of Angola LNG that show not only why it is such a unique project but also why it is a feasible and viable one, starting with the political willingness and financial readiness of all project sponsors involved.

As noted earlier all current sponsors of Angola LNG are partners in the World Bank-led Global Gas Flaring Reduction partnership, created in 2002 during the Summit of Sustainable Development in Johannesburg. As GGFR partners, they have expressed a commitment to reduce gas flaring to minimum levels whenever economically possible. The goal of GGFR is to facilitate dialogue and cooperation between governments and companies so that they can find synergies and joint resources to reduce gas flaring and unlock the value of wasted natural gas.

Sources for the project
The primary gas supply source for the project is associated gas. Non-associated gas will be utilised to provide supply when there is inadequate contracted associated gas to fill the LNG plant capacity. This supply hierarchy is aligned with the strategic objective of the project’s sponsors to protect oil operations by providing offtake for surplus associated gas.

It is expected that this combination of associated gas and non-associated gas will adequately supply the plant during a 30-year period. All blocks have committed to an initial seven-year production profile. Studies are still underway to identify a start date for the non-associated gas phase.

Once the gas is processed, 3.5 mcm will be delivered to Sonangol every day as part of the project’s domestic gas commitment. The first LNG cargo is to be produced in 2012.

During liquefaction the liquids will be extracted. This is a critical component of the revenues (approximately one-third). While the domestic butane is to be sold to Sonangol, the LPG and condensates are for export sales.

Associated gas pipeline network
The associated gas pipeline network is to be constructed by the associated gas block operators under the terms of their concession/licence agreements. The network will operate on a “blended” basis with regard to the management of contaminants (principally CO₂) in the commingled stream specification at entry to the LNG plant. Implementation of the offshore sections of the associated gas pipeline network will be carried out by the block operators.

ALNG Ltd and Sonangol are the only two shippers holding pipeline capacity on the network as agreed in the Gas Transportation Agreement. ALNG’s firm transportation capacity will be the total capacity in each line, less what has been reserved for Sonangol, who may later elect to sublet its capacity in the network to other shippers under commercial terms to be agreed between such parties and Sonangol.

LNG plant
The LNG plant and associated facilities to be developed include the following major activities:

- The development of the LNG plant, installation of a construction camp and associated facilities on Kwanda Island; and
- The operations staff residential housing project.

The site location was chosen from four options identified in the Soyo area. The chosen site on Kwanda Island represented the “best shipping” site and was selected on the basis of: lowest environmental and socioeconomic risk; lowest safety/operability risks; highest conformance to World Bank guidelines; and technical suitability.

In choosing the Kwanda Island site, it was recognised that site preparation would need to commence prior to the FID if the overall project schedule was to be maintained due to the require-
A n g o l A  l n g ,  n o t  J u s t  A n o t h e r  g A s  P r o J e c t

Kwanda Island (about 6,500 workers including management and services personnel).

In addition to the main LNG plant and construction worker housing, project sponsors agreed to build a residential housing complex for the Angola LNG workforce who will be responsible for operating and maintaining the LNG plant.

Marine transportation

For Sonangol its participation in shipping is a strategic requirement and therefore efforts were made to integrate into the project shipping arrangements using a consortium sponsored by Sonangol. In June 2007 it was agreed to charter seven LNG carriers for the project:

Four time charters to a consortium comprising of Mitsui, NYK Line and Teekay Shipping for the construction of four 160,400m³ LNG carriers to be delivered in the second half of 2011 from the Samsung Heavy Industries shipyard; and

Three time charters consisting of 160,500m³ LNG carriers from a consortium consisting of

Dredging operations underway for the Gulf LNG receiving terminal in Pascagoula, Mississippi.
Sonangol Shipping Holding Limited together with Chevron Shipping as its operator. The Sonangol ships are to be constructed by Daewoo Shipbuilding & Marine.

Regasification terminal
The target market for Angola LNG is the United States. Regasification capacity has therefore been secured at the GLE terminal being constructed in Pascagoula, Mississippi, where Sonangol is one of the shareholders and ENI has contracted capacity. The shareholders in the GLE terminal are Sonangol (20%), Crest Group (30%) and El Paso subsidiary Southern Natural Gas (50%), with the latter acting as operator. Site preparation activities commenced in 2008.

Product sales and offtake
As part of the project’s life cycle, there is the opportunity of selling NGL products (LPG and C5+) to sponsors as well as selling domestic butane to Sonangol.

ALNG will enter into a sales and purchase agreement with ALNGSS to agree the terms and conditions for the products offtake.

Conclusion
While the international community is examining ways for reducing greenhouse gas emissions and moving toward low-carbon economies to mitigate the impact of climate change, natural gas is increasingly becoming an attractive and important component of the energy mix in countries around the world.

As some industry representatives have noted over the past few years, natural gas is becoming a “bridge fuel” until other alternative sources of energy, like wind or solar, become sufficiently reliable and cost-effective.

One of the major attractiveness of natural gas is that it is the least polluting amongst the fossil fuels. Yet, in several oil and gas producing countries, vast amounts of natural gas are still being flared or wasted as demonstrated by the global satellite estimates mentioned earlier.

In order to address this wastage, the World Bank Group is supporting important initiatives that contribute toward reducing CO₂ emissions and improving energy efficiency. One of these initiatives is the GGFR.

GGFR partners have established a collaborative Global Standard for gas flaring reduction. This Global Standard provides a framework for governments, companies, and other key stakeholders to consult with each other, take collaborative actions, expand project boundaries and reduce barriers to associated gas utilisation.

While the GGFR has already achieved some important milestones, a significant reduction of global gas flaring still needs to be achieved in order to have the desired impact.

Initial achievements already demonstrate that gas flaring and venting reduction efforts are not only relevant in today’s energy context but also viable as demonstrated by several countries and companies, and desirable for their obvious environmental and economic benefits.

Angola LNG aims to unlock the value of currently wasted natural gas by improving energy efficiency, expanding access to energy and contributing to climate change mitigation, hence promoting sustainable development.

Once operational, Angola LNG should serve as a vivid example of what countries and companies can do to reduce gas flaring within a collaborative effort between public and private sector stakeholders.

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