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The EDF Group is an integrated energy supplier operating in a wide range of electricity and gas related activities: power generation, transmission and distribution, gas production, transportation, storage, energy sale and trading. We are the main operator in the French electricity market and hold strong positions in three other principal European markets (Germany, the United Kingdom and Italy) making us one of the leading electricity groups in Europe, and a recognised player in the gas market.

In the electricity sector, we have the largest generation fleet in the world with over 126,000 MW and our European supply portfolio has more than 38 million customers. With 58 nuclear power plants in operation, with a total of more than 63,000 MW, we are, by some margin, the world leading nuclear generator. Combining this with our position as the leading electricity network operator in Europe, provides us with a sound business model that is balanced between regulated activities and those open to competition.

In the gas sector the EDF Group is present mainly through EDF Energy (United Kingdom), EnBW (Germany), Edison (Italy), EDF SA (France and Belgium) and EDF Trading (pan-European trader).

In 2007 we handled approximately 27 bcm in Europe (EDF-Trading not included).

We are preparing for an increase in our own gas needs to 40-45 bcm/y in the medium term, both to deliver combined gas/electricity offers to our customers and to supply our own gas-fired power plants. The EDF Group is building a portfolio to supply and optimise our gas sourcing needs via a pan-European approach in long-term gas procurement (purchase and throughput contracts and equity gas) and investments in logistic assets (LNG, pipes, storage). These new project opportunities in North-West Europe (NWE) will complement Edison's historical projects in South-East Europe (SEE).

Our new projects include our LNG Terminal project in Dunkirk, France (which could have approximately 9bcm/y throughput in the first phase and should be operational by 2013), the gas storage project at Eitzel in Germany, where EDF and EnBW signed an agreement with the German company IVG to develop underground salt caverns in order to provide 400 mcm of working capacity from 2010 onwards, and on LNG, where EDF Trading and RasGas have signed a medium-term (4.5 years) LNG supply agreement for deliveries in Zeebrugge of up to 4.5 bcm.

In SEE, Edison co-sponsors the Rovigo offshore LNG Terminal in the Adriatic sea, which is due to start in 2009, and has secured LNG sourcing from Qatar for 6.4 bcm/y. Edison is also involved in the development of two leading pipeline projects: IGI (8bcm/y) between Greece and Italy and Galsi (8 bcm/y) between Algeria and Italy.

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FEATURES

This issue's feature section starts with an update on the UN climate change talks and an interview with Alexander Medvedev of Gazprom, which has now added LNG exports to its long-standing sales of pipeline gas. Articles follow on gas finance, European pipeline projects and coal-bed methane. We also have contributions from the World Alliance for Decentralised Energy, the World Bank-led Global Gas Flaring Reduction partnership and Oil for Development, a Norwegian initiative which is developing cooperation with IGU. The Task Force on Gas Market Integration continues its series of case studies and in this issue we have two, the first looking at South America's Southern Cone and the second at the Iran-Pakistan-India pipeline project. Then the Global Gas Historical Network writes about the exhibition it will be mounting at the 24th WGC, and there is a contribution from the new IGU Charter Member for Romania. As usual, we round up with a description of the publications and documents available from IGU and the events calendar.

Non-stop LNG operations

by Kees den Bakker – Shell Global Solutions International B.V.

▶ Introduction - If you think safety is expensive then think about the cost of an accident

Do you feel comfortable driving a car at over 200 km/h or hanging off a cliff? We all know that exceeding safety limits means danger. So why would you risk operating a liquefied natural gas (LNG) plant outside its design limits?

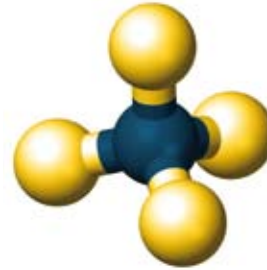
Why is operating within limits important? Over the last few decades, several serious industrial incidents have occurred including: the Texas City refinery explosion, the Piper Alpha fire, the Longford gas explosion, the Bhopal toxic gas leak, and the Flixborough chemical plant explosion. These incidents cost lives and caused major damage to installations and the environment. The investigations have shown that the causes of these incidents were very similar and were often related to operations outside the design limits (an abnormal situation).

Examples include the overriding of safeguarding functions, alarms not working and no handover between shifts. Why is it possible that these incidents could be repeated? The message here is clear: without a culture of learning in place, incidents can and do happen, irrespective of past experience.

LNG plants have hazards that can potentially lead to an incident when not managed well, for example:

- ▶ LNG plants operate a continuous process with no hold up vessels. Process upsets could result in flaring or, when not properly safeguarded, in gas releases into the atmosphere potentially resulting in an explosion.
- ▶ The operating environment is often corrosive (salt spray, high ambient temperatures). A particular hazard is corrosion under insulation, which is difficult to inspect. Such corrosion can cause leaks in a pipe or vessel that could release gas in to the atmosphere.
- ▶ Power generation is often in island mode (not connected to public power grid). Thunderstorms (lightning) or other upsets can cause a power black-out that may disturb LNG production for days.

To prevent incidents LNG asset owners require systems and processes that reduce the risks in their plant below acceptable levels.



▶ Gas-GAME

Shell has developed a framework for Asset Integrity and Process Safety Management (AIPSM). It is called **Gas-GAME**, which stands for Global Asset Management Excellence for Gas sites. Gas-GAME covers the 11 topics that are considered to be vital for AIPSM:



Figure 1: The Gas-GAME modules

The program is rolled out globally across LNG/NGL plants both internally within Shell as well as across Shell-advised plants.

It used to be said that three things were important in LNG: **reliability, reliability** and **reliability**. Nowadays **process safety** should be added. A reliable plant is a safer plant and operates at lower cost.

▶ Gas-GAME and the aircraft industry

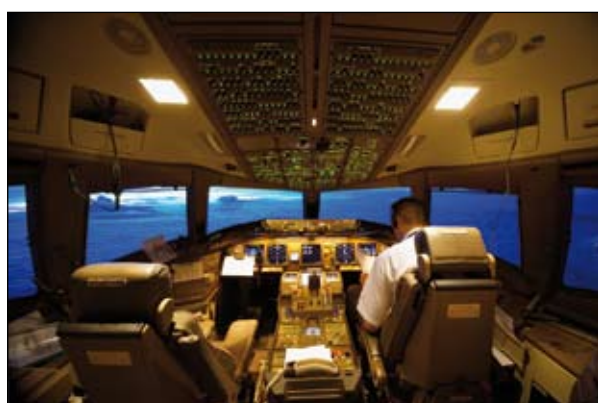
There are many parallels between the LNG process and aircraft industry.

Aircraft		LNG Process
Plane	◀▶	Plant
Pilot	◀▶	Panel man
Autopilot	◀▶	Advanced Process Control
Emergency landing	◀▶	Plant trip shut down
Fly by wire	◀▶	Distributed control system
Flight simulator	◀▶	Dynamic process simulator
Cockpit	◀▶	Control room



The aircraft industry has an excellent safety record which is the result of putting in place the right framework of systems, procedures and behaviours. These include a safety management system, reliability management, standard ways of working such as procedures/checklists, training on abnormal situation management (ASM), learning from incidents, communication protocols and so on. Much of this can be applied to the gas processing industry and this is the aim in Gas-GAME.

Did you know that the best landings are made on autopilot? The best plant operations are carried out by automated procedures.



Cockpit Boeing



Control room LNG plant

Figure 2: Parallel between cockpit and control room

Gas-GAME builds on the following key elements:

- ▶ the requirements for process safety and asset integrity (the Standard);
- ▶ the work process (go with the flow); and
- ▶ key performance indicators (KPI) and audit protocol (you cannot control what you do not measure).

Critical to the success of Gas-GAME is program change management (PCM). The implementation of Gas-GAME means changes in behaviours and organisation. PCM drives the effort from design to implementation and sustains the result. It addresses:

- ▶ leadership alignment;
- ▶ communication; and
- ▶ stakeholder management.

PCM is all about getting Gas-GAME into the “hearts and minds” of people.

▶ **Gas-GAME - Real at Nigeria LNG**

At Nigeria LNG, the implementation of the Gas-GAME programme is halfway through but a number of interesting results have already been achieved. Four mini case studies outline the progress.

Example 1: Ensure Safe Production (ESP)

“We know our limits and we operate within those limits all the time”

Nigeria LNG was experiencing a high number of operating alarms on its control system. Panel operators were consequently drowned in regular alarm floods, which sometimes made it difficult to recognise critical alarms and define a proper response.

To solve this, Nigeria LNG implemented the ESP module (one of the Gas-GAME modules) which can be seen in Figure 3:



Figure 3: The ESP module

Although implementation of the module is still under way, the results so far show:

- ▶ that the operating window is much better defined;
- ▶ a 40 to 90% alarm reduction in utilities area; and

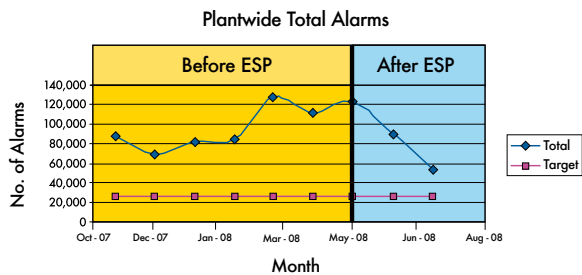


Figure 4: Alarm reduction after ESP introduction in May 2008.

- ▶ that communication during shift handover has been improved.

Example 2: Operator task management (OTTER®)
“Small tasks drive big results”

At Nigeria LNG the outside operator is accompanied on his rounds by a ‘friend’.



Figure 5: OTTER handheld device

This is OTTER (Operational and Technical Tasks for Efficient Rounds), a handheld device comparable to a PDA or palmtop. OTTER contains operational or maintenance tasks obtained from a reliability integrity system (e.g. Reliability Centred Maintenance) and it is used to navigate the operator from location to location.

At Nigeria LNG the use of OTTER has empowered the field operators. The results from using OTTER are:

- ▶ structured outside operator rounds;
- ▶ well defined operating limits and abnormal situation management;
- ▶ improved situational awareness of the outside plant condition;
- ▶ reduced downtimes;
- ▶ increased availability upon demand of standby equipment; and
- ▶ reliability improvements increased the mean time between maintenance.

The proactive monitoring strategy using OTTER provides a platform to improve Nigeria LNG’s operations, environmental compliance and process safety.

Example 3 – Maintenance Execution

“doing the right job, at the right place and time, with the right tools and the right people”

Best-in-industry operations proactively plan over 95% of all their maintenance activities and have less than 5% of reactive maintenance (i.e. schedule breakers).

Properly prepared and scheduled work is three to four times less costly than unprepared work. Not having the correct parts, tools and skills in the right place at the right time can result in waste in the form of:

- ▶ delays, confusion and lost time;
- ▶ inadequate co-ordination of materials that results in false starts, delays or makeshift repairs;
- ▶ poor co-ordination of crafts/disciplines that means excessive waiting time and idle personnel;
- ▶ poor timing of equipment isolation and shutdown leading to excessive downtime; and
- ▶ poor quality of work which jeopardises future reliability.

The ME module provides the capability to move towards “best-in-industry” performance.

For example, at Nigeria LNG an “Efficiency Improvement Programme” has been introduced to support their implementation of the maintenance execution module.

Benefits realised from the program include:

- ▶ production of a new (6th) LNG train started with the same manpower as for 5 LNG trains;
- ▶ better planning and scheduling to support the drive towards a more proactive culture; and
- ▶ improved discipline of people and productivity through the use of robust maintenance management control systems.

▶ Conclusion

Incidents have happened and, unfortunately, may happen again. But they should not happen so it is time for change.

Building on its many years of operational experience and knowledge in gas, Shell has created Gas-GAME, a framework to improve Asset Integrity and Process Safety.

Gas-GAME is applied to Shell-advised gas facilities around the world. Nigeria LNG, a Shell-advised Company, is a front-runner with Gas-GAME and is already experiencing the benefits.

THE RIGHT ANSWERS

START WITH ^{THE} RIGHT QUESTIONS

IT'S A STATEMENT OF THE OBVIOUS, BUT IN OUR EXPERIENCE, IT'S ONE THAT OFTEN GETS OVERLOOKED — PARTICULARLY WHEN THE QUESTIONS BEING TACKLED MAY BE HIGHLY COMPLEX. OUR GETTING TO THE HEART OF SOMETHING COMES FROM BEING ABLE TO PUT TOGETHER AN INTEGRATED TEAM FROM DIFFERENT BACKGROUNDS — ONE THAT SPECIALISES IN ASKING THE RIGHT QUESTIONS. THIS PRETTY MUCH SUMS UP HOW WE WORK, BOTH AMONG OURSELVES AND WITH OUR CLIENTS.

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From Poznan to Copenhagen – Combating Climate Change

By David Adam

Climate change is an important issue for IGU with three Technical Committees working on climate protection initiatives in specific parts of the gas chain and a Joint Committee Study on the overall contribution of the natural gas industry to CO₂ mitigation. The IGU Secretariat also attends the annual COP meetings held under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC). This article reviews the international climate change talks in the run-up to COP 15 in Copenhagen, and is followed by a box looking at the extensive experience that Norway – the host country of the IGU Secretariat – has of carbon capture and storage projects related to gas production.

Visit the website of the UN's official body in charge of tackling climate change – www.unfccc.int – and you are greeted with a loud, ticking noise. The

sound comes from a clock at the top of the page as it counts down in large red numbers, while a short video exhorts people to come together to combat global warming. The countdown is to key climate talks in Copenhagen, when the world could face its last chance to prevent catastrophic temperature rise.

Due to start on December 7, the Copenhagen talks will be the 15th round of negotiations under the UNFCCC. These annual meetings, known as the Conference of the Parties (COP), trace their roots to the 1992 Earth Summit in Rio, and in 1997 spawned the Kyoto Protocol, the world's only existing treaty aimed at restricting the carbon emissions that drive global warming. The first phase of Kyoto expires in 2012 and there is nothing yet lined up to replace it. For a seamless transition, and to give nations enough time to ratify a new treaty, analysts say pens must probably be put to paper on a new agreement at COP 15 in Copenhagen.

A failure to agree a new deal could spell disaster for emerging carbon markets, which are viewed as one of the only large-scale mechanisms available to cut emissions. Investment in clean technology and renewable energy could stall, and the much-vaunted road to a low-carbon economy could be blocked indefinitely. Scientists say that would be very bad news. In 2007, the Nobel-prize winning Intergovernmental Panel on Climate Change (IPCC) warned that global carbon pollution must peak within a decade, and then fall sharply, to offer any chance of limiting global temperature rise to 2°C, which the EU defines as dangerous.

If no new limits are placed on greenhouse gas emissions, then the IPCC warns of temperature rises of 5-6°C by the end of the century. That would bring death, disease and drought to billions of people, and send more than half the species on Earth the way of the dodo.



UNFCCC Secretary General Yvo de Boer and the countdown to Copenhagen.

● **Developments at Poznan**

Given the urgency of the problem, visit the UNFCCC website and you may expect to read about an avalanche of initiatives, promises and action plans from countries across the world with leaders who have spoken of the need for urgent action.

Sure enough, below the red ticking countdown, there is a summary of progress made at the last COP before Copenhagen, which was held in Poznan, Poland, in December 2008. The list, though, does little to convince. It talks of the meeting closing with a “clear commitment from governments to shift into full negotiating mode next year in order to shape an ambitious and effective international response to climate change, to be agreed in Copenhagen at the end of 2009”. And it goes on to say that nations “agreed that the first draft of a concrete negotiating text would be available at a UNFCCC gathering in Bonn in June of 2009”.

However, compared to the previous year’s meeting in Bali, events at COP 14 in Poznan were nothing to write home about. In Bali, nations formally agreed to negotiate a successor to Kyoto, to be signed at Copenhagen. At the half-way point of that process, and with a new US President waiting in the wings, developments at Poznan were never going to be dramatic, but even seasoned green campaigners were left downbeat by the lack of ambition.

Andy Atkins, head of environmental campaign group Friends of the Earth, said: “The climate talks fizzled out with no progress on the big decisions. We’re on a countdown to catastrophic climate change – yet the developed world is ignoring the ticking clock. The science clearly shows that developed nations must cut their greenhouse gas emissions by at least 40% by 2020, but this issue has been avoided at these talks.”

He added: “There’s now a plan to make decisions in 2009 but a radical quickening in pace is urgently required. Rich nations may be travelling



Dr Rajendra Kumar Pachauri, Chairman of the Intergovernmental Panel on Climate Change which warns that carbon pollution must peak within a decade and then fall sharply.

first class, but when the ship hits the rocks they’ll still drown.”

Some were more positive. To the applause and acclaim that now greets each move of his climate campaign, former US Vice President Al Gore claimed in a speech at Poznan that there had been “steady progress” but admitted it seemed “painfully slow”.

And UNFCCC Executive Secretary Yvo de Boer said: “We now have a much clearer sense of where we need to go in designing an outcome which will spell out the commitments of developed countries, the financial support required and the institutions that will deliver that support as part of the Copenhagen outcome.”

● **So what was actually achieved at Poznan?**

The finishing touches were put to the Kyoto Protocol’s adaptation fund, which takes a small percentage of carbon trading profits and is supposed to channel the money to poorer nations, to help them cope with floods and other impacts of global warming. The \$300 million or so already built up in the fund has been frozen, until now, with



Former US Vice President Al Gore addresses COP 14 (ABOVE), which took place at the Congress Centre of the International Poznan Fair (OPPOSITE).

countries squabbling over who should control access to, and release of, the money. With little else on the table at Poznan, the “operationalisation” of this fund became a totemic issue at the talks. Even that decision went to the wire, with agreement only reached with hours to spare.

Talks on how to protect tropical forests through carbon trading were soured by a row over the deletion of a reference to the rights of indigenous peoples in the draft text, for which campaigners blamed New Zealand, Australia, Canada and the US. No decision was reached, and the issue will be revisited in the coming months.

What disappointed green campaigners the most about Poznan was its failure to feature, in any meaningful way, the thorny issue of emission reduction targets. While officials and politicians will talk up the importance of adaptation, financing and technology transfer to a new deal in the build up to Copenhagen, a new treaty will be judged a success or failure on the strength of the carbon targets it sets countries.

In the jargon of the UNFCCC, this discussion, the most politically loaded of all, is known as “a

shared vision on long-term cooperative action on climate change”. There was no official negotiation on this in Poznan. Instead, ministers were invited to share their thoughts at a closed “roundtable” discussion.

Not surprisingly, given the lack of commitment required, the UNFCCC noted approvingly that “ministers gave a resounding commitment to achieving an ambitious and comprehensive deal in Copenhagen that can be ratified by all”.

● Positions of the major players

Overall, there were few specifics on offer at Poznan, and the position of most of the major players remains the same as it was in Bali, and for the decade since Kyoto.

Europe sees itself as the global leader on global warming, though its presence in Poznan was overshadowed by simultaneous events in Brussels, where European leaders struggled to seal a pledge to cut carbon emissions 20-30% by 2020 – which was eventually agreed with some heavy concessions to industry. Gore called it a “struggle between hope and fear”. The continent still has an

official target to limit global temperature rise to 2°C despite mounting scientific evidence that this is unachievable. Stavros Dimas, EU Environment Commissioner, has said the EU may strengthen its 2050 carbon target to 80-95% cuts, making the continent virtually carbon neutral.

For the US, the Bush administration regularly stalled on climate targets.

Barack Obama's team has yet to make its position clear, but it has promised "vigorous engagement" at Copenhagen.

The British team in Poznan said it was encouraged by the "enthusiasm" of the President-elect's team on the issue. But there remains a question mark over desire in Congress to sign the US to sizeable carbon cuts. In exchange the US would want much greater effort from developing countries, China in particular.

Western officials insist the Chinese leadership are more aware of climate change than they are often given credit for. The country is still likely to resist binding targets, but it knows some pledge of

future action will be needed to appease the US and give President Obama the political room to sign a successor to Kyoto.


China has already requested that rich countries pay 0.7% of GDP to poorer ones to help them adapt to the effects of global warming. The developed world is unlikely to agree, but some see the Chinese move as a positive step towards a meaningful negotiation.

One route to draw the Chinese into a Copenhagen deal could be for the West to agree that large developing nations can work to reduce their anticipated future growth in emissions – known as business as usual (BAU). The EU has floated cuts, known as "diversions", from BAU of 15-30% for China and others by 2020 or so, but officials said the Chinese were unwilling to discuss the proposal at Poznan.

Elsewhere, India has taken a hard line so far and regularly voices its opposition to legally binding targets. But it has indicated it would be willing to work to keep its growing per capita







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UN Secretary General Ban Ki-moon has suggested two summits on climate change should be held this year.

emissions below those of industrialised countries. Brazil, another key country, has pledged to cut deforestation 70% within a decade, saving a potential 4.8 billion tonnes of CO₂.

One problem for those trying to broker the Copenhagen deal is the twin-track nature of the talks. Because the US is outside the Kyoto process, a new world agreement to include the US must be discussed separately from efforts to extend Kyoto beyond 2012.

Why not scrap Kyoto and work on something totally new for everybody? The developing world fears rich countries would use that as a chance to escape from Kyoto's existing binding targets.

Alongside the UN meetings, a series of parallel events are planned for 2009. Ban Ki-moon, UN Secretary General, has suggested two special summits on climate change, and Barack Obama could hold a similarly high-level meeting now he has taken office. Throw in the forthcoming G8 summit and a suggested extra UN global ministerial meeting to get the US up to speed before Copenhagen, and climate change will be rarely off the global agenda this year.

● Challenges of Copenhagen

To be considered a success, British officials say a new deal needs serious short-term targets for all rich countries, including the US, as well as some signal from large developing nations such as China that they will endeavour to reduce their own emissions. To make that happen, a whole string of supporting decisions on adaptation, financing and technology transfer are needed too. It's a big ask, and some are already warning it may not be possible – especially given the current financial woes.

Privately, many senior figures in the field of climate change are already playing down the chances of a breakthrough at Copenhagen. The talks could come too soon for the new Obama administration, they warn, and negotiations could easily drift into 2010. Others are pessimistic about the chances of serious targets being set, never mind being met. The biggest challenge is likely to be converting concerned rhetoric and vague, long-term aspirations to make headline-grabbing massive cuts in carbon emissions, into achievable but demanding targets set over the next decade. Only such short-term goals are likely to drive the necessary political and technology changes.

Meanwhile, world carbon emissions continue to rise, at a much faster rate than anybody thought possible, driven by the coal-fuelled boom in China since the turn of the new century. Even a new focus on global warming in the White House and a robust successor to Kyoto will find the 21st century addiction to fossil fuels a difficult beast to tame. To borrow a phrase from Winston Churchill, the red numbers counting down on the UNFCCC website do not mark the end of the problem, nor even the beginning of the end. But we must hope they at least mark the end of the beginning.

David Adam is the environment correspondent of The Guardian newspaper (www.guardian.co.uk).

NORWAY'S CARBON CAPTURE AND STORAGE EXPERIENCE

Norway has extensive experience of storing CO₂ in geological structures. Since October 1996, 1 million tonnes of CO₂ per year have been separated from gas production on the Sleipner Vest field operated by StatoilHydro in the North Sea for storage in a formation called Utsira.

Gas from the field has a 9% CO₂ content which has to be reduced to a maximum of 2.5% to meet customers' requirements, and Norway's CO₂ offshore tax provided the financial incentive to capture and store rather than vent.

Treatment of the natural gas is carried out on a special platform using a process patented by Total, which is a partner in the Sleipner field. A liquid amine compound is added to the gas flow in an amine contact tower at a pressure of 100 bar, which absorbs the CO₂ for collection. The natural gas is piped off for further processing, while the amine/CO₂ blend is conducted under reduced pressure to the adjacent separation tower where the CO₂ is separated by heating. After separation the amine is recycled while the CO₂ is compressed and injected into the Utsira formation – a thick saltwater-bearing sandstone at a depth of between 800 and 1,000 metres below the seabed. The gas is held under a layer of shale cap rock, 80 metres thick.

Monitoring the behaviour of the CO₂ storage facility is a legal requirement. Statoil (the operator prior to the creation of StatoilHydro) initiated and organised a multinational and multidisciplinary research project named Saline Aquifer CO₂ Storage

(SACS). The project collected relevant data, modelled and verified the distribution of the CO₂ in the Utsira formation for three years, and developed and demonstrated prediction methods for the movement of the CO₂ for many years into the future. Time-lapse 3D seismic data were acquired in 1994, prior to injection, and again in 1999, 2001 and 2002 with, respectively about 2.3, 4.3 and 5 million tonnes of CO₂ in the reservoir. SACS was followed by the CO₂ Store research project and the work confirms that the CO₂ is confined securely within the storage reservoir.

● Snøhvit

In October 2007, production of natural gas, NGL and condensate began from the StatoilHydro-operated Snøhvit field in the Barents Sea and here 700,000 tonnes of CO₂ a year are separated and stored.

The natural gas is produced by sub-sea solutions and transported via a 145-km pipeline to the island of Melkøya near Hammerfest, where the CO₂ is separated. The natural gas is liquefied for export and the CO₂ is transported back to the Snøhvit field in a second pipeline for injection into a layer of saltwater-bearing sandstone called the Tubåen formation. This layer lies 2,500 metres below the seabed, safely below the natural gas reservoir.

● In Salah

StatoilHydro is also a partner in the BP-operated In Salah development in Algeria, where production from three fields started in 2004. Natural gas is processed by a facility at Krechba where 1 million tonnes of CO₂ a year are separated and reinjected.

Mark Blacklock



Carbon capture and storage has been carried out at the Sleipner Vest field since 1996.

The UK's Energy Excellence is a natural asset.



With world-beating expertise the UK's energy industries can lead the way to a global low-carbon economy.

Global demand for energy continues to rise and is not likely to be slowed much by the current economic downturn. The International Energy Agency's latest forecast says that the world's energy needs will grow by 55% between 2005 and 2030, with fossil fuels accounting for 84% of this. This means that the challenges of meeting energy demand while combating climate change cannot be separated. The need to convert to a low-carbon economy is taken very seriously, by government, industry and the general public: what we need now are serious capabilities in energy technology and services to bring that transition about. The UK energy industries have those capabilities and are already applying them to global energy and climate change projects.

Global Energy Needs

Although oil and gas will continue to be major ingredients in the global energy mix, new oil and gas resources are becoming harder to reach and more difficult to produce. Reservoirs are at ever greater depths, at higher temperatures and pressures, and require complex drilling and completion solutions. Ever increasing environmental pressures also need to be managed. Cleaner and more efficient utilisation of oil, gas and coal will be required for new power projects. As hydrocarbons use declines and renewables come to the fore, projects will require forward-looking expertise in wind, wave, tidal, solar and biomass, among others. A new generation of nuclear power facilities is likely to emerge in the next few years, to fill any shortfall between declining hydrocarbons and expanding renewables. The UK has leading-edge expertise in all these areas.

UK Energy Expertise

The UK's energy supply chain has developed its skills through decades of oil and gas production from the harsh environment of the North Sea and elsewhere. Those skills have grown into a set of capabilities applicable across all energy sub-sectors, including the increasingly vital renewable energy sources. The UK energy industries have proven expertise in major project management and engineering capability; the design, manufacture and installation of advanced equipment; in conducting ground breaking research and development; and in providing learning and skills training across the entire energy spectrum. All of this expertise comes with a global commitment to human and environmental safety. The key UK strengths of innovation, reliability, adaptability, sustainability and knowledge can be brought to bear on any energy project, anywhere in the world.

Meeting the World

UK energy companies currently generate revenues of more than \$180 billion from domestic and international business and employ 600,000 staff. This is expected to rise to \$400 billion and one million employees by 2030, by which time perhaps \$22 trillion will be spent annually, worldwide, on supplying energy. Clearly there is a great deal for UK energy companies to offer and to gain. UKTI can help those companies substantially in the global market place.

UKTI offers information and support that only government can provide. For example, facilitating access to key decision makers in government and industry; providing in-depth advice on the political, economic and cultural environment; as well as help with identifying business opportunities and provision of specific, detailed market information.



The UK Energy Excellence Marketing Strategy provides a compelling message to the world, positioning the UK as the destination of choice for energy trade and investment.

The strategy is being implemented by the UK energy industries, supported by the UK Government – working in a 'UK Energy' partnership – to convey the key attributes of UK business excellence – Innovation, Reliability, Adaptability, Sustainability and Knowledge, to potential and actual buyers and investors overseas. These attributes are common to UK companies working across the energy industries – in oil and gas, power generation, carbon capture and storage, renewable energy, clean coal, hydro, nuclear and network technology. There is no part of the global energy scene where UK excellence is without relevance.

Marske Site Services (MSS) is an engineering projects and employment business operating in the oil and gas, petrochemical and power generation industries, among others. MSS sources, interviews, and selects experts then introduces them to clients looking for permanent staff, or assigns them for a specific duration on a contract-hire basis.

The company's strategy for business growth has been to focus on exploring overseas markets. It was not until early in 2003 that MSS gained significant overseas business. Since then, MSS has provided engineering consultants to companies in Holland, Mexico, China and Saudi Arabia, and over the last six years MSS has been providing specialist personnel to major operators in Libya through a third party company. After participating in a UKTI mission to the Deep Offshore Technology conference in Norway, in 2007, MSS secured a contract with Deep Sea Group to recruit senior management for Thailand. UKTI also helped MSS with a grant to attend a trade mission to Libya, in October 2008, one of the company's key target markets.

"At this time in our business development, it was useful to have people working so proactively for us," said Alan Gibbin, Business Development Director of MSS.

"We continue to receive help and support from UK Government agencies. This really gives us a sense of 'partnership' and any success we have in achieving business exports eventually concludes in a win-win situation for us as a company and the UK economy."



The UK's energy excellence makes us the world's natural energy champion. New natural gas resources are becoming harder to reach and more difficult to produce. Reservoirs are at ever greater depths, at higher temperatures and pressures, and call for complex drilling and production solutions. Ever increasing environmental pressures also need to be managed. The UK's energy supply chain has developed its skills over decades of working in the North Sea and other highly challenging environments and is second to none in conducting cost effective and environmentally friendly developments. Those skills are at your disposal, wherever you are in the world.

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Delivering energy excellence





Q&A with Gazprom's Alexander Medvedev



Alexander Medvedev.

This interview with Alexander Medvedev, Deputy Chairman of the Management Board of OAO Gazprom, is published to mark the start of LNG exports by Russia, the world's largest gas producer. In a new departure for the IGU Magazine, it is presented in question and answer (Q&A) format.

A key concern of gas exporting countries is security of demand.

Traditionally Russia has been a regional exporter of pipeline gas but now the start of LNG exports

opens up the global market. How will Gazprom's client portfolio develop?

Alexander Medvedev (AM): Gazprom intends to become a global energy company, and LNG production and marketing are a vital part of our strategy. LNG enables Gazprom to have a presence around the world, and gives an opportunity to promote the positive image of the company worldwide.

Our LNG target markets are located in North America, Asia-Pacific and Western Europe. We plan to develop downstream assets in order to enter the retail business to achieve additional profits.

Strategic diversification of products (oil, gas and derivatives, electric power, carbon emission certificates, etc.) will help us create a diversified client portfolio.

In addition to our traditional European consumers, there will be clients in Asia and the US. The Sakhalin 2 project has contracted almost 100%



Sakhalin Energy started LNG production in February. OPPOSITE The Lunskeye-A drilling and production platform and ABOVE the export jetty.

of the production volumes for Japan, South Korea and the US.

How quickly will LNG production from Sakhalin 2 ramp up to the design capacity of 9.6 mtpa?

AM: Sakhalin Energy started LNG production at the beginning of 2009. According to our current schedule, we will reach 9.6 mtpa production in 2010.

In advance of the start-up of domestic LNG production, Gazprom became involved in LNG trading through swaps of cargoes for pipeline gas and sales, at an average rate of 900 mcm a year. Now that Gazprom is an LNG producer will these swaps continue and if so how do you see the volume of trading developing?

AM: We do not limit ourselves to any particular instrument. Any energy product or operation enabling us to achieve our strategic goals and improve overall Group economics can be used.

Is all of the Sakhalin 2 production allocated to long-term contracts or is there some flexibility to sell directly into the spot market?

AM: There is some flexibility in the contracts in the long run but Sakhalin Energy expects very limited opportunity for short-term operations.

The \$5.3 billion Sakhalin 2 financing signed in June 2008 was the largest project finance deal in Russia. How is the financing challenge of Shtokman being addressed? And related to this is the fact that Gazprom has developed a new model for cooperation with international companies. Could you explain how the Shtokman model works?

AM: In order to coordinate all the activities related to Shtokman, the partners (Gazprom, Total and StatoilHydro) set up a project company – Shtokman Development AG. This legal body will be used to attract project financing for upstream construction. Under current arrangements, the company will act as owner and operator of the field infrastructure,



offshore pipelines and onshore LNG production facilities. It will provide services of gas extraction and liquefaction to Gazprom Group for the offsetting service fee. The licence for the field as well as title to all products remains with Gazprom Group at all stages.

What is the timescale for the development of Shtokman and could you briefly outline the technical challenges?

AM: Shtokman is an extremely challenging project in most of its aspects. We expect to reach FID (final investment decision) by the end of 2009, and start-up of production is planned for the end of 2013 for the pipeline part and 2014 for the LNG part of the project.

The technical challenges include: building 500 kilometres of pipelines from the field to shore; the



Developing the Shtokman field beneath the Barents Sea is an extremely challenging project.

sea depth at the field; harsh climatic conditions; and the fact that the LNG facilities will be located in areas without infrastructure.

Shtokman will export both pipeline gas and LNG. How will the field be connected to Russia's Unified Gas Supply System (UGSS)?

AM: The onshore facilities of the project will be connected to the UGSS using a 1,400-km pipeline to Volkhov.

As regards the new export pipelines, how is construction of Nord Stream progressing and what can you tell us about the South Stream project?

AM: Nord Stream and South Stream are at different stages of development.

As regards Nord Stream, the basic technical design is finished. Agreements for pipe laying and components have been signed, corresponding orders made and partial deliveries of pipes for the

first pipeline made. We await the results of the ecological study which will enable us to estimate the real rather than the imagined environmental risks. Documents on this basis are necessary to obtain permits from the Baltic states.

We are keeping to the schedule previously set: construction of an offshore pipeline section to start in 2010, and first gas to be delivered to Europe through this route in 2011. We keep to our plans.

As to South Stream, technically there is still a lot of work to be done. Apart from the offshore pipeline, all the necessary and extensive onshore infrastructure has to be built, which will pass through many countries. Experts are now working on a feasibility study for this project. Together with Nord Stream, this project will contribute to the security of gas supplies to EU countries, which, as estimated by the European Commission, will face a gas deficit of not less than 195 bcm per year in 2025.

The latest developments in the gas row with Ukraine have confirmed the necessity of diversifying the transit routes – the very goal these two projects serve.

The issue of underground gas storage (UGS) has moved up the international agenda. How are Gazprom's plans as regards co-ownership and development of UGS facilities outside Russia developing?

AM: Gazprom in its strategy has to take into account all the risks of planned repair and maintenance works and emergency repairs as well as those of force majeure. Imagine the scale of this infrastructure: the length of pipeline through which gas is transported from Russia to Europe reaches 6,000 kilometres. To avoid possible cuts in gas deliveries, as observed during the Ukrainian transit blockade, our company emphasises the development of gas storage facilities in Europe.

In April 2007, Gazprom and VNG of Germany signed an agreement on cooperation which foresees the construction of a new gas storage facility called Peissen in salt caverns near the German town of Bernburg. After commissioning, this storage facility will be able to store up to 500 mcm.

The investment decision on a second stage of the Haidach storage facilities in Austria has been made. Its active capacity after commissioning of the second stage will reach 2.4 bcm, with a daily load of 24 mcm. It will start in April 2010. Let me remind you that Haidach was the very first project of this kind where Gazprom is not only a tenant but an investor and capacity owner as well. Gazprom has announced the sale of its capacities starting from January 2009, according to EU requirements on non-discriminatory access.

In the last five years, Gazprom has increased its storage volumes in Europe four times. But the demand for this fuel grows. Thus, to provide supply security, our company continues negotiations on the construction of UGS facilities in Hungary, The Netherlands, Germany, Austria, Serbia, Bulgaria

and other countries. We have recently seen how the stored gas could provide security for the countries affected by gas transit cuts.

Finally, how will the current global financial crisis impact the progress of Russian gas projects?

AM: In 2008 the total capital investments of Gazprom Group amounted to about 531.2 billion rubles (\$16.3 billion) which means an increase of 51.78 billion (\$1.6 billion). All investment projects underway in 2008 will be continued.

Our priority projects include the development of Bovanenkovo and Shtokman fields as well as the Kharvutinskaya section of the Yamburg field, En-Yakha, Urengoy, Zapolyarnoe and other fields.

Such large-scale projects as Nord Stream and Sakhalin 2 are actively progressing, as well as the development and operation of the oil and gas condensate reserves of the Arctic shelf; the Prirazlomnoe and Shtockmanovskoe fields being special here.

Gazprom Group has a clear vision: despite world financial market volatility, all the main projects covered by the company's investment strategy will be put into operation.

Thank you very much for your time Mr Medvedev.



Laying the onshore section of Nord Stream.

Lloyd's Register – our commitment to the LNG industry

For over 80 years, Lloyd's Register has been involved in the design approval, and survey of gas ships, writes Stephen Chan, Global Business Manager, Gas Ships.

Our first initiative was an oil tanker, built in 1928, and then modified for the carriage of liquid petroleum gas (LPG).

In 1959 we classed the first ocean going liquefied natural gas (LNG) ship, the 5,000 cubic metre Methane Pioneer – a converted dry cargo ship which carried natural gas in independent tanks.

Today, we are proud to still be at the forefront of gas ship technology with the recent naming of the first Q-Max LNG ship classed to Lloyd's Register, the Mozah. In May 2008, we were the first classification society to have classed more than 100 LNG ships.

The Q-Max programme has taken LNG ship design and construction in a new direction and onto a different level. It has allowed us to work alongside shipowners and shipbuilders in ensuring the success of the biggest LNG ships ever constructed.

Whilst Lloyd's Register has built a strong reputation within the LNG industry for providing reliable experience-based services, we believe the success of any one project is not the work of one person but the result of close collaboration with all the project's key stakeholders.

Our approach to the design, construction and operation of these LNG ships has to be more responsive than the traditional prescriptive approach. Applying our market-leading knowledge gained over many years, we have provided a robust framework for a risk-based approach to managing this project.

In pursuing our mission to protect life, property and the environment at sea, we have constantly worked with shipowners in reviewing their's, and statutory bodies' requirements, and testing and assessing design modifications to help ensure that technical specifications are met.

Where applicable, we develop a practical approach to technology qualification by adopting safety cases for technologies such as re-liquefaction and dual-fuel diesel-electric propulsion.

We are committed to the full life cycle of these ships. Once in service, our qualified and experienced surveyors can help ensure full compliance with the Class Rules and that each ship is being operated safely, reliably, and in an environmentally friendly manner.

Not resting on our laurels, we are committed to working with shipowners and shipbuilders in the next generation of LNG ships to be constructed.

For further information, contact Stephen Chan: Stephen.chan@lr.org, or call +1 (1) 281 675 3137.

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Gas Finance – Think Long Term

By Rod Morrison

The unprecedented end to 2008 left many actors in the world economy battered and bruised – and frankly, fearing the worse. The energy markets suffered their fair share of pain as the speculators withdrew from the commodity markets and fears rose about energy consumption falling for the first time in years.

But despite the turmoil the gas market remains an attractive one for investment. Even during the bleak fourth quarter, following the collapse of Lehman Brothers, international oil companies were scrambling to gain access to gas assets. This article will look at the scramble for gas, which has

involved billions of dollars, at new technological developments, which will enable smaller gas assets to come on line, and conclude with details of some larger financings which funded in one of the most challenging years in the history of the global capital markets.

This optimism is not based on the short term. Indeed, there is no reason to believe that either the equity or the debt markets will spring back into life in the short term. But gas projects take time to put together – Yemen LNG, one of the major deals financed in 2008, took 15 years to put into place – while gas has a great future as the cleanest of the fossil fuels. So it will not be too much of a gamble to assume that by keeping faith with projects in development now, the returns will come in five or 10 years time when the projects are completed.

Looking forward two clear trends have already emerged from the new economic environment. This is a time for the larger companies with deep pockets to claim the big prizes which will set the agenda for the gas market in years to come. But at the same time it remains a time for innovators. Gas projects have grown so large, to achieve economies of scale, that in the new, capital-constrained, environment they have become too big a challenge for many developers. Small could well become as beautiful as big.

● Deep pockets and the scramble

The credit crunch, followed by collapse in the energy prices, has hit the smaller independents in the energy sector hardest. They had enjoyed an unprecedented boom over the last few years. Credit was easy to obtain and energy prices were headed only one way. The smaller independents were able to set their sights high and fund a series of development projects across the globe. Indeed, some contrasted their activity with that of the energy majors who, the perception went, were giving more back to shareholders in share buy-backs than spending on new capex.

Now that has changed, completely. And the smaller independents are having to react quickly.



These are challenging times for dealers in the world's energy markets.

Some have been lucky, or clever, enough to have arranged committed finance for their programmes. Those that have not are now all seeking new investors. The credit markets are dry and the equity markets are bombed out. So the independents tend to go looking for investors who are the bigger corporate players – who in turn are looking for bargains.

In September 2008 ENI snapped up First Calgary, a small Canadian independent whose main asset was a 75% stake in the Menzel Ledjet Est (MLE) fields in Algeria. Total reserves in the fields are 1.3 billion barrels of oil equivalent (boe), half of which is gas – in a location on the doorstep of Europe.

The scheme was to have been financed in the equity and debt markets. To keep funding the development First Calgary issued \$267 million of convertible bonds priced at 9% in late 2007.

Citigroup was then hired to arrange the project debt. But the financing was delayed by an internal struggle within the company. Chief Executive Richard Anderson had to step down following pressure from Russian investor Michael Kroupeeve who owned 9.4% of the company.

By the time the project was back on track in mid-2008, the markets had turned down. The appetite to finance the whole MLE scheme via equity and debt placements for a small company was reduced. So up stepped ENI with a cash bid of \$865 million. The Italian giant will now start developing the asset with funding from internal sources. Production will begin in 2011 and peak at 30,000 boe per day in 2012. Algerian state-owned company Sonatrach holds the other 25% of the scheme.

In the US a similar story was being played out. In November 2008 StatoilHydro bought a significant stake in Chesapeake Energy's unconventional



Projects such as Yemen LNG are long-term ventures.



StatoilHydro invested in Chesapeake Energy's Marcellus shale gas acreage in November 2008.

gas assets in the Marcellus prospects in the Appalachia region in the eastern USA. The Norwegian company paid \$3.375 billion for a 32.5% stake split between \$1.25 billion in cash and \$2.125 billion in drilling costs. In return it has obtained up to 3 billion boe of reserves from the deal. The deal followed a similar announcement in September 2008 when BP took a 25% stake in Chesapeake's Fayetteville shale scheme – split between \$1.1 billion in cash and \$800 million in drilling costs.

Analysts said the cash is welcome for Chesapeake. The company had already announced plans to cut its capex by \$3 billion to respond to falling US gas prices and tightening credit. Asset sales of up to \$2.5 billion were pencilled in to help reduce debt. Chesapeake had grown rapidly in the last decade. It led the search for new domestic gas production from unconventional sources. The search was spurred by fears the US would be short on gas and

it might need to rely on LNG imports. Unconventional gas sources from deposits such as shale fields were opened up. But with the change in the economy, Chesapeake is now consolidating.

It is inevitable there will be more deals like First Calgary and Chesapeake. The advantage will be with those companies that can write their own cheques.

However, in 2008, the biggest scramble for gas was not driven solely by big companies buying up the small – although that played a part. It was driven by a mix of quick corporate manoeuvring and long-term strategy, plus the consolidation of a young and growing industry.

● **Coal-bed methane**

The Australian coal-bed methane (CBM) industry – known as coal-seam gas (CSG) locally – has long been the preserve of local companies but its development was slow. The CBM resource in the

cleaner-burning natural gas goes a long way. our technology makes it go even further.

Natural gas is one of the world's cleanest fuels. But it's often found far from where it's needed most. The solution? Supercool it to a liquid, transport it by ship, and then "regasify" it at its destination for delivery to local homes and power plants. Until recently this ingenious technology was only practical across shorter distances. But ExxonMobil's scientists and engineers have transformed the scale on which natural gas can be safely and efficiently liquefied and transported. So we can now carry 80% more liquefied natural gas across vast oceans and make more cleaner-burning energy available to more people the world over.

The story continues at exxonmobil.com

"Natural gas produces a lot less CO2 emissions than coal. That's why its use in European power generation is growing so rapidly."

Ferah Çakmak, Economist



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country is abundant, given the size of the coal fields in Queensland and New South Wales. But for a long time technology imported from the US failed to deliver – until that is the local companies started to adopt their own extraction methods, suited to local conditions. Then, when a planned 3,000-kilometre gas pipeline from Papua New Guinea was cancelled, CBM companies stepped up to plate by proving up reserves in the Bowen and Surat Basins. And the CBM boom took off.

This came at a time when LNG trading in the Asia-Pacific region surged with LNG cargoes being diverted from other markets to feed Asia's demand. Prices reached \$17 a gigajoule, compared with just \$4 a gigajoule in the local Australian market.

The heat has now come off the Asian boom as the world economy slows but in the medium to long term, the prospect of abundant gas reserves situated in a stable OECD country, close to key LNG buyers in Asia, is too attractive to miss. And the big players have been moving in.

The CBM boom first came to global attention when BG made an A\$13.6 billion (\$9.2 billion) friendly and then hostile bid for Origin Energy in mid-2008. The local company felt BG was undervaluing it and so enlisted Macquarie to help put together an auction of its CBM assets in Queensland. ConocoPhillips won the auction and took a 50% stake in Origin Energy CSG Limited for \$5 billion plus \$780 million to fund Origin's share of CBM development costs until a final investment decision, with a further \$2 billion of financing based on project approvals.

The deal gives Conoco access to a possible 1.2-tcm resource base. The partners intend to develop 20,500 wells to feed a four-train LNG export scheme and the domestic market over the next 40 years. Conoco has CBM experience in the US and Canada and had already looked at a CBM scheme proposed by Santos just before the Origin auction. This made the Origin auction process easier.

In the Santos deal, the local company offered 40% of its Gladstone LNG scheme in Queensland

to the international market. Malaysia's Petronas snapped up the asset at a hefty premium with a bid of \$2.5 billion. The deal did not get quite the attention of the Origin saga but was significant nevertheless. The partners will now develop the local firm's Greater Fairview and Roma fields, build a 450-kilometre pipe and then the LNG scheme which will have an initial capacity of 3 mtpa.

The corporate manoeuvring for Santos might not be over, however. In November 2008 the Queensland government's cap on anyone owning more than 15% of the company, dating back to the days of Alan Bond, lapses and Santos could become a takeover target.

BG did not leave Australia when its bid for Origin failed. It quickly changed horses and paid A\$5.5 billion (\$3.7 billion) for Queensland Gas Corporation (QGC). The bid was friendly and the two companies had been close. Another local firm AGL Energy had made a hostile bid for QGC in 2007 and acquired a 24.5% stake. The bid failed and QGC turned to BG to help develop its LNG project. BG acquired a 9.9% stake in the company. Now BG is buying out AGL and the other shareholders. BG will use some debt put in place on the Origin bid to help fund the QGC acquisition. It had put together a bank group of HSBC, RBS, Santander and SG for the A\$9 billion (\$6 billion) Origin facility. The same banks are expected to help out on the smaller QGC acquisition. BG and QGC intend to develop an LNG scheme with a capacity of 12 mtpa.

Shell took a significant position in the new CBM market by buying a 30% stake in Arrow Energy's upstream CBM interests for A\$915 million (\$620 million) in 2008. The deal includes a 10% stake in Arrow's overseas CBM assets. Again the two partners will now plan a LNG scheme – this time costing A\$8 billion (\$5.2 billion).

While the corporate activity has been intense, CBM has still to prove itself in the large-scale projects the majors are clearly intending to build out. Extracting gas from CBM is not as straight-

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forward as from natural gas fields and carries extra financial risk.

Figures from Wood Mackenzie show how big the challenge is for CBM to supply an LNG scheme. It compared two Australian schemes – one CBM to LNG and one conventional gas to LNG. The CBM scheme requires 60 wells in operation per annum, compared to one, with a much longer ramp-up period to first LNG. Moreover, it produces no other heavy hydrocarbon liquids to support project economics. However, Wood Mackenzie did suggest capex costs for a CBM-fuelled scheme were lower at A\$3.8 billion (\$2.5 billion) compared to A\$4.76 billion (\$3.2 billion) and royalty payments were just 10%, albeit non-deferrable, compared to 40%.

There is another challenge. It is unlikely even Asia needs the volumes of LNG being planned in all these schemes. The competition is on to obtain buyers – particularly as ExxonMobil, Oil Search and their partners are pressing ahead with the conventional Papua New Guinea LNG scheme, aimed at the same buyers.

One area where CBM is starting to prove itself in Australia is in the domestic power sector as a fuel source for a new generation of gas-fired power stations. Two important power projects to be fuelled by CBM have been financed in the capital markets in 2008 – Darling Downs and Braemar 2. Both are now under construction.

Origin obtained a A\$1.1 billion (\$745 million) loan from a group of banks led by ANZ, CBA, Deutsche, JP Morgan and NAB back in February 2008 before it came under corporate attack. The deal was a corporate facility banked on the company itself but it was used mainly to pay for the Darling Downs scheme and its associated CBM developments. The power scheme, near Braemar in Queensland, will be the biggest combined-cycle power plant in Australia at 630MW and will use CBM from Spring Gully and the Walloons. The loan has a short three-year tenor and, given the credit markets were still active back in February,

was cheaply priced at just 65 basis points (bp) over BBSY (bank bill swap bid rate). Nevertheless the syndication of the loan was successful with commitments of A\$1.5 billion (\$1 billion) obtained.

Arrow Energy and ERM Power obtained A\$335 million (\$227 million) for their A\$546 million (\$370 million) Braemar 2 450MW development in August 2008. This financing was a lot more structured than the Origin deal and was banked solely on the revenues from the plant, making it a traditional project financing. Both Braemar 2 and Braemar 1, financed in 2005 by Babcock & Brown and ERM, are peaking plants which produce high levels of power at irregular intervals. So both have their own 150-kilometre high pressure gas pipes from the associated CBM fields to act as a linepack facility to shape the continuous gas supplies from the various CBM wells into much higher gas consumptions to meet the demands of the peaking plants.

Braemar 2 will be supplied with gas by Arrow Energy for 12 years. Origin Energy will buy at least 300MW of the plant's output. The project financing to fund the plant was put together by ANZ, Bank of Scotland, KBC, NAB, Suncorp-Metway and WestLB. The loan has a 10-year tenor with pricing in the range 150bp to 170bp over BBSY.

● **Smaller is beautiful**

While the size and scope of gas projects has grown over the last decade, together with the financing required to build out the schemes, some developers have gone the other way. They have targeted schemes involving smaller gas volumes and smaller capex costs, with smaller amounts of funding required. This could be a key development in the global gas industry. If successful it will allow smaller and more remote gas deposits to be developed. And, at the other end of the LNG chain, it will allow gas to be imported into locations with small or isolated markets.

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- 18. November 2008 - FLEX LNG LTD and KBR OI the start process of selecting LNG offshore and integrated partner for FLEX offshore LNG
- 26. October 2008 - FLEX LNG LTD Annual Report and Financial Statement 2007
- 29. October 2008 - FLEX LNG LTD and Samsung Heavy Industries extend option for LNGP hull no. 8
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Flex LNG is leading the way in developing floating liquefaction units for the LNG industry.

company was started in 2006 and it already has four LNG producer hulls on order from Samsung Heavy Industries (SHI). The idea is simple enough – to replicate floating production, storage and offloading (FPSO) vessels in the LNG sector – although technically, of course, the concept is a lot more challenging. Cost estimates show it is cheaper, at \$550-700 million per tonne compared to \$1.3 billion on current standard LNG mega schemes.

If the systems work, the floating LNG vessel could become as regular feature in the gas business as the FPSOs are in the oil business. Unlike rigs or offshore platforms, oil FPSOs can be moved around, extracting oil from smaller fields on short to medium-term charter contracts.

Flex LNG says huge cost increases and timing delays for onshore LNG schemes can be contrasted the comparatively shorter construction periods for a cheaper floating project. If the floating LNG

market takes off in a similar way to the oil FPSO market, there could be potentially 100 vessels in 20 years time. Other larger companies are starting to show an interest in the floating LNG idea – Shell in particular.

Flex LNG has signed its first commercial contracts. It has a heads of agreement with Mitsubishi and Peak Petroleum to produce 1.5 mtpa of LNG from block OML 122 offshore Nigeria. And it has a heads of agreement with Rift Oil for 1.5 mtpa a year from gas fields onshore Papua New Guinea. The gas will be piped offshore to the Flex vessel where it will be liquefied.

The company has already raised \$570 million of equity in three funding raisings since March 2007. Japanese shipping line K-Line is the largest single shareholder with 15%. Over the last year the company has been working with French bank SG and UK law firm Linklaters to put together a debt funding package – again similar to the thriving bank market for FPSO financings. Despite the credit crunch, the company still believes it can raise up to \$400 million of new money, but company officials now suggest they might additionally look at obtaining support from industrial players.

Gasol has a slightly different model to Flex LNG. It wants to aggregate gas from various stranded on and offshore fields in West Africa, construct requisite collection networks and deliver the gas to a central network for use domestically or for export via LNG. It has signed MoUs with EdF and Afren for potential projects in West Africa and with E.ON Ruhrgas and Afren for potential projects specifically in Nigeria.

Gasol is working on floating liquefaction solutions as well, although it is not as advanced as Flex LNG. It has signed a heads of agreement with Teekay Corporation and African LNG, in which Gasol has a stake, to develop floating LNG technologies in north, west and central Africa utilising gas supplied by Afren.

On the importation side, smaller LNG projects are more difficult to justify. But smaller import

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Gate in Rotterdam is the first LNG import terminal to be built in The Netherlands.

projects, either mainly linked to a specific power project or to an isolated area such as an island economy, have been built. Crete has an import terminal project. And both EcoElectrica in Puerto Rico and AES in the Dominican Republic have small import terminals linked to power projects.

● **A bumper 2008**

Despite all the doom and gloom 2008 was actually a bumper year for financing projects in

the gas industry. Three major and challenging projects were financed – Yemen LNG, Peru LNG and Sakhalin 2 LNG. On top of that two large import terminals were financed – Gate in The Netherlands and GNL Quintero in Chile. In total that is nearly \$15 billion of debt.

Both Yemen and Peru were developed by Hunt Oil although Total became the lead partner in Yemen. Both deals involve gas production inland linked by long pipelines to coastal liquefaction plants. Both deals had a mix of multilateral institution and commercial bank funding, plus in the case of Yemen a \$1.1 billion shareholder loan from Total.

The Yemen financing was perhaps the most remarkable. International finance has not touched the country and yet this scheme raised \$2.8 billion. The deal was split between the Total loan, a commercial bank loan of \$750 million, a French Coface guaranteed tranche of \$423 million, a \$400 million South Korean Kexim tranche and a \$200 million Japanese JBIC tranche. The scheme was about to start up at presstime with gas being sold to South Korea's Kogas, Suez and Total.

Peru is perhaps not quite as challenging as Yemen but the \$2.25 billion Peru LNG financing is the largest single financing in the country. And it will generate \$1.5 billion of hard currency earnings every year. Hunt is leading this scheme. The deal has tranches guaranteed by US Exim, Kexim, Sace of Italy, the International American Development Bank and the World Bank's IFC. The gas will be sold to Spanish company Repsol and into Mexico.

The Sakhalin 2 deal was the largest scheme in 2008. Gazprom now has a majority stake in the \$20 billion project which will sell gas into Japan, South Korea and the US. The debt financing totalled \$5.3 billion with JBIC providing a \$3.7 billion direct loan and the commercial banks the other \$1.6 billion.

Yemen LNG Company



FIRST GAS IN BALHAF – NOVEMBER 2008

Marking the completion of pipeline construction works and the beginning of the commissioning phase of the Yemen LNG plant, Yemen LNG celebrated the inauguration of Gas-In in Balhaf on Wednesday, 19 November 2008.

The gas introduction in the Yemen LNG 38-inch pipeline (Gas-In) started from the Kamil Processing Unit (KPU) located in Block 18, Marib Governorate, at a flow rate of 59,000 m³/hr which allowed the completion of the pressurisation up to Balhaf Plant gas inlet.

This major milestone has been achieved thanks to the proactive and positive attitude shown by all parties involved in the preparation of this operation.

Non-Flaring Policy

Although the Yemen LNG liquefaction plant in Balhaf is designed in accordance with a non-flaring policy, it has flares which will not be used for regular flaring but will function as the main safety devices for protection in case of emergencies, such as in the situation of shutdown for maintenance reasons. Flaring will also be used during the commissioning phase for testing purposes.

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9.55%



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5.00%



Peru LNG was one of three major LNG projects to be financed in 2008.

● **2009**

This will be a much tougher year for energy finance. But already one major scheme is lining up to obtain a final tranche of project finance. The Dolphin Gas Project – which provides processed

Qatari gas to the UAE and Oman through a dedicated subsea pipeline – is owned by three partners: Mubadala Development Company of Abu Dhabi, Occidental and Total. Dolphin Energy will arrange its third tranche of project finance in the first half of 2009. This will replace the \$3.45 billion facility arranged in 2005 to finance physical completion of the Dolphin Gas Project, and will be used to repay capital costs of the project during the coming 10-15-year period. RBS is advising on the deal.

The financing will be an important test for the debt finance markets. A successful syndication of this deal would calm a few nerves and put bankers in a better frame of mind for stiffer financing challenges to come – as such the Nord Stream gas pipeline financing – which are expected later in the year.

Rod Morrison is the Editor of Reuters Project Finance International (www.pfie.com).



Dolphin Energy will provide an important test for the markets in 2009.

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- ▶ **Bayerngas Norge AS**, Oslo, exploration & production company. The company holds shares in exploration licences on the Norwegian Continental Shelf and through **Bayerngas Danmark ApS**, Copenhagen, licences in the Danish North Sea.
- ▶ **actogas GmbH**, Munich, gas trading company, active on European hubs and energy exchanges.
- ▶ **novogate GmbH**, Munich/Düsseldorf, undertakes for Bayerngas the pan-German gas sales and consultancy business.
- ▶ **bayernSERVICES GmbH**, Munich, provides technical services for gas plants and gas filling stations for industrial customers.

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