

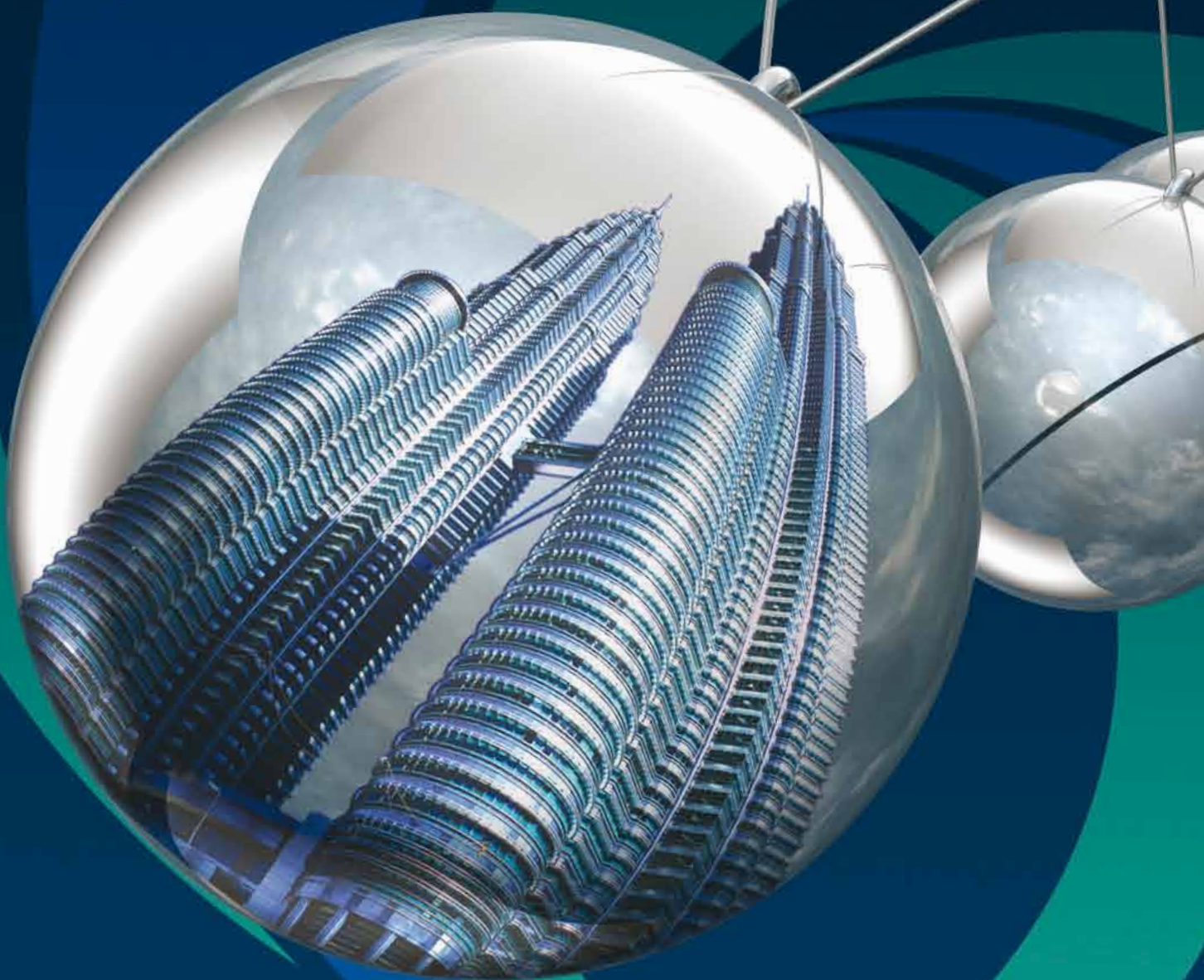
International Gas APR-SEPT 2012
INTERNATIONAL GAS UNION

www.igu.org

MEETING IN KUALA LUMPUR

Countdown to 25th World Gas Conference





25th world gas conference | 1 9 3 1 - 2 0 1 2

- The first World Gas Conference in South East Asia
- The World Gas Conference Silver Jubilee
- 5,000 delegates
- 10,000 trade visitors
- 500 international speakers
- 14 keynote speakers
- 10 high level strategic panel sessions
- 4 luncheon speakers
- 200 exhibiting companies
- More than 30 technical committee sessions

“Gas: Sustaining Future Global Growth”
Kuala Lumpur, Malaysia
4 - 8 June 2012

www.wgc2012.com





Triggering Sustainability

REGISTER FOR YOUR DELEGATE PLACE TODAY

From 4 - 8 June 2012, the world's most prestigious gas conference will be held in Kuala Lumpur. Focusing on the theme of gas sustainability with regards to the world's future growth, the event will feature thought leaders and industry specialists discussing current issues and future trends.

It will be a place to expand knowledge, accelerate business and strengthen networks.

our world, our future

see you in kuala lumpur

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International Gas

APRIL-SEPTEMBER 2012

The IGU Magazine

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Vision, Mission and Objectives

The International Gas Union (IGU) is a worldwide, non-profit organisation promoting the progress of the gas industry. Through its many member countries representing approximately 95% of global gas sales, IGU covers all aspects of the natural gas industry.

● The Vision

Recognising that natural gas has an important part to play in satisfying the global need for an environment-friendly energy source, IGU will be the most influential, effective and independent non-profit organisation, while serving as the spokesman for the gas industry worldwide.

● The Mission

IGU will actively, directly and through its members, promote the technical and economic progress of the global gas industry.

IGU will work towards improving the competitiveness of gas in the world energy markets. By promoting the development and application of new technologies and best practices, IGU will help optimise the economics of the entire gas chain, while emphasising sound environmental performance, safety and reliability.

IGU – serving as a global information clearing house – will promote transfer of technology and know-how.

In carrying out this mission, IGU will maximise value to its members and gas customers.

● Objectives

In striving towards the vision and fulfilling the mission, IGU will regarding:

ECONOMY: Promote all activities within the entire gas chain, which can add to the technical and economic progress of gas;

CUSTOMERS: Encourage development of good customer services and customer relations;

TECHNOLOGY: Encourage research and development towards new and better technologies for the gas community;

SAFETY: Promote the safe production, transmission, distribution and utilisation of gas;

ENVIRONMENT: Encourage and promote development of clean technology, renewable energy applications and other activities, which will add to the environmental benefits of gas;

INTERNATIONAL GAS TRADE: Encourage international trade in gas by supporting non-discriminatory policies and sound contracting principles and practices;

LEGAL: Promote and contribute to the development of legislation concerning:

- the establishment of equitable, non-discriminatory and reasonable environmental and energy efficiency regulations, and
- efforts to establish appropriate and relevant international standards, as well as
- the promotion of and participation in the exchange of information relating to regulatory processes;

COOPERATION: Enhance partnership with industry and manufacturers, and cooperation with governments, policy makers and international energy related organisations, and promote the exchange of information among members in order to help them in improving the efficiency and safety of gas operations.



ideas for a brighter future

eni has always promoted advanced scientific research, rewarding the most innovative projects and discoveries in sustainable energy. The eni award is a prestigious prize awarded once a year to researchers who stand out internationally for their work on the new frontiers of hydrocarbons, unconventional renewable energies and environmental protection. To build a better future out of today's brightest ideas. Under the High Patronage of the President of the Republic of Italy.

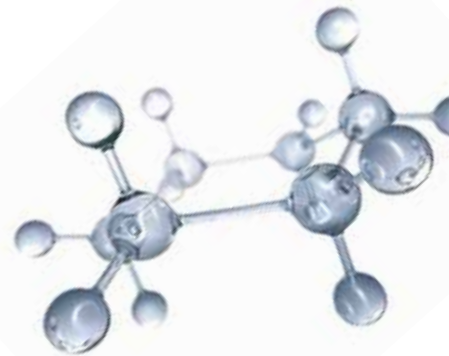




“One of the best ways to reduce greenhouse gases is to keep them from entering the atmosphere in the first place. At ExxonMobil, we’re developing a whole new way of producing cleaner-burning natural gas. In Wyoming, we’ve just built a new plant to demonstrate how we can safely freeze out CO₂ from natural gas. It’s one way that we’re helping provide energy with fewer emissions.”

Stephen Greenlee | President, Upstream Research, Geoscientist

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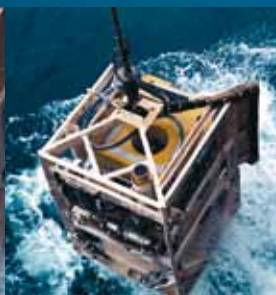
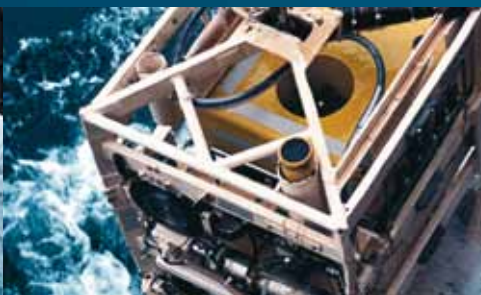
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and the most revolutionary theories.



Throughout its history of over half a century, Petrobras has become one of the largest energy companies in the world. As a leader in exploration and production of oil in deep and ultra-deepwater, Petrobras is already producing in the area that



contains the largest oil accumulation ever found in Brazil: the offshore pre-salt layer. To confront this challenge, Petrobras is employing its usual strategy: research, technology, investments and safety. If the future is a challenge, Petrobras is ready for it.



CHALLENGE IS OUR ENERGY

Message from the President

Dear Colleagues

It has been exactly two years since I penned my inaugural message as President of IGU in the April 2010 issue of *International Gas*. Time has flown by very quickly and we are now coming to the “home stretch” of our Presidency.

Reflecting upon the last two years, the energy industry and, by default, the gas industry has experienced significant upheavals and challenges. Coming out of one of the most severe economic crises, the world was hopeful for a strong recovery in 2010 and 2011. However, although there were some positive signs, the world economy is still in a fragile and precarious state. This has impacted the demand for energy, albeit to varying degrees in different parts of the world. Energy demand in Asia is still very strong driven by China, India and the Middle East, but throughout the western world the growth in demand is at best flat.

The shale gas “revolution” in the United States has impacted the global gas supply equation, resulting in LNG supplies previously destined for the US being diverted to other markets in Europe and Asia-Pacific. The Fukushima Daiichi nuclear disaster in March 2011 has created heightened concern about the safety of nuclear energy at a time when the world is concerned about the increasing use of fossil fuels and the impact on climate change. The sudden increase in demand for LNG, particularly in Japan and China, has pushed up the price of LNG to unsustainable levels, widening the disparity in price between the Atlantic and Pacific Basins. The Arab Spring and events in the Middle East continue to create geopolitical uncertainties that have disrupted investment plans in oil and gas projects. Moreover, some governments have shifted their focus to meet increasing domestic demands from their



Datuk (Dr) Abdul Rahim Hashim, President.

populations instead of exporting their energy resources. This will certainly have an impact on future gas supply.

● **Gas: Sustaining Future Global Growth**

When proclaiming the theme for our Triennium, which is “*Gas: Sustaining Future Global Growth*”, we also expressed four major prerequisites which IGU should pursue to enable natural gas to play a key role in the world’s future energy system. These prerequisites are:

- The need to have a more effective and consistent voice as the spokesperson of the gas industry;
- To ensure availability at the right time, right place and right price;
- The need to improve efficiency throughout the value chain; and
- To ensure adequate human capability to foster growth and integrity of the industry.

Today, I am pleased to report that almost all of IGU’s activities and events during the Malaysian

Triennium have aimed at meeting the above concerns.

Our efforts on the gas advocacy front have been consistently pursued and, in the process, have attracted many allies and partners in our common pursuit to make the voice of natural gas heard. The mission is not over but I must say that, thus far, we have achieved considerable success in making some of the key stakeholders recognise the important role of natural gas in achieving a low-carbon future. Moreover, we have taken concrete steps to establish a long-term vision for natural gas and a clear roadmap on how a low-carbon energy future can be achieved with natural gas as the cornerstone. The intent is to establish natural gas, not as a transitional fuel, but one that is clearly an integral part of the energy system for the long term. This should help build confidence in

the future demand for gas across a variety of sectors, and will provide clear signals to attract the necessary investments into the industry for long-term sustainability.

The emergence of unconventional gas has been a “game changer”, resulting in an abundance of the resource that will last for the next 250 years or more. Coming at the time when there are serious doubts about the nuclear option, this development is certainly welcome news. But there are issues that may seriously impede the development of this sector. There has been a lot of negative publicity about the dangers of the technologies used in terms of water contamination, emissions and so on, many of which are myths that need to be corrected. IGU is making an effort to address these concerns by publishing a document which will be available by June this year.



Demand for LNG is booming.



The emergence of unconventional gas has been a game changer.

In the last few months, IGU has been actively involved in various fora and conferences, notably the Asian Pipeline Conference & Exhibition in Kuala Lumpur (October 11-12, 2011), the IGU Research Conference in Seoul (October 19-21, 2011), Geopolitics Global Roundtable in Paris (October 24, 2011), Australia Gas Conference in Sydney (October 31-November 2, 2011), World Shale Gas Conference in Houston (November 8-10, 2011), the IGU Natural Gas Symposium during the UN Climate Conference (COP17) in Durban (December 4, 2011), World Petroleum Congress (December 4-8, 2011) and Oil & Gas HR Conference in Paris (December 12-14, 2011).

Our symposium during COP17 followed similar successful events during COP 16 in 2010 and COP15 in 2009. Climate change has been an ongoing issue and at the UN conferences we see intensive lobbying by other fuels. IGU's presence

at these conferences is significant and demonstrates the fact that natural gas has a role to play in mitigating the effects of climate change. IGU has been able to engage with some key politicians and government officials, but it will be a constant challenge which we must continue to pursue.

● Election for the IGU Presidency 2015-2018

In early October 2011, the IGU Council met in Dubrovnik and a key item on the agenda was the election for the 2015-2018 Presidency of IGU. After some interesting and intense lobbying, the United States emerged as the winner, but not without strong and determined efforts from Korea and Qatar. I take this opportunity to congratulate our colleagues from the USA, and we look forward to them assuming the IGU Presidency from France in 2015.

● Preparations for WGC2012

The Malaysian Triennium is now in its final months, with the 25th World Gas Conference (WGC2012) just around the corner. All the Programme Committees, Working Committees and Task Forces are racing to complete their respective assignments and reports.

As regards the preparations for WGC2012, I am very pleased to tell you that the programme and venue are ready. All the keynote speakers have confirmed their attendance, while 100% of the exhibition space has been sold and more than 2,000 delegates have registered. All indicators point towards a great event and I urge those who have yet to register to do so quickly.

To conclude, reflecting on the past three years, a great deal has indeed been achieved, but more needs to be done to position IGU to be in the forefront of the world's natural gas industry. I am thankful that Jérôme Ferrier, who will be taking over as President under the French Triennium, has agreed to continue many of the efforts that we have started.

I attribute the many successes that IGU has achieved to the great efforts and hard work put in by all the members of the various teams, in particular the respective team leaders. I also salute the companies which have generously contributed by allowing their staff to participate in the various teams, including providing the valuable financial support required. The strong support and excellent relationship with the IGU Secretariat have also been an important factor.

I wish to thank everyone who has been involved in the activities and programmes of IGU under the

Malaysian Triennium. Your support and invaluable contributions have definitely helped us to make our IGU Presidency, a fruitful, pleasant and memorable experience. We look forward to welcoming you to Kuala Lumpur for the 25th World Gas Conference from June 4 to 8.



Datuk (Dr) Abdul Rahim Hashim



The 25th World Gas Conference will be held in the Kuala Lumpur Convention Centre from June 4 to 8.



Peru LNG



Peru LNG

Reinforcing our competitive

Repsol is an international integrated oil and gas company operating in over 30 countries. It is a market leader in Spain and Argentina and the largest private energy company in Latin America in terms of assets.

Repsol is one of the largest LNG Operators in the world and has a strong LNG Marketing presence in both the Atlantic and Pacific Basins due to its position in the following LNG assets:

- **Liquefaction plants:**
Atlantic LNG: 15 Mtpa
Peru LNG: 4,45 Mtpa
- **Regasification plant:**
Canaport™ LNG (Canada): 10 Bcma
- **11 LNG tankers: 2 Mm³**

In Atlantic LNG, Repsol owns 22.5% of the liquefaction facilities and has contracted to purchase 23% of the LNG produced by trains 2, 3 and 4.



position in the LNG business

In Peru LNG, Repsol owns 10% of Camisea Field, that supplies natural gas to Peru LNG, 20% of the Peru LNG liquefaction facility and has contracted to purchase 100% of the LNG produced by the facility.

Repsol has sold LNG to 13 out of the 25 importing countries located worldwide.

Repsol owns 75% of the Canaport™ LNG facility, is the General Manager of Canaport™ LNG and has contracted for 100% of the capacity, through which Repsol regasifies LNG for sales to markets in Eastern Canada and New England.

Repsol's strong global presence in the Natural Gas Business is enhanced by its approximately 30% stake in Gas Natural Fenosa, which is the largest gas distributor in Spain and a significant player in Global LNG.



REPSOL

Let's invent the future



Message from the Secretary General

Dear Reader

We are only a few months away from the Opening Ceremony of the 25th World Gas Conference taking place in Kuala Lumpur, Malaysia on June 4-8 this year.

The World Gas Conference is the most important and prestigious of all the IGU events and our main platform for presenting and discussing the short- and long-term issues facing the gas industry. It also offers a unique opportunity to meet old friends and make new ones in the energy business.

At WGC2012 political and industrial leaders will share their views on the energy challenges facing the world, and experts from the IGU com-



Torstein Indrebø, Secretary General.

munity will present the results of the extensive study programme that has been carried out by the Committees and Task Forces during the 2009-2012 Triennium.

I am confident that WGC2012 will further advance the political, technical and economic progress of the gas industry.

● **New Triennium**

The transfer of the IGU Presidency from Malaysia to France will also take place at WGC2012. The 2012-2015 Triennial Work Programme prepared by the incoming French Presidency will address the challenges facing our industry in the years to come. These include managing the global economic turmoil, mitigation of climate change, security of supply and demand, globalisation



The 2012-2015 Triennial Work Programme will address the challenges facing our industry such as mitigation of climate change.

of the gas markets, and securing the human resources that are required to ensure further progress of the gas industry.

The gas advocacy initiatives this Triennium have produced positive results. The long-term role of gas is increasingly being recognised by governments and international institutions. To support and facilitate the ongoing energy dialogue with all relevant stakeholders, we will launch a report at WGC2012 presenting the “Global Vision for Gas: The Pathway towards a Sustainable Energy Future”.

IGU enters the next Triennium stronger than ever with 116 members from all over the world, and natural gas increasing its share in the global energy mix. We will expand our interaction with NGOs and organisations representing renewables, and we will continue the close cooperation with important institutions like the International Energy Agency, United Nations and others.

● Sustainable Energy for All

The United Nations has declared 2012 the International Year of Sustainable Energy for All. An important role in this initiative is being played by Dr Kandeh Yumkella, Director-General of the UN Industrial Development Organisation, who co-chairs the UN Secretary-General’s High-Level Group on Sustainable Energy for All and is a member of the IGU Wise Persons Group. You will find an interview with Dr Yumkella elaborating on the UN goals in the field of energy in this issue of the magazine.

Furthermore, this issue includes information from the Secretariat, reports from the IGU Committees and Task Forces and articles of relevance to our business.

Enjoy your reading!

Torstein Indrebø



The International Year of Sustainable Energy for All was launched at the World Future Energy Summit in Abu Dhabi, UAE in January.



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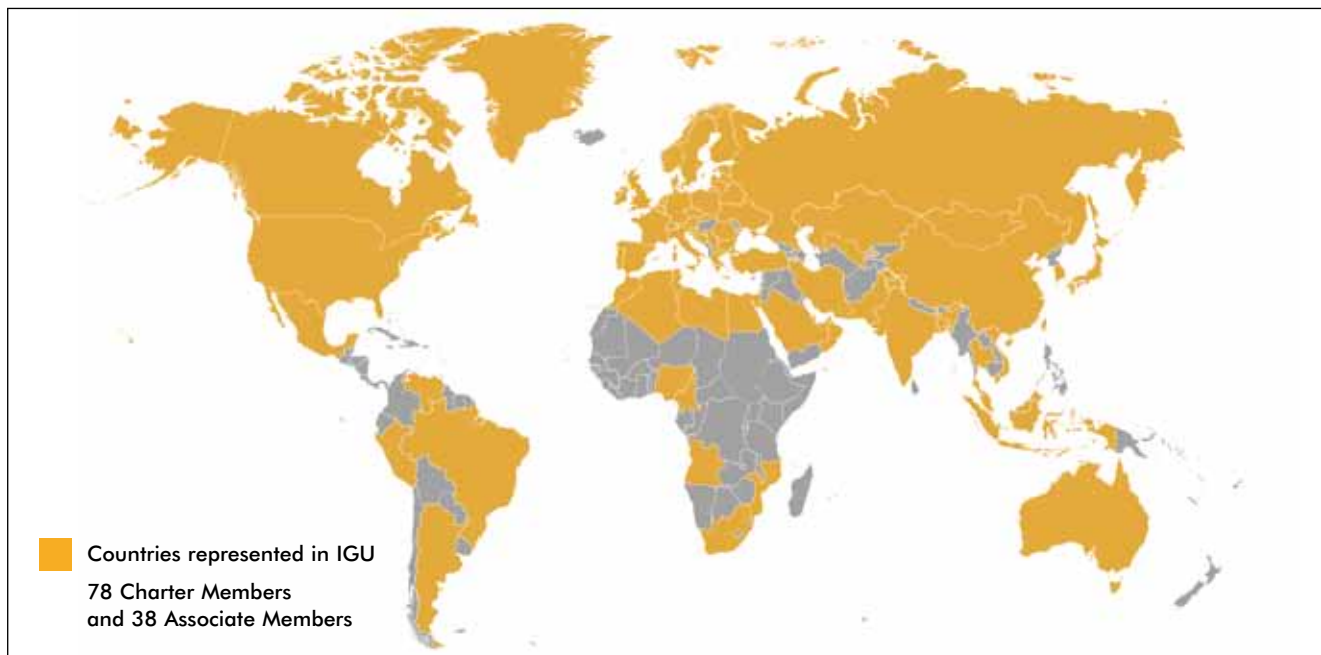


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THE ENERGY TO TRANSFORM



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Angola	Finland	Monaco	South Africa
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Australia	Germany	Morocco	Sweden
Austria	Greece	Mozambique	Switzerland
Belarus, Republic of	Hong Kong, China	Netherlands, The	Taiwan, China
Belgium	India	Nigeria	Thailand
Bosnia and Herzegovina	Indonesia	Norway	Timor-Leste
Brazil	Iran	Oman, Sultanate of	Trinidad and Tobago
Brunei	Ireland	Pakistan	Tunisia
Bulgaria	Israel	Peru	Turkey
Cameroon	Italy	Poland	Ukraine
Canada	Japan	Portugal	United Arab Emirates
China, People's Republic of	Kazakhstan	Qatar	United Kingdom
Croatia	Korea, Republic of	Romania	United States of America
Czech Republic	Latvia	Russia, Federation of	Uzbekistan
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Eurogas

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(NPF) – Norwegian Gas
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My granddaughter means the world to me. Wonderful to see her grow up. And when I look at her, I'm reminded of our obligation to pass this world on to future generations in a habitable, clean and sustainable state.

GasTerra shares this obligation. We strive to create a sustainable society in which the potential of clean energy sources is optimally realised. And if the wind or sun happen to take a day off, natural gas can function as a responsible backup. We are therefore part of the solution.

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The National Gas Company of
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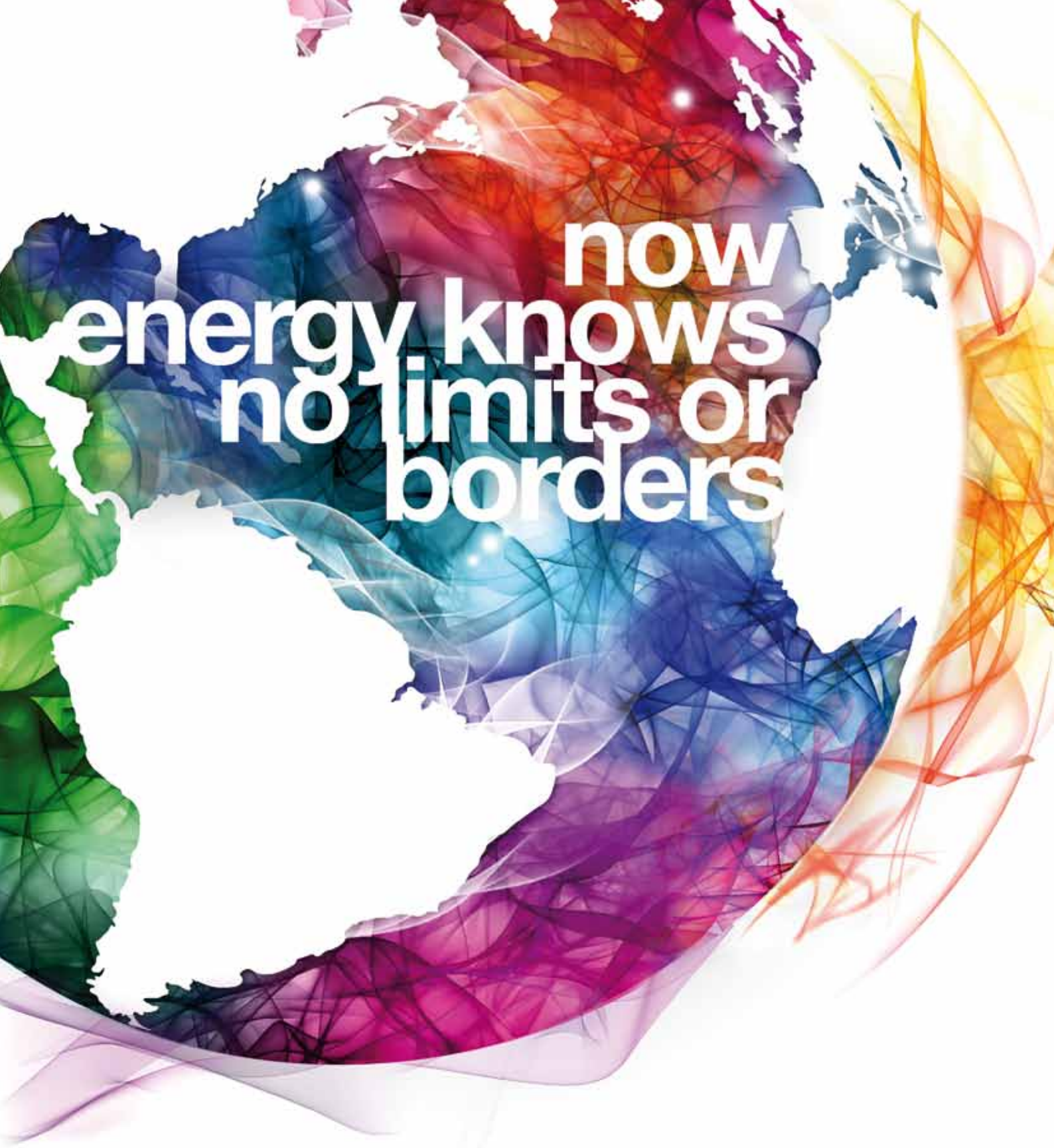
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BP Gas, Power & Renewables (United Kingdom)	OMV Gas & Power (Austria)
Bursagaz (Turkey)	Origin Energy Limited (Australia)
Cheniere Energy Inc. (USA)	Petróleo Brasileiro S.A. – Petrobras (Brazil)
Chevron Corp. (USA)	Russian Gas Society (Russia)
China National Petroleum Corporation (China)	RWE Deutschland AG (Germany)
ConocoPhillips Company (USA)	Shell Gas & Power International B.V. (The Netherlands)
DanaGas (UAE)	Société Suisse de l'Industrie du Gaz et des Eaux – SSIIGE/SVGW (Switzerland)
Det Norske Veritas (Norway)	Sonorgás (Portugal)
E.ON Ruhrgas AG (Germany)	Spetsneftegaz NPO JSC (Russia)
ExxonMobil Gas & Power Marketing (USA)	Taqqa Arab Company for Energy (Egypt)
Gaslink – Gas System Operator Ltd (Ireland)	TBG – Transportadora Brasileira Gasoduto Bolívia-Brasil S/A (Brazil)
GasTerra (The Netherlands)	TOTAL S.A. (France)
GAZBIR – Association of Natural Gas Distributors of Turkey	Vopak LNG Holding B.V. (The Netherlands)
GDF SUEZ (France)	Wintershall (Germany)
IGDAŞ – Istanbul Gas Distribution Co. (Turkey)	Woodside (Australia)
Indian Oil Corporation Ltd (India)	
Instituto Brasileiro de Petróleo, Gás e Biocombustíveis – IBP (Brazil)	

ORGANISATIONS AFFILIATED TO IGU

Energy Delta Institute (EDI)	International Association for Natural Gas Vehicles (IANGV) including its regional affiliates
Gas Infrastructure Europe (GIE)	International Pipeline & Offshore Contractors Association (IPLOCA)
Gas Technology Institute (GTI)	Marcogaz
GERG – Groupe Européen de Recherches Gazières/European Gas Research Group	Pipeline Research Council International, Inc. (PRCI)
GIIGNL – Groupe International des Importateurs de Gaz Naturel Liquéfié/International Group of LNG Importers	Russian National Gas Vehicle Association (NGVRUS)

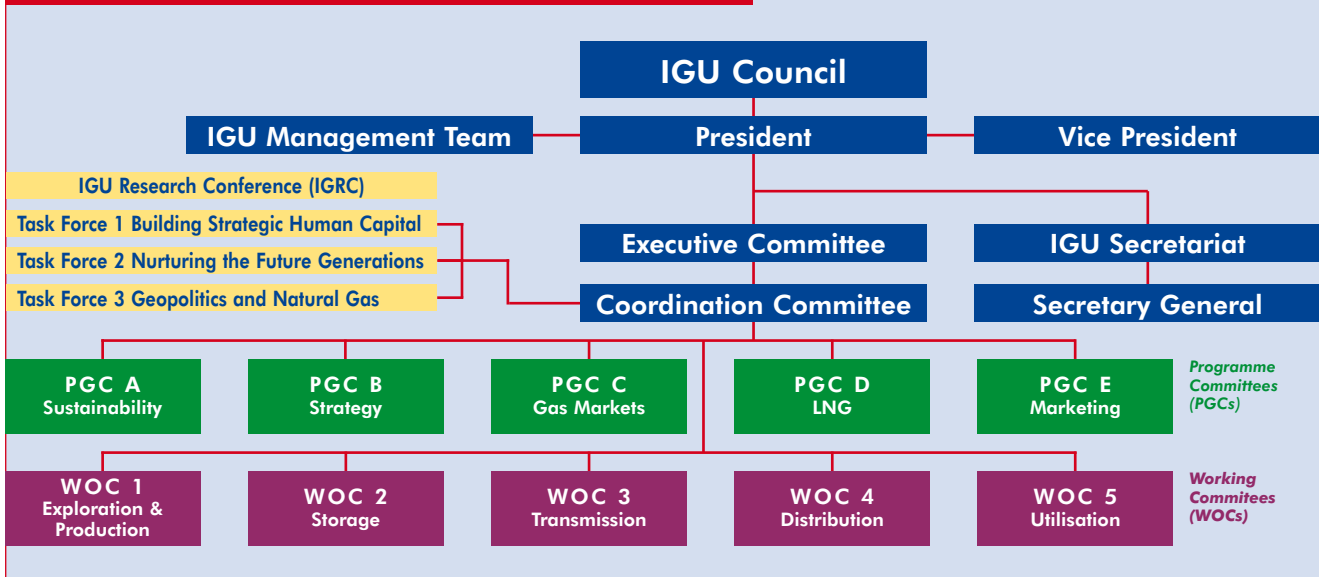
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IGU Organisation 2009–2012



This photograph was taken at the Executive Committee (EXC) meeting which was held in Dubrovnik, Croatia, in October 2011.

From left to right in the front row are:

Antoni Peris Mingot, Carlos Eduardo de Freitas Brescia, Kap-young Ryu, João Carlos de Luca, Qing Wang (who was substituting for Wang Guangjun), Ho Sook Wah, Jérôme Ferrier, Datuk (Dr) Abdul Rahim Hj Hashim, Ieda Gomes (who was attending her last meeting as an EXC member), Ernesto López Anadón, Khaled

Abubakr, Yves Tournié, James Kwan, Daniel Paccoud, Alaa Abu Jbara, Torstein Indrebø (IGU Secretary General, not a member of the EXC) and David McCurdy.

From left to right in the back row are:

Kenji Ikejima, Walter Thielen, Marcel Kramer, Miloš Kebrdle, Domenico Dispenza, Fethi Arabi (who was substituting for Nordine Cherouati), Georges Liens, Colin Lyle, Timothy Egan, Runar Tjersland and Evgueni Riazantsev.

IGU MANAGEMENT TEAM



Datuk (Dr) Abdul Rahim Hj Hashim, President (Chairman) (Malaysia)



Mr Jérôme Ferrier, Vice President (France)



Mr Ernesto López Anadón, Immediate Past President (Argentina)



Mr Ho Sook Wah, Chairman of the Coordination Committee (Malaysia)



Mr Georges Liens, Vice Chairman of the Coordination Committee (France)



Mr Torstein Indrebø, Secretary General

IGU EXECUTIVE COMMITTEE

Mr Nordine Cherouati,
Algeria

Mr Ernesto López Anadón
Argentina

Mr Carlos Eduardo de
Freitas Brescia, Brazil

Mr Timothy M. Egan
Canada

Mr Miloš Kebrdle
Czech Republic

Mr Jérôme Ferrier
France

Mr Georges Liens
France

Mr Daniel Paccoud
France

Mr Walter Thielen
Germany

Mr Domenico Dispenza
Italy

Mr Kenji Ikejima
Japan

Mr Kap-young Ryu
Republic of Korea

Datuk (Dr) Abdul Rahim
Hj Hashim, Malaysia

Mr Ho Sook Wah
Malaysia

Mr Marcel Kramer
The Netherlands

Mr Runar Tjersland
Norway

Mr Alaa Abu Jbara
Qatar

Mr Evgueni Riazantsev
Russia

Mr Antoni Peris Mingot
Spain

Mr Colin Lyle
United Kingdom

Mr David McCurdy
United States of America

James Kwan
IGU Regional Coordinator
for Asia-Pacific

Mr Andrew Lane
BP Gas, Power & Renew-
ables, Associate Member

Mr Wang Guangjun,
China National Petroleum
Corporation, Associate
Member

Mr João Carlos de Luca
Instituto Brasileiro de
Petróleo, Gás e
Biocombustíveis,
Associate Member

Mr Khaled Abubakr,
Taqa, Associate Member

Mr Yves Tournié
Total, Associate Member

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News from the Secretariat

The IGU Secretariat's main activities since the last edition of the IGU Magazine (October 2011) are detailed below in news items and general information.

● Secretariat staff changes

New employee

Statoil has seconded Mats Fredriksson to support the Secretariat with effect from March. Mats, 52, holds a degree in economics from Mid Sweden University, Sundsvalla, Sweden. He has worked in various positions with Statoil since 1987 and has a broad experience of commercial affairs across the field of energy. Between 2006 and 2009, Mats was based in London where he developed Statoil's European gas trading activities. His last position was Manager of Portfolio Management in Natural Gas.

Seconded vacancy

The next seconded vacancy will be when Carolin Oebel from E.ON Ruhrgas ends her term in the second half of 2012. All members are invited to contact the Secretariat regarding the opportunity of seconding a person with some years of experience in the field of energy to the IGU Secretariat in Oslo. The position will expose the candidate to a wide area of responsibilities and give them experience of a unique international environment. IGU will cover the candidate's job-related expenses, including travel costs, while the employer of the secondee must cover salary and other costs related to the assignment. The secondment period is normally for two years.

● New agreement for IGU Magazine

The contract with International Systems and Communications Ltd (ISC) to publish



The staff of the IGU Secretariat. *From left to right*, Hans Riddervold (Director), Ksenia Gladkova (Advisor to the Secretary General), Torstein Indrebø (Secretary General), Carolin Oebel (Advisor to the Secretary General), Sjur Bøyum (Communication Manager & Webmaster) and Silje Storsul (Administrative Assistant). Mats Fredriksson (INSET) started as Senior Advisor to the Secretary General in March.

the IGU Magazine expired with the autumn edition in 2011. A new agreement covering the period 2012-2015 is now in place and was signed on November 24, 2011 by the Secretary General, Torstein Indrebø and Nigel Ruddin, ISC Managing Director. ISC is also publishing a special book to commemorate IGU's 80th anniversary on behalf of the Secretariat and the Malaysian Presidency. This will be launched at the 25th World Gas Conference in June.

● **IGU at COP17 and COP18**

The annual UN Climate Change Conference is an important arena for IGU. Building on the success of previous events, IGU organised a natural gas symposium and had a stand in the exhibition area during COP17, which was held in Durban, South Africa in late 2011.

The symposium was sponsored by E.ON Ruhrgas and Statoil, and organised with support from the South African Department of Energy and iGas, a state-owned company (SOC). Mike de Pontes was the representative of iGas which is a subsidiary of IGU's South African Charter Member, CEF (SOC). The aim was to inform COP17 delegates, press, public servants, non-governmental organisations and other stakeholders about the environmental benefits of natural gas, and to show how the industry can help mitigate global energy poverty by offering solutions to widen access to energy. IGU's President, Datuk Abdul Rahim Hashim moderated the symposium and was interviewed by the UN TV channel.

The presentations can be downloaded from the IGU website, and there is a report on pages 146-152 of this issue of the magazine.

IGU will organise a similar gas symposium this December during COP18 in Doha, Qatar in cooperation with Charter Member Qatargas and Qatar Petroleum.



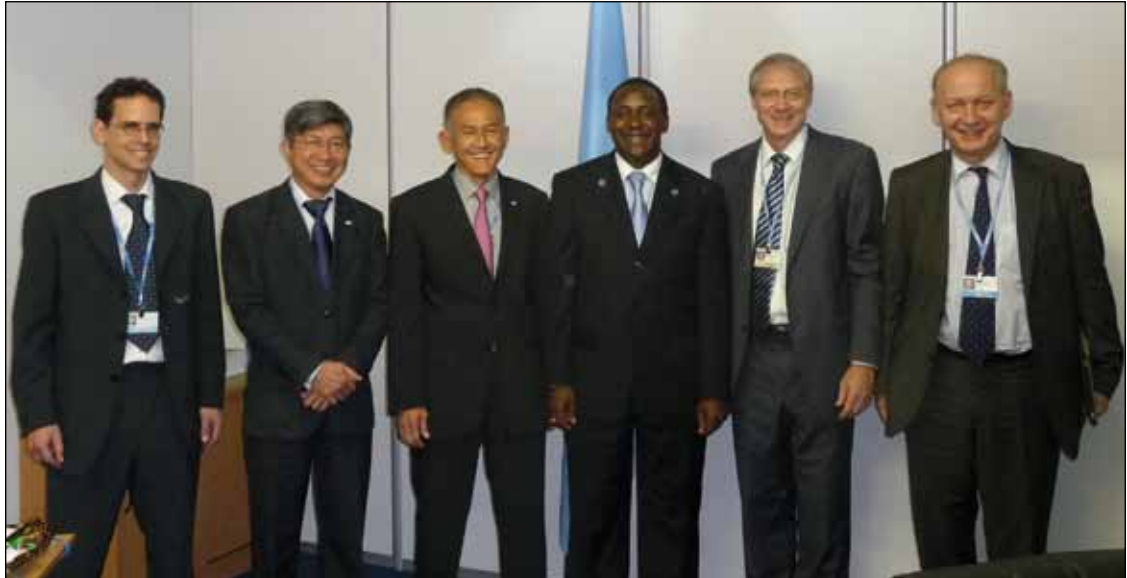
Nigel Ruddin, Managing Director of ISC (seated left) signs the new contract for the IGU Magazine with Torstein Indrebø. Behind them from left to right are: Mark Blacklock, ISC Editor; Peter Storm, IGU Honorary Secretary General, and Robert Miskin, ISC Publications Director.

● **2012 – International Year of Sustainable Energy for All**

On December 5, 2011, the IGU President and the Secretary General, together with the Chairman of the Coordination Committee, Ho Sook Wah and



IGU's stand at COP17 in Durban with (from left to right) Carolin Oebel, Sjur Bøyum, Ho Sook Wah and Torstein Indrebø.



Pictured following the IGU-UNIDO meeting on December 5, 2011 are: (from left to right) Dimitri Piskounov, Managing Director of UNIDO's Programme Development and Technical Cooperation Division; Ho Sook Wah, Datuk Abdul Rahim Hashim, Dr Kandeh Yumkella, UNIDO Director-General; Torstein Indrebø; and Patrick Nussbaumer, an energy analyst with UNIDO.

Advisor, Carolin Oebel, met Dr Kandeh K. Yumkella, the Chair of UN-Energy and UNIDO Director-General. Dr Yumkella is a member of IGU's Wise Persons Group.

The main topic of discussion was the initiative launched by the UN Secretary-General Ban Ki-moon regarding sustainable energy for all, which is led jointly by Dr Yumkella and Charles Holliday, Chairman of Bank of America and former CEO of DuPont. The Secretary-General's initiative contributes to the International Year of Sustainable Energy for All in 2012, as declared by all UN Member States, by mobilising action from key stakeholders.

The UN points out that over 1.4 billion people worldwide have no access to electricity and 1 billion more only have intermittent access, which means that some 2.5 billion people rely on traditional biomass for cooking and heating.

UNIDO recognises that gas can play an important role in changing this picture and in providing access to energy to those in need. IGU has offered to support UNIDO in the best possible way. Indeed, half of IGU's natural gas

symposium during COP17 was dedicated to the topic of access to energy and how natural gas can contribute to widening access, and UNIDO's Director of Energy & Climate, Dr Pradeep Monga was one of the speakers. IGU looks forward to continuing the cooperation with UNIDO in the future.

● Gas Awards

IGU's Gas Efficiency Award and Social Gas Award were introduced during the 2006-2009 Triennium. The idea is to generate ideas and projects to improve energy efficiency and encourage people to use gas more efficiently, and thereby raise the profile of IGU as a socially responsible organisation. IGU considers energy efficiency to be an important way of contributing to a sustainable energy future.

The winners for the 2009-2012 Triennium will be selected by the IGU Evaluation Committee consisting of:

- Maria van der Hoeven, Executive Director of IEA;
- Datuk Abdul Rahim Hashim, President of IGU;

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IGRC2011 was attended by more than 500 delegates from 39 countries.

- Prof. Dr-Ing. Rainer Reimert, Karlsruhe University;
- Ho Sook Wah, Chairman of the IGU Coordination Committee; and
- Torstein Indrebø, Secretary General of IGU.

The winners of the two Awards will be invited to the 25th World Gas Conference in Kuala Lumpur, Malaysia, where the prizes will be presented. They will receive free registration for the conference, travel and accommodation expenses, together with a cash prize of \$5,000.

The winning projects and their authors will be featured in the next issue of the IGU Magazine and on the IGU website.

● **IGU Research Conference**

The IGU Research Conference, IGRC2011 was hosted by the Korea Gas Union in Seoul, Korea, October 19-21. It was attended by more than 500 delegates from 39 countries. Altogether some 260 papers and posters were presented and 40 exhibitors offered information to the delegates. IGU's Immediate Past President, Ernesto López Anadón, chaired the IGRC Policy Committee and Marc Florette of GDF SUEZ chaired the Technical Programme Committee. There is a full report on pages 54-57.

The next IGU Research Conference (IGRC2014) will be held in Copenhagen, Denmark, September 17-19, 2014.

● **Gas advocacy**

Toolkit

Gas advocacy is a key part of IGU's work and the Union is very active in promoting the benefits of natural gas to the general public, politicians and other non-industry stakeholders. IGU has worked to establish a clear and coherent message on the role natural gas can and should play in the energy mix – especially considering its potential contribution to the mitigation of climate change and widening access to energy.

In order to provide a “toolkit” that members can use in the context of a customised communication strategy, IGU has issued different reports that are available on the website under www.igu.org/gas-advocacy:

- The Gas Advocacy Report;
- The Sustainable Development Work Group Report: Natural Gas – Facts & Figures, last updated in March 2012;
- Report on Gas and Climate Change Mitigation; and

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- Report and overview focusing on environmental issues surrounding shale gas production based on the US experience, published in early 2012.

2011 Council meeting

Following the successful workshop on gas advocacy at the Executive Committee meeting in Rio de Janeiro, Brazil on April 6, 2011, gas advocacy was also on the agenda of the 2011 Council meeting. This was held in Dubrovnik, Croatia, with the Council convening on October 6 (see pages 44-49 for a full report) and a half-day workshop organised on October 5. The workshop began with presentations by communications experts from the industry on different cases and guidelines for communicating with relevant stakeholders. Delegates then divided into groups led by IGU's Regional Coordinators to discuss priority issues for gas advocacy in each region: Africa & the Middle East; Asia and Asia-Pacific; Europe and the CIS; and North and South America.

● **EU Energy Roadmap 2050**

The European Commission published the Energy Roadmap 2050 in December 2011. The roadmap aims to establish guidelines for discussion of the future energy mix in Europe, and is expected to have a significant impact on the energy policy of EU countries.

IGU is cooperating with six gas associations based in Europe (Eurogas, GERG, GIE, GIIGNL, Marcogaz and OGP – the International Association of Oil and Gas Producers) in a joint gas advocacy programme called GasNaturally (for more information visit www.gasnaturally.eu). The aim is to ensure that natural gas is well represented in the European debate and to promote natural gas as a sound alternative in a sustainable European energy future.

The GasNaturally programme kicked off with a debate in Brussels on February 15, when leading experts took part in the "Member States Gas Forum, Gas for Europe's Energy Future". This will

be followed by a gas week (April 23-27) with a public hearing arranged by the cooperating organisations accompanied by an exhibition in the lobby of the EU parliament.

● **LNG 17 in Houston, April 16-19, 2013**

The 17th International Conference and Exhibition on Liquefied Natural Gas (LNG17) is now just one year away. Under the auspices of IGU, the International Institute of Refrigeration and the Gas Technology Institute, the triennial event is being hosted by the American Gas Association, and will take place in Houston, USA, April 16-19, 2013. This will be the first time the event has been held in the USA since 1986, when LNG8 was held in Los Angeles.

LNG17 will be the largest global gas industry event in 2013 with some 5,000 delegates from 80 countries expected to attend. The event will feature strategic, technical and commercial sessions, anchored by a 20,000m² exhibition.

The tremendous growth of the LNG industry globally means that LNG17 will be the gas industry event to attend in 2013. In addition to the traditional exhibition, there will be special pavilions focusing on Gas Energy Education and LNG for Transportation. Exhibition space and sponsorships are moving at a record pace. Shell is the principal sponsor for LNG17, and the international law firm of Baker Botts will be the Lead Law Firm/Thought Leadership Sponsor for the event.

Delegate registration will begin at the 25th World Gas Conference in Kuala Lumpur in June.

● **Bids to host LNG19 in 2019**

In January, the Secretariat invited bids to host LNG19 from Charter Members importing or with definitive plans to import LNG. The deadline for bids is June 1, and the election will take place in April 2013. Australia, an LNG exporter, has been elected to host LNG18 in 2016. The host responsibility alternates between LNG exporting and importing countries.

● **3rd IEF-IGU Ministerial Gas Forum**

The 3rd IEF-IGU Ministerial Gas Forum will be hosted in Paris this autumn by the French Ministry of Energy. The date is yet to be confirmed so please check the IGU website for further information.

Organised by IGU and the International Energy Forum, the IEF-IGU Ministerial Gas Forum is regarded as an important arena for dialogue among high-level policymakers and industry executives from gas exporting and importing countries.

● **Russian ambassador visits IGU Secretariat**

On October 28, 2011, the Russian ambassador to Norway, Vyacheslav Pavlovskiy, together with the third secretary, Roman Saitov, paid a courtesy visit to the IGU Secretariat to be briefed on IGU's work.

● **IGU at international events**

The IGU management attends a large number of energy events. Below we have listed a few of the most important.

IPLOCA Annual Convention, Beijing, China

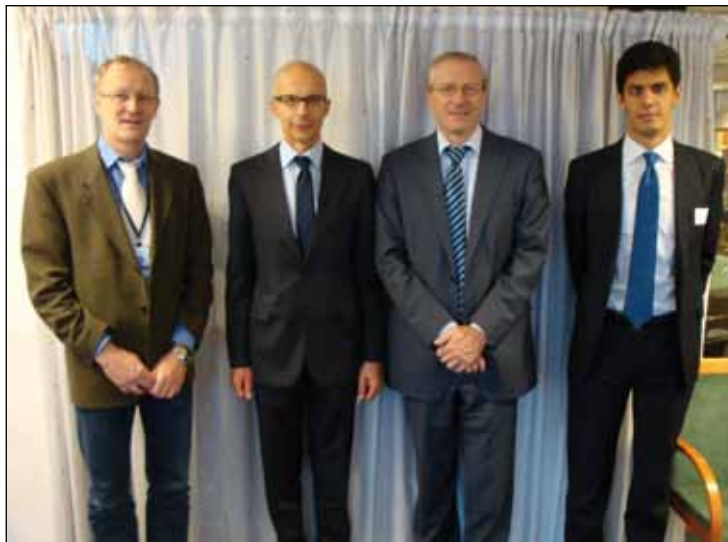
The Secretary General participated with a keynote address entitled "Natural Gas Powering the Low-carbon Economy". IPLOCA is an organisation affiliated to IGU with members from the pipeline and offshore contractors industry. More than 400 delegates attended the event which took place September 12-16, 2011.

6th International Energy Week, Moscow, Russia

Director Hans Riddervold attended and gave a speech entitled "Natural Gas – Part of the Long-term Energy Solution" on October 24, 2011.

GAT Conference, Hamburg, Germany

Gasfachliche Aussprachetagung (GAT) is an annual conference organised by IGU Charter Member DVGW in cooperation with BDEW, the German Association of Energy and Water Indus-



The Russian ambassador to Norway, Vyacheslav Pavlovskiy (second left) visited the IGU Secretariat on October 28, 2011 accompanied by the third secretary Roman Saitov (far left). They were welcomed by Sjur Bøyum and Torstein Indrebø.

tries. The 2011 event was held October 25-26 and was attended by the President, CC Chairman, Ho Sook Wah and Advisor, Carolin Oebel. The President gave a welcome speech and participated in a high-level panel on "Sociological Consensus for an Energy Policy Enabling the Future".



Torstein Indrebø with Juan Arzuaga, IPLOCA Executive Secretary during IPLOCA's 2011 Convention.



Torstein Indrebø with Pål Rasmussen, Chairman of the Norwegian Gas Association during Gassarena 2011.

Gassarena 2011, Haugesund, Norway

The Secretary General attended the event which was organised by the Norwegian Gas Association, October 26-27, 2011. He gave a presentation on “The Role of Gas in the Global Energy Future” to an audience of business people, parliamentarians and students.

Australia Gas, Sydney, Australia

Australia Gas was launched with the aim of becoming the premier international gas conference in Australia. Organised by the CWC Group and co-hosted by IGU, the inaugural event was held

October 31-November 2, 2011. The President and CC Chairman attended, and the President delivered a keynote speech entitled “The Transformation of the Global Gas Markets: New Dynamics and Commercial Drivers”. The conference provided thought provoking insights into market dynamics in Australia and the wider global context. It also highlighted upstream developments on the west and east coasts, floating LNG and the fast-moving coal-bed methane-to-LNG industry.

Oil & Gas 2011, Kiev, Ukraine

Each year, IGU Charter Member Naftogaz of Ukraine organises a major conference and exhibition in Kiev. The 2011 event was held November 1-3. The Secretary General attended the opening ceremony and gave a speech. He also used the opportunity to meet Yevhen Bakulin, the Chairman of Naftogaz, and Deputy Chairman, Vadym Chuprun, to discuss areas of mutual interest.

Dii 2nd Annual Desert Energy Conference, Cairo, Egypt

This was held on November 2, 2011. Khaled Abubakr, representing the Charter Member for Egypt, gave a presentation on “Gas & Renewables: Let’s Be Friends...”.



Australia Gas was organised by the CWC Group and co-hosted by IGU.

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Khaled Abubakr at the Desert Energy Conference in Cairo.

World Shale Gas, Houston, USA

CWC in cooperation with IGU and the American Gas Association organised this event which was held November 8-10, 2011 and attracted more than 400 delegates from all over the world. The Secretary General gave a presentation on how gas can contribute to climate change mitigation and sustainable economic development.



Torstein Indrebø addressing World Shale Gas in Houston.

UNECE, Geneva, Switzerland

The 20th annual session of UNECE's Committee on Sustainable Energy was held November 14-18, 2011. Director Hans Riddervold addressed members of diplomatic missions, UN delegates and industry experts with a presentation on the role of gas in climate change mitigation.

100th Anniversary, Danish Gas Association

IGU was invited to join in celebrating the centenary of the Charter Member for Denmark on November 18. The President addressed delegates and guests from the Danish gas industry and policymakers, sharing his perspectives on the global long-term role of gas. The Secretary General presented a gift from IGU.

20th World Petroleum Congress, Doha, Qatar

This was held December 4-8, 2011 and IGU participated in the session on Gas Supply and Demand. The President gave an address on the long-term role of gas in the global energy markets.

IGU also had a stand in the exhibition to promote WGC2012 and IGU membership.



Datuk Abdul Rahim Hashim promotes WGC2012 at the 20th World Petroleum Congress in Doha.



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Record Attendance at 2011 Council Meeting

By Mark Blacklock

A hotly contested election for the 2015-18 Presidency, the accession of nine new members and interesting guest presentations were the highlights of IGU's 2011 Council meeting, which was the best-attended in the Union's 80-year history.

The meeting was held in the Excelsior Hotel in Dubrovnik on October 6, following an advocacy workshop and sessions of the Coordination Committee and Executive Committee on October 4-5. The whole event was hosted by Charter Member the Croatian Gas Association and was attended by 225 delegates and 45 accompanying persons.

The day's business was opened by IGU's President, Datuk (Dr) Abdul Rahim Hashim, who asked delegates to approve the minutes of the previous Council meeting, which had been held in Doha in October 2010. Secretary General Torstein Indrebø then gave delegates an overview of the Secretariat's work and activities over the past year.

The Secretary General's presentation included reports on the second IEF-IGU Ministerial Forum and the advocacy programme; and he reminded

delegates about the materials available for download from the Gas Advocacy folder of the IGU website. He also announced that in addition to the regular gas event during the annual UN Climate Change Conference (see pages 146-152 for a report on the 2011 event), the Secretariat was working with a number of other organisations to organise a two-stage gas event in Brussels in 2012. The first stage, a Member State Forum, subsequently took place on February 15 and a gas week is planned for April 23-27. The aim is to discuss the European Energy Roadmap 2050, which was released three months after the Council, with EU policymakers and improve the position of gas in the discussions. This initiative underlines the increased focus of IGU on international energy policy issues.

Next up was Jay Copan, Executive Director of the LNG17 National Organising Committee, who gave an update on preparations for this important triennial conference and exhibition – co-sponsored by IGU, GTI and IIR – which will be held in Houston, USA, April 16-19, 2013.

The Council then approved new members to the Executive Committee to represent Algeria (Nordine Cherouati), Canada (Timothy Egan), Norway (Runar Tjersland), the UK (Colin Lyle), the USA (Dave McCurdy) and Associate Member BP Gas, Power & Renewables (Andrew Lane).



The 2011 Council meeting was the busiest in IGU's history.

Immediate Past President Ernesto López Anadón took the podium to give a final update on IGRC2011, which took place two weeks after the Council meeting in Seoul, Korea (see pages 54-57 for a report). He also briefed delegates on the organisational structure for future IGRCs, which sees the creation of a new Programme Committee (PGC F – R&D & Innovation) to take over the responsibilities of the Technical Programme Committee while those of the Policy Committee will be transferred to the Executive Committee and PGC F.

● **New members**

Applicants for IGU membership always have the opportunity of addressing the Council and the President first invited the prospective Charter Members to speak.

Pascoal Mahikete Mocumbi of Mozambique’s Empresa Nacional de Hidrocarbonetos EP (ENH) and Shokir Fayzullaev, Chairman of Uzbekneftegaz Holding Company of Uzbekistan gave presentations on their companies, while Daniel Paccoud of the French Gas Association said a few words on behalf of Morocco’s Fédération de l’Énergie de la Confédération Générale des Entreprises du Maroc (CGEM) which could not send a representative. Mongolia’s Baganuur Joint Stock Company also sent apologies.



For the prospective Associate Members OMV Gas & Power’s Luca Della Gatta and Woodside’s Roger Martin gave presentations, while the latter also said a few words about the Australian Petroleum Production & Exploration Association (APPEA) of which Woodside is a member. KEMA Nederland BV (The Netherlands) and Wintershall (Germany) could not send representatives.

Delegates then approved all nine applications. As Izgaz has not renewed its membership given that parent company GDF SUEZ is an Associate



A gala dinner was held in Dubrovnik’s Museum of Modern Art the evening before the Council meeting (ABOVE). The farewell dinner featured a display of Croatian folk dancing (TOP).



Member (Izgaz joined before GDF SUEZ acquired its majority shareholding) and Thyssengas has withdrawn, IGU now has a total of 116 members (78 Charter and 38 Associate) from 77 countries.

The Secretariat continues its efforts to increase membership under IGU's marketing plan, which has identified a number of countries and companies of particular interest.

● **WGC2012**

Ho Sook Wah, Chairman of the Coordination Committee, gave an update on the Triennial Work Programme (TWP), the results of which will be presented at the 25th World Gas Conference. He announced that there had been 694 paper submissions from 50 countries for WGC2012, which is a new record for IGU, along with 247 submissions for the Best Practices Award and 145 for the Social Gas Award.

Zahariah (Liza) Abdul Rahman, CEO of WGC2012, followed with an update on preparations for the conference and exhibition, which will

be held in the Kuala Lumpur Convention Centre, June 4-8.

● **French Triennium**

Jérôme Ferrier, Vice President, and Georges Liens, Vice Chairman of the Coordination Committee, presented the TWP for 2012-15 and announced that the theme of the French Triennium would be "Growing together to a friendly planet".

The existing structure of the Technical Committees will be maintained apart from the creation of PGC F and the widening of PGC E's remit to include communications. The countries chairing the committees will be those currently providing the vice chairs. Datuk Rahim and Jeanet van Dellen, Advisor to the Secretary General, separately presented the selection of countries providing the vice chairs for 2012-15 (see table).

In addition, there will be three Task Forces dealing with Human Resources (including encouraging young people to join the industry which is the subject of a separate Task Force in the current Triennium), Gas Advocacy and Geopolitics.

● **New logo**

Datuk Rahim announced that the IGU Management Team had reviewed strategic issues related to the future development of IGU and recommended that the logo be modernised to enhance the visibility and promotion of the Union to external stakeholders. Delegates were given a preview of the new logo selected by the Executive Committee, which will be launched on the last day of WGC2012.

● **Other business**

Delegates approved IGU's accounts for 2010, the budget for 2012 and the offer of Statoil to host the Secretariat for a further three years until the end of October 2016. Following the latter vote, Statoil's Runar Tjersland was invited to address the meeting. There was a presentation on IGU's communications strategy by Sjur Bøyum, Communication

LEADERSHIP OF THE TECHNICAL COMMITTEES 2012-2015

<i>Committee</i>	<i>Country Chair</i>	<i>Country Vice Chair</i>
WOC 1 Exploration & Production	Brazil	Malaysia
WOC 2 Storage	Slovak Republic	Russia
WOC 3 Transmission	Argentina	Czech Republic
WOC 4 Distribution	Germany	Spain
WOC 5 Utilisation	Russia	Iran
PGC A Sustainability	Japan	Argentina
PGC B Strategy	Algeria	The Netherlands
PGC C Gas Markets	Korea	Algeria
PGC D LNG	The Netherlands	Japan
PGC E Marketing & Communications	Spain	Argentina
PGC F R&D & Innovation	USA	Germany

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"We are honoured, humbled and energised to serve in this role," declared David Carroll after the USA won the election for IGU's Presidency from 2015 to 2018.

Manager & Webmaster in the Secretariat, while Datuk Rahim urged delegates to make use of the current Strategic Statement "Natural Gas for a Sustainable Energy Future".

● **Afternoon session**

Following lunch the election for the 2015-2018 Presidency of IGU and host of the 27th World Gas Conference was held. Datuk Rahim explained the procedure and noted that, "There were four bids initially, but Brazil subsequently withdrew". This left Korea, Qatar and the USA to contest the election. The candidates for President, Kang Soo Choo, President & CEO of KOGAS, Alaa Abujbara, COO of Qatargas Shipping & Trading and David Carroll, President & CEO of the Gas Technology Institute each gave a 15-minute presentation including a video.

While the votes of the 55 Charter Members present were being counted by Hans Riddervold, Director of the Secretariat, Honorary Secretary General Peter Storm and Honorary Member Roberto Brandt, delegates listened to reports from two visiting organisations. Eric Dam, President of the Energy Delta Institute, an organisation

affiliated to IGU, gave a presentation on EDI and announced that he had welcomed two new Associate Partners, Eneco and TAQA Abu Dhabi National Energy Company. Pierce Riemer, Director General of the World Petroleum Council (WPC) gave an update on final preparations for the 20th World Petroleum Congress, which was held in Doha two months after the Council meeting.

Datuk Rahim then announced the election would go to a second round as no candidate had achieved an overall majority. He thanked Qatar for its efforts and asked Korea and the USA to make final 3-minute presentations.

While the tellers counted the second round of votes, diplomas were presented to Erik Gonder, the former Senior Advisor & Press Contact who had left the Secretariat in July 2011 to take up a position as Investor Relations Officer with Statoil, and Jeanet van Dellen, who left a month after the Council meeting to become an account manager with Gasunie Engineering. Both Erik and Jeanet were invited to address the Council. Datuk Rahim thanked Gasunie for seconding Jeanet and presented a further diploma to Eric Dam as a representative of Gasunie, who urged other companies to participate in the secondment programme. Torstein Indrebø went on to thank Åse Nicolaysen, who had left the Secretariat in September 2011 and was not present at the Council, for her services since November 2007. Åse later received her diploma in Oslo.

Datuk Rahim then received the result of the second ballot and announced that the USA had won, whereupon David Carroll returned to the podium to say a few words. "We are honoured, humbled and energised to serve in this role," he declared.

After the coffee break delegates listened to a presentation on the gas industry in Croatia. First up was Dr Miljenko Sunić, President of the Croatian Gas Association followed by Davorka Tancer, Director of Prirodni Plin and Jerko Jelić-Balta, Managing Director of Plinacro.

Then there were presentations by Andree Böhling of Greenpeace Germany and Maria van der Hoeven, Executive Director of the International Energy Agency (IEA).

Although Greenpeace is against carbon capture and storage and fracking, and sees gas as a bridge to a 100% renewable energy system rather than a long-term complement, Andree Böhling's presentation showed that there is some common ground with the industry. "We need natural gas to fight climate change," he declared. He also urged the industry to improve its advocacy, observing that during the energy debate in Germany following the Fukushima nuclear disaster, "the voice of the gas industry was not there when it was needed".

Maria van der Hoeven reviewed the IEA's report *Are We Entering a Golden Age of Gas?*, which sees gas playing a greater role in the global energy mix, and affirmed that gas will be needed in the long term as a balancing fuel. She also urged the industry to up its advocacy game. "We need to tell the world that gas has the power to make renewable energy successful," she said.

Datuk Rahim asked Hans Jørgen Rasmusen, as the most senior honorary official present, to close



Eric Dam of Gasunie, Jeanet van Dellen and Erik Gonder received their diplomas during the Council meeting and Åse Nicolaysen received hers later in Oslo.

the proceedings and ask for a vote of thanks for the host. The day was rounded off with a farewell dinner and display of Croatian folk dancing on the terrace of the Excelsior.

Mark Blacklock is the Editor-in-Chief of International Systems and Communications.



Both Andree Böhling of Greenpeace (LEFT) and the IEA's Maria van der Hoeven (RIGHT) urged the industry to improve its advocacy efforts.

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Mitsui & Co. LNG Investment Ltd (MITLI)* holds LNG and gas related projects in Equatorial Guinea, Qatar, Abu Dhabi and Oman. MITLI is dedicated to contributing long term to the dynamic LNG industry and is actively pursuing new investment opportunities in the Atlantic area.

*MITLI is a newly established 100% subsidiary of Mitsui & Co Ltd based in London.

World Leader in LNG Projects

MITSUI is currently engaged in various LNG, natural gas and oil development projects all over the world. These projects require long lead time for their development and implementation. MITSUI has participated in the projects from various stages – such as starting from the initial exploration phase and partnering in LNG development.



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MITLI has invested in the projects shown below:



Qatar Gas 1 and Qatar Gas 3

Qatar Liquefied Gas Company Ltd 1(QG1)

7.5% interest, 9.6 million tons/year†*

Qatar Liquefied Gas Company Ltd 3(QG3)

1.5% interest, 7.8 million tons/year†*

MITSUI is one of the foundation partners in the first LNG project in Qatar, and has established an excellent relationship with Qatar.



Abu Dhabi Gas LNG

Abu Dhabi Gas Liquefaction Ltd (ADGAS)

15% interest, 5.6 million tons/year†*

ADGAS is MITSUI's first LNG project which started production in 1977. MITSUI has also played a key role in LNG marketing to TEPCO.



Equatorial Guinea LNG

Equatorial Guinea LNG Company, S.A (EGLNG)

8.5% interest, 3.7 million tons/year†*

EGLNG is the first project in Africa that MITSUI has invested in. EGLNG started production from 2007. MITSUI is also actively looking for expansion train (Train-2) in Equatorial Guinea with our partners.



Oman LNG and Qalhat LNG

Oman LNG LLC

2.8% interest, 7.1 million tons/year†*

MITSUI is fully committed to Oman upstream development, and has participated in block 3, 4, 9 and 27 with its equity production volume being as much as 30,000 BOED. MITSUI will continue to proactively pursue oil and gas development opportunities in Oman.



Experience and Capability

MITSUI is uniquely placed to successfully develop LNG projects. This includes arranging multilateral international financing, concluding LNG SPA with premium world class buyers and making appropriate EPC arrangements. MITSUI has extensive experience in LNG projects and is able to effectively integrate all the necessary arrangements for current and future projects.



MITSUI & CO., LTD.

MITSUI has invested in the projects shown below:



Sakhalin-II LNG

Sakhalin Energy Investment Company Ltd (SEIC)
12.5% interest* 9.6 million tons/year†

MITSUI is one of the foundation partners of the Sakhalin-II project and is fully committed to oil and gas development in Russia. MITSUI is also actively looking for new investment opportunities.



Mozambique LNG Development

MITSUI discovered significant natural gas reserves in offshore Mozambique (Area 1) with partners, which can be developed as a world class LNG project. MITSUI holds a 20% interest in the next booming project.



Tangguh LNG

Tangguh LNG project in Indonesia
2.3% interest* 7.6 million tons/year†

This is the first LNG project for MITSUI in South East Asia, which is very important due to MITSUI's E&P assets portfolio.



North West Shelf Australia LNG

Northwest Shelf JV in Australia (NWS JV)
8.3% interest* 16.3 million tons/year†

NWS JV is one of the crown jewel assets of MITSUI and is the first LNG project in Australia promoted by a multinational consortium. MITSUI is participating in a wide range of E&P activities in Australia – this is regarded as our core focus area.

* % interest held by MITSUI / MITLI in natural gas liquefaction and LNG exporting activities.

† Tons per annum production capacity.

High Attendance Makes IGRC2011 a Success

By Marie-José Fourniguet, Jack Lewnard, Peter Hinstrup, Robert Badoux and Marc Florette

At a time when uncertainties in the industry are greater than ever, IGRC2011 created a unique opportunity for technology and business leaders across many research and innovation areas to discuss and develop new approaches and solutions. The conference, which was held in Seoul, Korea, attracted more than 500 participants from 39 countries. There were 260 oral and poster presentations, while 40 exhibitors from 11 countries participated in the exhibition.

- **A forum to discuss technology development and future business**

IGRC2011 continued the IGRC tradition of hosting a valuable forum for the international gas research community to discuss technology

developments, share best practices and interact with their commercial counterparts regarding innovative business concepts to expand the use of gas. Significantly, more than half the attendees were authors of papers or presenters, and thus actively driving the latest R&D advances. Consistent with its mission to enhance communications within the international gas community and promote high-quality gas R&D, IGRC2011 also selected 11 peer-reviewed papers for publication in the *Journal of Natural Gas Science and Engineering*¹, and will provide access to papers through the IGU website in 2012.

IGRC2011 provided a unique opportunity for CEOs to critique international R&D efforts. Two themes that emerged were the need for more international cooperation in gas R&D, and development of open innovation models to accelerate R&D. Their comments directed researchers not just to do innovative work, but to work in more innovative ways.

- **Very active agenda in upstream topics**

R&D activities have expanded gas supply globally, including development of unconventional resources such as coal-bed methane, tight sands and shale gas, and advancements that have expanded the pool of technically recoverable conventional resources. IGRC2011 continued the trend towards expanded coverage of upstream topics, with posters, presentations and a workshop. In addition to increasing gas supply, R&D continues to drive down costs across the gas supply chain. Examples highlighted at the conference include drilling and completion technologies for unconventional gas, lower-cost metals and insulation for LNG tankers, improved scheduling algorithms for deploying interconnected transmission assets, and continued progress on trenchless rehabilitation of distribution systems.



Kang Soo Choo, President & CEO of Kogas and Chairman of the Korea Gas Union addresses delegates during the opening ceremony of IGRC2011 on October 19.

¹ Volume 3, issue 5 – October 2011, ISSN 1875-5100, Elsevier Edition.

● **Tangible results and new equipment for the residential and commercial market**

As in past IGRCs, a major theme was R&D to expand the markets for gas. For the residential and commercial market, several papers and presentations highlighted on-going progress in gas-fired fuel cells and engines for combined heat and power generation, with large deployments in Japan and Europe. It is now clear that micro-cogeneration and fuel cells are not just on the brink of commercialisation; they are currently providing energy to thousands of customers worldwide helping them to reduce the carbon footprint of their energy usage. Hybrid devices such as integrated gas heat pumps and gas-fired cooling units have also moved into commercial demonstrations. However, gas consumption in individual homes will decrease drastically over the coming years. New business models and markets need to be created that establish the value of gas as part of an integrated energy strategy that includes renewable energy technology. Researchers are leading these developments. For example, the Young Researcher Prize, introduced for the first time

at IGRC2011, was awarded to Cyril Vuillecard, a PhD student supported by GDF SUEZ, for bottom-up modelling of local gas and electricity interactions with hybrid technologies.

Moreover, there is increasing interest in R&D to enable gas to capture a larger share of the transportation market, either directly through CNG or LNG, or indirectly via gas-to-liquids processes. A positive example is the use of LNG fuel in ships, with cost and environmental benefits. Interestingly, there were fewer papers covering R&D for industrial gas applications compared to previous IGRCs.

● **Safety: a continuing commitment for the gas networks**

Safety continues to be a focus for gas R&D. Researchers shared theoretical analyses and field-based data for pipes and components in transmission and distribution systems. Numerous papers highlighted advancements integrating field measurements and material science to improve risk assessment and prioritise investments in integrity programmes. Progress in LNG safety was pre-



IGRC2011 provided a unique opportunity for CEOs to critique international R&D efforts in a roundtable session.



ABOVE The exhibition at IGRC2011 is ceremonially opened. (INSET) Kang Soo Choo escorts IGU President Datuk Abdul Rahim Hashim and other members of the IGRC2011 Policy Committee around the exhibition.

sented across the supply chain, including innovative concepts such as underground storage, analysis of tank roll-over for offshore facilities and development of better flanges to eliminate leaks.

● **Gas sustainability assessment: a growing interest for R&D**

Continuing the trend from IGRC2008, the sustainability of the gas industry is increasingly a topic of R&D focus. Several papers addressed quantifying and reducing the environmental footprint of natural gas. Life-cycle analysis (LCA) for gas has expanded beyond energy efficiency and carbon footprint, and now includes impact on water use and air emissions beyond CO₂. LCA is being applied across the supply chain, and even extended to biogas, with the biogas LCA paper from Marius Adelt of E.ON Ruhrgas receiving the Dan Dolenc Award for the best paper. Numerous papers and a workshop focused on production of biogas and integrating it into the gas grid; development of hybrid gas/renewable devices; and demonstrations of biogas-powered equipment ranging from vehicles to boilers; indicating that biogas and to a

certain extent also gasification processes are positioned for rapid expansion with many new commercial installations being built around the world.

Sustainability also includes the financial viability of the gas industry. Papers, presentations and workshops explored options for the industry in light of legislation to reduce greenhouse gas emission, codes and standards that may exclude gas, and mandates to use renewable energy sources. These factors represent both a threat and an opportunity for the gas industry. For example, one workshop addressed whether carbon capture and storage (CCS) could become a new market for the gas industry, allowing the industry to leverage existing capabilities and assets such as exploration & production, gas transport, gas storage and energy services. A priority should be put on identifying (nearly) depleted gas fields which could be deployed for CO₂ storage as CCS systems are commercialised.

● **Role for natural gas in smart energy grids**

A theme across many R&D activities is the integration of the gas and electric grids, whether through

micro-CHP or emerging concepts to “store” off-peak power as hydrogen in the gas grid. Gas is an efficient and flexible carrier of renewable energy, with the conversion of wind-generated electricity to hydrogen or renewable methane. Smart energy grids that more holistically manage gas, electricity, renewable energy sources and potentially thermal energy have the potential to reduce cost and environmental impacts as well as disrupt existing business models. In this way, the role of gas appeared more important than ever in the transition to a renewables-based energy system.

● **Innovation is the key to a sustainable future!**

In fulfillment of its above theme, IGRC2011 provided details and high-level overviews of the latest R&D developments driving the international gas industry and thus contributed to mapping out the future. The cumulative impact of innumerable R&D efforts has resulted in global natural gas demand growing at almost twice the rate of other primary energy sources. Continued research, and innovations in the way research is conducted, will be essential to the sustainability of the gas industry and the global economy and will contribute to the gas advocacy initiative of IGU.

With its large attendance IGRC2011 was a great success. The IGRC Technical Programme Committee chaired by Marc Florette, and the IGRC Policy Committee, chaired by Ernest Anadón,

expressed their satisfaction to the National Organising Committee chaired by Kap Young Ryu. Key observations from IGRC2011 will be summarised by Marc Florette, Senior Vice President Research & Innovation at GDF SUEZ, as an introduction to Strategic Panel 8 of the 2012 World Gas Conference in his presentation “Innovation and New Technology: The Key to Increasing the Gas Business”.

The next IGRC will be hosted by the Danish Gas Technology Centre on behalf of the Danish Gas Association, the IGU Charter Member for Denmark. It will take place in Copenhagen, September 17-19, 2014, under the direction of IGU. The new Programme Committee F, dedicated to research and innovation, will be set up during the next IGU Triennium. Chaired by Jack Lewnard from the Gas Technology Institute in Chicago, it will be in charge of the technical programme for IGRC2014 and will develop additional objectives such as creating a roster of worldwide gas R&D facilities and their capabilities and programmes; identifying areas and models for international research collaboration; and exploring integration of gas with renewable energy and electricity.

Marie-José Fourniguet, Jack Lewnard, Peter Hinstrup, Robert Badoux and Marc Florette were members of the IGRC2011 Technical Programme Committee. For more information on the next IGRC, visit www.igrc2014.com.



Members of the Policy and Technical Programme Committees on stage during the closing ceremony of IGRC2011.

Power to gas

► Paradigm switch stimulates energy transition

In the transition to a sustainable energy supply, gas infrastructure, storage, and end user applications play a crucial role in creating flexibility and in facilitating seasonal energy storage. In fact, an integrated approach combining the strength of power and gas infrastructure is a very promising way to guarantee an affordable and realistic transition to a sustainable, and reliable energy system.

Natural gas is the cleanest fossil fuel in comparison to oil and coal. Substitution of these energy sources by gas is the first step in the transition process. The addition of biomethane and hydrogen will make the gas system even more sustainable, as a second step in the transition. The third step is the use of the gas and power infrastructure as exchanging grids. Hence, gas is not only acknowledged as a transition fuel but it can also be seen as a destination fuel.

Traditionally, gas is converted into electricity and heat in mostly large scale power plants, where after the electricity and/or heat is distributed to the end user. The reverse procedure – conversion of power to gas – is not that common a practice, yet. There are good reasons to change this way of thinking and

acting as the gas system can offer maximum flexibility to the power system in cases that demand and supply do not match and surpluses of sustainable electricity need to be accommodated. In cases of surpluses, sustainable power can be converted into hydrogen or methane and can be supplied to the gas grid.

► Flexibility

The main need for flexibility is driven by the difference in supply and demand of energy. The extension of installed capacity of sustainable energy sources, mainly wind and solar power, will, in the next decades, certainly cause more differences in supply and demand. The fluctuating supply pattern of these technologies can affect the stability of the existing electricity infrastructure. As demand and supply of electricity should be balanced all the time, there is a growing need for flexibility in electricity accommodation and storage. Only sufficient energy storage can ensure a secure supply based on renewable energy sources.

For long-term storage and seasonal balancing the electricity infrastructure itself has limited capacity. Therefore, interest in the possibilities of using gas infrastructure, as a virtual battery, for electricity storage emerges. Europe's extended and robust gas infrastructure enables storage directly and in large quantities with a cycle time from days to months through the conversion of electricity into gas.

KEMA acknowledges the value of the gas infrastructure to facilitate flexibility and seasonal storage. Power to gas can contribute to a sustainable energy system. Additionally, the conversion enables CO₂ recycling contributing to a more sustainable gas sector.



Fluctuating supply patterns from renewables such as wind can affect electricity infrastructure stability.



Power to Gas for a smooth energy transition

An integrated approach toward the power and gas infrastructure enables an affordable and realistic transition to a sustainable and reliable energy system. Conversion of power to gas can offer maximum flexibility to the power system in cases that demand and supply do not match and surpluses to be accommodated. KEMA acknowledges the value of the gas infrastructure to facilitate flexibility and seasonal storage.

Advantages of converting power to gas

- > Flexibility in electricity accommodation
- > Seasonal storage of renewable energy to balance demand and supply
- > Direct storage in large quantities in Europe's extended and robust gas infrastructure with a cycle time from days to months
- > Cost-effective energy transport over long distances
- > Decarbonization of gas infrastructure

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News from Organisations Affiliated to IGU

In this issue we have reports from the Gas Technology Institute (GTI), International Pipeline & Offshore Contractors Association (IPLOCA) and Pipeline Research Council International (PRCI), while the European Gas Research Group (GERG), International Group of LNG Importers (GIIGNL) and Marcogaz have contributed separate articles.

● Record US Natural Gas Demand Boosts Outlook for Robust Growth

GTI Technology Supporting Energy Efficiency, Environmental and Productivity Benefits

By Bill Liss

According to the US Department of Energy (DOE) Energy Information Administration, the 22.1 trillion cubic feet (626 bcm) of natural gas demand in

2010 was the highest-ever level in the US – exceeding the previous high set in 2000 by more than 10%.

The outlook for gas demand remains robust, thanks to the remarkable expansion of natural gas supplies and very attractive end user prices. Demand continued an upward trend in 2011 and is poised to reach 24 to 26 trillion cubic feet (680-736 bcm) by 2020, while also helping to reduce US carbon emissions.

Future demand growth will be led by the power generation sector, where natural gas is poised to help offset an expected wave of older coal-fired power plant retirements. Low prices are helping to expand manufacturing – particularly in the chemical, petrochemical, and food processing segments.

The natural gas industry is also experiencing growth in residential and commercial market sectors, though overall demand is muted by ongoing appliance and building energy efficiency improvements.



The coming decade should see a strong expansion of NGV use in the US.



Ultramizer is based on GTI-licensed technology.

In the transportation sector, fleet owners are increasingly turning their attention to natural gas vehicles (NGVs) for their economic benefits. The coming decade should see a strong expansion of NGV use in the US.

Working with the natural gas industry and other government and industry partners, Gas Technology Institute (GTI) is helping to develop a portfolio of new end-use gas technologies that can provide energy efficiency, environmental and



The GTI natural gas vehicle team.

productivity benefits to all energy market sectors over the next decade.

One primary example is the Ultramizer®, commercialised by Cannon Boiler Works. This high-efficiency heat recovery system for large commercial and industrial boilers is based upon GTI-licensed technology, including the Transport Membrane Condenser (TMC). GTI is also advancing the number of alternative fuel vehicles on the road, by helping businesses add NGVs to their fleets, expanding fuelling infrastructure, and demonstrating low-emission, high efficiency natural-gas engines for regional hauling and heavy fleet vehicle applications.

Bill Liss is GTI Managing Director, End Use Solutions. For more information about other GTI initiatives, visit www.gastechnology.org.

● IPLOCA's Novel Construction Initiative: Phase III

By Osman Birgili

After a great deal of hard work by representatives of many of IPLOCA's member companies, the second edition of *Onshore Pipelines: The Road to Success* was published in September 2011. It is available in limited numbers in hard copy, on DVD and via links at www.iploca.com/roadtosuccess.

This is the latest deliverable of IPLOCA's ongoing Novel Construction Initiative to examine pipeline laying efficiency and installation standards for large diameter onshore pipelines. The work is far from complete, however. Indeed, it is hoped that Phase III of the initiative will produce some new sections and further development of content:

- Welding (new section);
- Pipelines and the environment (new);
- Testing (new);
- Earthworks (to be further developed);
- Logistics (to be further developed);
- Crossings (to be further developed);
- New trends and innovation (to be further developed).



IPLOCA President Osman Birgili (left) congratulates (left to right) Phase II group leaders Sean Haberer (Bredero Shaw), Paul Andrews (Fluor), Zuhair Haddad (CCC), Marco Jannuzzi (Caterpillar), Bruno Pomare (Spiecapag), Bernard Quereillahc (Volvo Construction Equipment) and Criss Shipman (Gulf Interstate Engineering).



IPLOCA's Board of Directors for 2011-12.
 From left to right in the front row are: Harald Dresch (Max Streicher); Douglas Evans (Gulf Interstate Engineering); Osman Birgili, President (Tekfen Construction); Najib Khoury (CCC); Karl Trauner (HABAU); and Juan Arzuaga (Executive Secretary of IPLOCA).
 Second row: Marco Jannuzzi (Caterpillar); Leonardo Gravina (Sicim); Adam Wynne Hughes (CRC-Evans); Andy Lukas (A. J. Lucas); Iosif Panchak (Stroygazmontazh); Nasser Issa (The C.A.T. Group); and Gerry Grothe (Pipeline Machinery International).
 Back row: Roberto Castelli (Bonatti); Daniel Fernandez (Techint); Pierluigi Zanin (Goriziane Group); Wilhelm Maats (Maats Pipeline Equipment); Jerrit Coward (Willbros); John Tikkanen (Bredero Shaw); and Bruno Maerten (GEOCEAN)
 Not pictured: Rajen Kilachand (Dodsall Group).

A wiki (a collaborative online tool) has been set up to allow IPLOCA members to make Phase III more interactive and easier to manage internationally during further development.

IPLOCA Convention 2011 – Beijing

More than 630 delegates attended IPLOCA's 45th Annual Convention, which was held in Beijing, September 12-16, 2011.

During the Convention, the Association elected its Board of Directors for 2011 to 2012; and recognised the hard work of the work group leaders of the Novel Construction Initiative's Phase II, which produced the second edition of *Onshore Pipelines: The Road to Success*.

Eight guest speakers gave presentations at the Open General Meetings including IGU's Secretary General, Torstein Indrebø, who talked about "The Role of Natural Gas in a Low-Carbon Energy Future". Details of these presentations are available at www.iploca.com/beijingpresentations.

Three awards were presented, as follows:

IPLOCA New Technologies Award, sponsored by BP
 Winner: Marco Laurini of Laurini Officine Meccaniche, Italy, for the Seam Aligner Clamp
 Runners Up:

CRC-Evans Pipeline International, USA, for the High Unround Line-Pipe Corrector Series: Internal Welding Machines and Copper Back-Up Clamps and New Generation Welding & Inspection Systems;

SPIECAPAG, France & Laurini Officine Meccaniche, Italy (jointly) for the Swamp Muletrax, Ultimate Multi-Purpose Tractor for Remote Swampy Areas;

Bredero Shaw, Canada for Thermotite ULTRA Superior Subsea Insulation

IPLOCA Health & Safety Award, sponsored by Chevron

Winner: SNC-Lavalin Construction, Canada, for the Focus Task Card

Technical and managerial support for the Czech gas industry

- The CGA represents the Czech Republic in IGU bodies: WOC, PGC and TF, and cooperates with other European and global non-governmental organisations
- Transmits information from international organisations to the Czech gas industry
- Develops legal and technical regulations and helps to harmonise them with EU legislation
- Pursues activities promoting the image of natural gas
- Supports education: conferences, workshops, etc.

Please pencil in your diary:

Central European Gas Congress

Prague, Czech Republic, 11 and 12 September 2012

For more information please visit: www.cgoa.cz/en/industry-events/CEGC-2012.ep

Czech Gas Association

Novodvorská 803/82, 142 00 Praha 4, Czech Republic

Tel./fax: +420 222 518 811, cpsvaz@cgoa.cz, www.cgoa.cz



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technical insight and training to
unlock the global potential of natural gas.

Runners Up:

Max Streicher GmbH, Germany for the Water, Principle of all Things programme;
 McDermott International, USA for the 2010 Zero Hand Injury Program Objective and Targets;
 Land & Marine, UK and National Grid, UK (jointly) for Targeting Zero Accidents through World Class Safety Leadership

IPLOCA Corporate Social Responsibility Award (presented for the first time)

Winner: GDK for refurbishment and maintenance of a bakery to support the Saõ Francisco do Conde Bahia APAE, an association of parents and friends of people with special needs.

Runners Up:

McDermott International, USA for Social Investments and Activities in Batam, Indonesia;
 Kalpataru Power Transmission, India, for their Save the Tiger campaign

The 2012 IPLOCA Convention will take place in Istanbul, September 10-14.

Osman Birgili of Tekfen Construction is the President of IPLOCA (www.iploca.com).

● **Pipeline Industry R&D Summit Led by PRCI**

By Cliff Johnson

In March 2011, the Pipeline Research Council International (PRCI) Board of Directors approved a new Strategic Plan for 2012-2017. This plan will enable PRCI to continue its leadership in the pipeline R&D arena and to provide the solutions needed by the industry to ensure safe, reliable and environmentally compatible operations. The new mission and plan are:

PRCI Mission Statement

To be the global leader in collaborative energy pipeline research that provides safe, reliable, environmentally conscious and efficient means of delivery.

- **Goal 1:** PRCI will execute and deliver innovative technical solutions using a nimble and flexible R&D process model.
- **Goal 2:** PRCI research is viewed as direction setting by stakeholders through the communication of technology needs, ongoing R&D and innovative solutions for the pipeline industry.
- **Goal 3:** PRCI will compel participation by fostering a collaborative culture that enables quality research, networking opportunities, professional development and industry leadership.
- **Goal 4:** Develop and maintain the worldwide collaborative pipeline industry R&D "roadmap".
- **Goal 5:** Identify and pursue step change solutions for the energy pipeline industry.

In response to the Strategic Plan and the current initiatives and high level of interest in the pipeline community in research and development (R&D) programmes, PRCI hosted an R&D Summit in Houston, Texas on December 7 & 8, 2011. The R&D Summit was organised to establish consensus and unified agreement of the top priorities for pipeline R&D and develop a process by which the top priorities can be addressed in a more efficient and more collaborative manner by the industry stakeholders. The R&D Summit provided the forum needed to solicit input from industry experts with a diverse range of needs and interests, develop a framework to achieve better collaboration to meet the needs of the industry and focus energy and resources on activities that have the greatest impact and benefit. Another objective of the R&D Summit was to bring together and align two separate initiatives of the liquids pipeline industry, AOPL/API Pipeline Safety Improvement Areas (or PSIA) and INGAA Integrity Management Continuous Improvement (or IMCI), each of which has identified pipeline research as a core component to further improving pipeline safety and achieving the ultimate goal of zero incidents. The R&D Summit was an initial step to developing the pipeline industry R&D Roadmap, which is part of PRCI's Strategic Plan.



The PRCI 2012 Research Exchange Meeting was held in Phoenix, February 7-9.

The R&D Summit included two half-day sessions for the participants. Day 1 included several presentations followed by discussion on improving the current model for pipeline R&D. The presentations provided an overview of the current state of the pipeline industry R&D programme and where the industry needs to be, including the future vision for pipeline R&D and an improvement to the existing processes and programmes to promote a comprehensive and unified pipeline industry R&D Roadmap. Day 2 was dedicated to breakout sessions that provided an opportunity for industry subject matter experts to address the top priorities (as defined from the AOPL/API PSiAs and the INGAA IMCI), the gaps associated with each, and defining how to address the gaps. The outputs from the breakout sessions on Day 2 have provided the foundation for the initial development of the pipeline industry R&D Roadmaps, which are being drafted by PRCI and will be distributed for review by the industry organisations and stakeholders when completed.

The R&D Summit is the first in a series of meetings and workshops that PRCI is sponsoring to work toward the development of the pipeline industry unified R&D Roadmap. The initial meeting in Houston focused on integrity management R&D

programmes for onshore transmission pipelines. PRCI plans to organise separate meetings to solicit greater input from distribution pipeline operators/organisations, Facility Integrity Management and offshore and subsea pipelines, with facility integrity and subsea pipelines being established R&D programmes within PRCI. The most recent session to promote and advance the R&D Roadmap was in February in Phoenix, Arizona as part of the PRCI 2012 Research Exchange Meeting. In addition, PRCI will sponsor a meeting with European operators in conjunction with the May 2012 Pipeline Programme Technical Committee Meeting, which is being held in Barcelona, Spain.

PRCI acknowledges the participation and support of the American Petroleum Institute (API), the Association of Oil Pipelines (AOPL), the Australian Pipeline Industry Association (APIA), the Canadian Energy Pipeline Association (CEPA), the European Pipeline Research Group (EPRG) and the Interstate Natural Gas Association of America (INGAA), each of which attended the R&D Summit and contributed substantially to the successful outcome of the Summit.

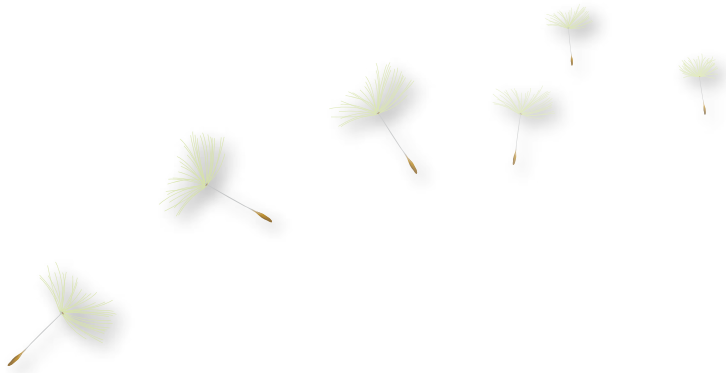
Cliff Johnson is the President of the Pipeline Research Council International (www.prci.org).



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Welcome to the 25th World Gas Conference

By Zahariah Abdul Rahman

With only a few more months to go, the National Organising Committee is making the final preparations to host the Silver Jubilee World Gas Conference (WGC2012) in Kuala Lumpur, June 4-8. We have been planning the event since 2008, and are expecting to welcome 5,000 delegates and 10,000 trade visitors to Malaysia.

● Registration

Early Bird registration closed on December 31, 2011, by which time 1,700 delegates had registered. They were automatically entered into a draw to win a variety of exciting prizes and we congratulate the winners. The key dates for registration are now:

- April 4 – Deadline for cancellation;
- April 15 – Deadline for bank transfer payment;
- April 30 – Deadline for registration on the WGC2012 website; and
- June 2-8 – On-site registration.

We would like to remind registered delegates to book their accommodation soon as the rooms within the WGC2012 Concept Village are being taken up very quickly. Registration and accommodation information is available through our official website at www.wgc2012.com.

● Conference

Each day of WGC2012 will have a theme – Foundation for Growth, Securing Gas Supply, Enhancing Gas Demand and A Sustainable Future – and we have lined up debates on current topics related to these themes. There will be 14 keynote speakers (see *Table 1* for a list of confirmed speakers), four luncheon speakers and 10 high-level strategic panel sessions (see *Table 2* for a list of topics).



Zahariah (Liza) Abdul Rahman.

The results of studies that have been carried out by IGU's Technical Committees during the Malaysian Presidency will be shared in committee sessions, expert fora and a new type of poster session called the Interactive Expert Showcase.

WGC2012 will also be featuring a Youth Programme for the first time in the series of World Gas Conferences, and a range of exciting activities will run concurrently with the main event.

Don't miss out on any of these interesting sessions while you are at WGC2012.

● Paper submission

At the close of the call for papers, we had received 712 abstract submissions. Those authors selected had until February 1 to submit their final papers. Guidelines for speakers have been distributed and are also available on our website.

● Exhibition

Over 200 companies have booked exhibition space at WGC2012 and we have filled the capacity of our main exhibition area. We have allocated additional space to give international and local businesses a last opportunity to take part in this prestigious event.



BELOW
Table 1.

KEYNOTE SPEAKERS

Foundation for Growth (June 5, 08:30-09:15)



Chair

Datuk Anuar Ahmad
Executive Vice President,
Gas & Power Business
PETRONAS



Keynote Address 1: Natural Gas
for Sustainable Global Growth

Peter Voser
CEO
Royal Dutch Shell



Keynote Address 2: Enabling
Economic & Environmental
Progress: the Role of Natural Gas

Rex W. Tillerson
Chairman & CEO
Exxon Mobil Corporation

Foundation for Growth (June 5, 13:45-14:30)



Chair

Jérôme Ferrier
Vice President
International Gas Union



Keynote Address 3: Integrating
the World Gas Market

Alexey Miller
Deputy Chairman of the Board
of Directors & Chairman of the
Management Committee
OAO Gazprom



Keynote Address 4: Investing in
Gas Infrastructures

Paul van Gelder
Chairman of the Executive Board
& CEO
Gasunie

Securing Gas Supply (June 6, 08:30-09:15)



Chair

Dr Valery Yazev
President, Russian Gas Society &
Deputy, State Duma of the
Russian Federation



Keynote Address 5: Securing
Future Gas Supplies

George Kirkland
Vice Chairman & Executive Vice
President, Global Upstream &
Gas, Chevron Corporation



Keynote Address 6:
The Next Phase for Global LNG

**Hamad Rashid Al
Mohannadi**
Managing Director
RasGas Company Limited

Securing Gas Supply (June 6, 13:45-14:30)



Chair

Khalid Al Thani
CEO
Qatargas Operating Company
Ltd.



Keynote Address 7:
New Supply Perspectives for Gas
Markets in Asia

Karen Agustawan
President Director & CEO
PT Pertamina (PERSERO)



Keynote Address 8: New Sources
& New Markets for Gas

Helge Lund
President & CEO
Statoil ASA

Enhancing Gas Demand (June 7, 08:30-09:15)



Chair

Kangsoo Choo
President & CEO
Korea Gas Corporation



Keynote Address 9: Satisfying
the Needs of Customers

Mitsunori Torihara
Chairman
The Japan Gas Association



Keynote Address 10: Fuelling the
Tiger

B. C. Tripathi
Chairman & Managing Director
GAIL (India) Limited

Enhancing Gas Demand (June 7, 13:45-14:30)



Chair

Jean-François Cirelli
President
EUROGAS



Keynote Address 11: Growing
National & Global Markets

Zhou Jiping
President, CNPC & Vice
Chairman & President,
PetroChina



Keynote Address 12: Building
Demand in a Competitive
Market

Lawrence Borgard
Chairman, American Gas
Association & President & COO,
Utilities, Integrys
Energy Group, Inc.

A Sustainable Future (June 8, 08:30-09:15)



Chair

Paolo Scaroni
CEO
Eni



Keynote Address 13: Challenges
Along the Gas Chain

Christophe de Margerie
Chairman & CEO
TOTAL



Keynote Address 14: The
Natural Choice for a Sustainable
Future

Gérard Mestrallet
Chairman & CEO
GDF SUEZ



STRATEGIC PANELS AND SPECIAL SESSION

<i>Strategic Panel (SP)</i>	<i>Host/Organiser</i>
SP1 The Future of Natural Gas: Winning the Race for Talent	Task Force 1
SP2 Youth Roundtable Forum: the Magic in the Young Generation	Task Force 2
SP3 Impact of Geopolitics on Natural Gas Market Development	Task Force 3
SP4 Unconventional Gas: A Game Changer or a Global Bubble?	Presidency and Gas Technology Institute
SP5 The Future of LNG	Presidency and Programme Committee D
SP6 The Case for Natural Gas	Presidency and Programme Committee E
SP7 Natural Gas Vehicles – Sustainability & Opportunity	NGV Global and Working Committee 5
SP8 Innovation & New Technology – the Key to Increase the Gas Business	IGU Research Conference
SP9 Gas & Renewables Partnership	Programme Committee A and Programme Committee E
SP10 Special Panel from the World Petroleum Council (WPC)	WPC
<i>Special Session</i>	
Triennial Work Programme 2012-2015	Incoming Presidency

ABOVE
Table 2.

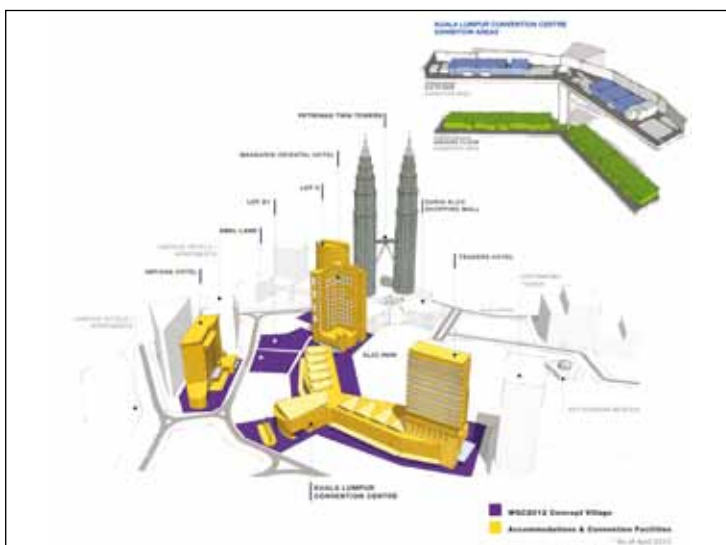
Hospitality suites can be booked at our three main hotels. At the Mandarin Oriental Kuala Lumpur, 80% of the hospitality suites have been sold, while only four are left at Traders Hotel with another four remaining at Impiana KLCC Hotel.

We started selling advertising space in the WGC2012 Exhibition Catalogue in the last quarter of 2011, and launched the Trade Visitor Marketing Campaign in February.

● A fascinating destination

We are encouraging delegates to enhance their trip with the numerous post-conference tours and social events that are available. These include a special concert by the Malaysian Philharmonic Orchestra featuring traditional Malaysian music, Gamelan. This will take place at the much acclaimed Dewan Filharmonik PETRONAS, which is adjacent to the WGC2012 Concept Village. A golf tournament has also been arranged on June 3 for those interested.

Furthermore, delegates will be able to enjoy half-day city tours or longer sightseeing or adventure tours should they like to extend their stay. Malaysia has much to offer, so do take this opportunity to explore the country. For more





ABOVE AND OPPOSITE BELOW The Kuala Lumpur Convention Centre will be the hub of the WGC2012 Concept Village.

information and to book these tours, visit our website www.wgc2012.com.

● **Everything matters**

In doing our best to achieve a memorable delegate experience, we have left no stone unturned. Delegate safety and security are of utmost importance to us. Close collaboration with the relevant authorities and the host sponsor, PETRONAS, are on-going to ensure smooth running of the conference.

We are getting strong support from our sponsors, who are still growing in number. To date our sponsors are Shell, Qatargas, TOTAL, ExxonMobil, RasGas Company Limited, Mitsubishi Corporation, GDF Suez, Chevron, JX Group, Kogas, Scomi, BP, Murphy Oil, Hess, JGC and

Talisman Energy. We have also engaged various partners to assist in providing high-quality services to delegates and the WGC2012 organising team. They include courier, internet, airline and medical companies.

From the moment a delegate lands until they bid goodbye to Malaysia, we hope that while they gain much from the conference and exhibition, they will also experience the richness and warmth of Malaysian culture and hospitality. It is our hope that WGC2012 will be a conference to remember and Malaysia a destination to return to.

We'd like to thank the team and all our sponsors, partners and the media for helping us bring the event together.

See you in Kuala Lumpur!

Zahariah (Liza) Abdul Rahman, Chief Executive Officer of WGC2012 / Head Directorate of the National Organising Committee.

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Message from the Incoming President

By Jérôme Ferrier

2011 was an exceptionally eventful year. The Arab Spring saw political repercussions across North Africa and the Middle East, the financial and economic crisis created a shockwave that increased unemployment and social pressures, while the economic climate and the catastrophe in Japan, which revived the debate over nuclear power, caused an energy crisis.

What challenges are in store for 2012? Will peace return to the North African and Middle Eastern countries affected by the spring uprisings? Will the financial world stabilise and release the investment needed for growth? Will natural gas become the energy of the future, complementing renewable energies and supporting sustainable development? Of these questions, the last two will be central to the discussions at the 25th World Gas Conference in Kuala Lumpur in June.

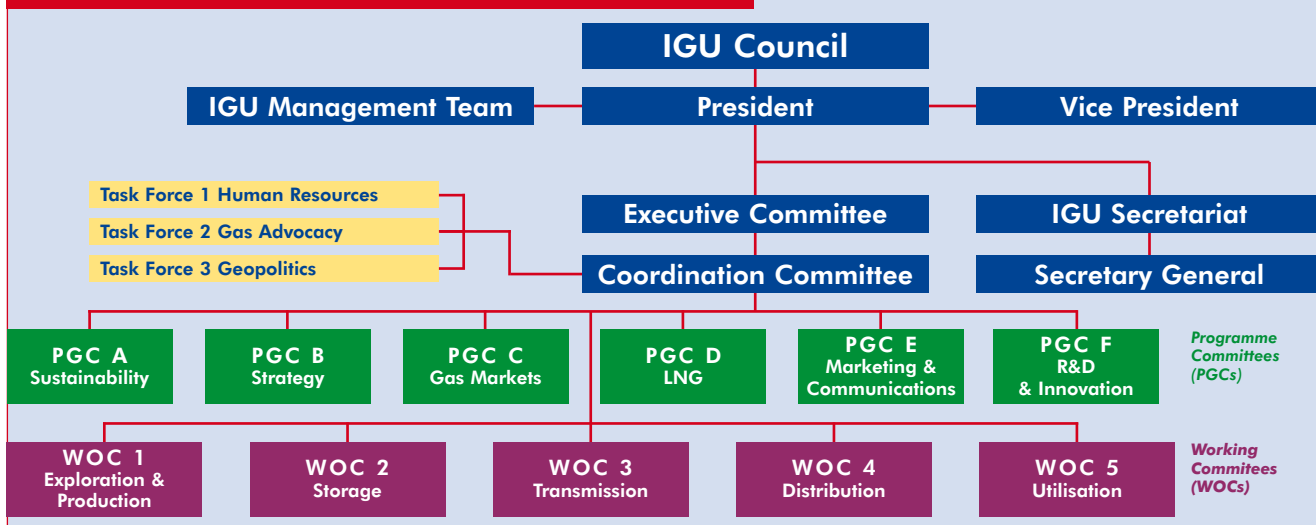


Jérôme Ferrier: the gas industry must be united.

That is when France takes over the Presidency of IGU. It's an honour and a privilege for us to take on this role at such a challenging time.

As candidates in 2008, we made "Growing Together" the theme of our campaign. To mark the start of our three-year term, we've expanded this

IGU Organisation 2012–2015



A new Programme Committee (PGC F) will be set up under the French Presidency.



A key challenge for the industry is mobilising sufficient human resources.

to “Growing together towards a friendly planet”. Of course, we want the entire energy sector to grow together, not just the gas community. We can only succeed by working together.

To achieve this, the gas industry must be united. Today, IGU comprises 78 Charter Members and 38 Associate Members, but we need to expand our activities and convince the gas industry’s new players – from Africa, Latin America and Asia – to join us.

For many years, the gas industry has had a low profile – now we have to raise our profile and our voice. A lot of progress has been made over the past few years as we’ve realised how important it is to present our point of view, supported by realistic and relevant arguments. In particular, we need to target the European Union. Europe’s national gas associations were the driving force behind IGU’s creation in 1931 and European countries continue to be leading gas consumers, but unlike America or Asia, Europe has so far failed to give much consideration to the role that natural gas can play in optimising the energy mix. It is up to us to use the powers of persuasion of the Gas Advocacy Task Force to convince politicians of the benefits of natural gas.

Putting research and innovation at the heart of our business is the second focal point for our Presidency. That is why we will be launching a new Programme Committee dedicated to research and innovation (PGC F) in June. PGC F will take over the organisation of the triennial IGU Research Conferences – the next being scheduled for Copenhagen in 2014. This is particularly relevant in the light of the unbundling of activities imposed on major energy groups in the EU, as this affects their research strategies and makes the funding of certain programmes subject to approval from the regulatory authorities.

Thirdly, we will be putting emphasis on mobilising the human resources required for the future development of the natural gas industry. It will be a major challenge to find people with the right skills and to persuade them to join us. This will be a primary focus for our Presidency.

The French team is ready to set to work on these objectives, prepared for whatever new situation arises, and willing to defend the benefits of natural gas with strength and conviction.

Jérôme Ferrier is the Vice President of IGU and will become President at the close of the 25th WGC.

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COORDINATION COMMITTEE PROGRESS REPORT

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Introduction and Key Developments

By Ho Sook Wah and Ungku Ainon Ungku Tahir



Ho Sook Wah, CC Chairman (LEFT) and Ungku Ainon Ungku Tahir, CC Secretary (RIGHT).

RIGHT
Table 1.

The Coordination Committee (CC) progress report provides information about the status of the work as described in the Triennial Work Programme (TWP), and consists of contributions and updates by IGU's five Working Committees (WOC), five Programme Committees (PGC) and three Task Forces (TF). This is the fourth and final progress report of the 2009-2012 Triennium. It aims to give the reader a preview of the technical programme to be delivered during the 25th World Gas Conference (WGC2012) in Kuala Lumpur, Malaysia, June 4-8, where the results of almost three years of studies and work by some 914 members of the Technical Committees will be presented.

● Good response to WGC2012 Call for Papers

The preliminary programme was made available beginning May 1, 2011, in an electronic version as well as in hard copy, and was distributed to IGU members and others across the spectrum of the global gas industry.

The Call for Papers for WGC2012 was launched on February 1, 2011 with a closing

deadline of September 1, 2011. However, the deadline was extended to September 18 following many requests for an extension due to the summer holidays. A total of 712 abstracts (4% more than WGC2009) from 50 countries were received for evaluation, representing a new record for IGU. Tables 1 and 2 show the breakdown of abstracts submitted by Technical Committee and by the top 10 countries respectively.

From the 712 submissions received, 352 papers were accepted. At press time, 204 had been selected for oral presentation and another 148 for the Interactive Expert Showcase (IES), the new name for the poster session.

The IES gives authors an opportunity to make a 10-minute oral presentation as well as to display their poster. All presentations by IES authors have been carefully planned in order not to clash with

ABSTRACTS SUBMITTED BY COMMITTEE

Committee	Submitted	Approved
WOC 1	107	45
WOC 2	37	24
WOC 2 / PGC A*	10	10
WOC 3	109	38
WOC 4	75	45
WOC 5	128	51
PGC A	47	20
PGC B	41	28
PGC C	48	31
PGC D	65	38
PGC E	15	9
TF 1	14	9
TF 2	5	4
TF 3	11	0
TOTAL	712	352

* For a joint Expert Forum

ABSTRACTS SUBMITTED BY COUNTRY, TOP 10

China	72
Iran	65
Russia	64
Japan	55
Brazil	45
USA	41
France	37
Algeria	31
The Netherlands	27
UK	26

A total of 50 countries submitted abstracts

the relevant Committee Session/Expert Forum or the Plenary Sessions, hence allowing delegates to attend the presentation. Each day will see some 45 physical posters on display from three Committees. Presentations will be given concurrently at special podiums with at least 10-15 seats each in Exhibition Hall 6. In addition, it will be possible to view posters throughout WGC2012 via touch-screen computer terminals at the IES booth. Successful authors for both the oral and IES sessions were notified on November 15, 2011. Submission of their full papers was on February 1.

● **Awards**

There were 247 submissions for the Best Practices Award, which were reviewed by the IGRC Technical Programme Committee (TPC). A short list of 30 was drawn up from which the best three papers have been selected as winners.

The IGRC TPC invited entries for the Gas Efficiency Award at the time it made the call for papers for IGRC2011. The initial selection of submissions was made by a group of experts drawn from the IGRC TPC including its Chair, Marc Florette, Senior Vice President Research & Innovation at GDF SUEZ. Three proposals were

short-listed for final selection of the winner by the IGU Evaluation Committee.

There were 145 submissions for the Social Gas Award, which were reviewed by a group of experts from PGC A (Sustainability) including its Chair, Juan Puertas, Director of Engineering & Technology at Gas Natural Fenosa. Three proposals were short-listed for final selection of the winner by the IGU Evaluation Committee.

The winners of all the Awards will be announced during WGC2012.

● **CC meeting**

The Coordination Committee held its seventh meeting in Dubrovnik, Croatia in conjunction with the meetings of IGU's Executive Committee (EXC) and Council. The Chairs and/or representative of the various Committees and Task Forces presented the progress and challenges of their work in the presence of EXC members and guests during the open second part of the meeting. Preliminary programme booklets for WGC2012 were also distributed to all delegates.

LEFT
Table 2.



Dubrovnik with its breathtaking views was the venue for the seventh CC meeting of the Triennium.



A working session during the seventh CC meeting.

The meeting focused on the programme content and activities planned for WGC2012. Additionally, Robert Badoux, Secretary of the IGRC TPC gave a briefing on the review and selection process for the Best Practices Award, while the TOC Chair, Marc Florette gave a presentation on the final preparations for IGRC2011 in Seoul, Korea.

Throughout 2011, the CC Chairman, Secretary and representatives from IGU management continued to attend and participate in the scheduled Committee meetings whenever possible, or through conference calls with the Committee leaderships to discuss work progress and related matters. Attendance by members at all CC meetings has been very good reflecting a high level of support and commitment. We would like to express our deep appreciation to the Chairs, Vice Chairs, Secretaries, Study Group leaders and all the Committee members who have contributed with such commitment during the Triennium.

The CC meeting was followed by meetings of the EXC and Council, which included a half-day workshop on gas advocacy in which CC members participated. Gas advocacy will remain a key item on IGU's agenda going into the next Triennium.

Summaries of the Committees' progress reports follow this introduction. The full documentation and minutes of the seventh CC meeting in Dubrovnik are available to IGU members on the CC section of the IGU website.

● Special projects

The special projects of the Malaysian Triennium focus on two key issues impacting the outlook of the gas industry, namely human resources and geopolitics.

Task Force 1 – “Building Strategic Human Capital” has concentrated on understanding the demographics of the industry; the key issues relating to the attraction, retention and development of critical talent; priorities and challenges across regions; sharing of best practices; and how energy professionals see the future and attractiveness of the industry. TF 1 has organised a WGC2012 Strategic Panel with invited speakers to debate the key messages from the study.

Task Force 2 – “Nurturing the Future Generations” was set up in response to the crisis facing the gas industry due to the diminishing talent pipeline of science, technology, engineering and mathematics (STEM) students. TF 2 has been assessing the efforts of academia, industry and government to stimulate the interest of young people in STEM; as well as developing a strategic approach and recommendations to tackle the crisis. TF 2 will present its findings and recommendations at WGC2012 and has also organised the WGC2012 Youth Programme, the first time dedicated events for young people have been held during a World Gas Conference.

Task Force 3 – “Geopolitics and Natural Gas” has been examining the interplay between economic and political factors in the development of

natural gas resources. Some key themes have emerged from four regional roundtables held by TF 3 and a global roundtable hosted by the International Energy Agency.

These will be shared and debated at the Strategic Panel organised by TF 3 during WGC2012, for which an interesting line-up of invited speakers have confirmed their attendance.

The progress report from the Task Forces gives a round-up of recent developments and follows the progress report from the Committees.

● **WGC2012 in Kuala Lumpur**

The preparations for the 25th World Gas Conference in June are progressing well with speakers for the 14 Keynote Addresses having all confirmed. There will be four Luncheon Addresses, 10 Strategic Panels, one Special Session on the TWP 2012-2015, 30 Committee Sessions, 17 Expert Fora and 148 posters displayed in the Interactive Expert Showcase from Tuesday, June 5 to the closing day on Friday, June 8. The opening ceremony of WGC2012 is scheduled for Monday, June 4 and will be followed by the opening of the exhibition.

WGC2012 has adopted different themes for each day of the conference starting with the theme

“Foundation for Growth”. Day 2’s theme is “Securing Gas Supply”, followed by “Enhancing Gas Demand” for Day 3 and “A Sustainable Future” on the final day. The Keynote Addresses and Strategic Panels have been planned and structured in line with the theme of the day. The Strategic Panels will cover topics of strategic and current significance to the gas industry including unconventional gas, LNG, gas advocacy and a special presentation by the World Petroleum Council (WPC).

The inaugural WGC Youth Programme will run concurrently with the main event in a nearby venue. It will include a Youth Conference and Carnival, Youth Roundtable Forum, Fun with Gas Carnival, Movie Magic Youth Night-out, the World NRG (Energy) Battle and other activities. All WGC2012 delegates are invited to join in the fun and interact with the young people.

Ho Sook Wah is the Chairman of the Coordination Committee and Ungku Aion Ungku Tahir is the Committee’s Secretary. Readers enquiring further information are invited to contact Ungku Aion at ungkuainon@malaysiangas.com or to visit IGU’s website at www.igu.org.



Delegates enjoyed a reception and dinner after the meeting.

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ANCIENT WISDOM GIVES

Rich in natural gas resources, China has seen natural gas demand increase rapidly in tandem with its expanding economy. This situation has brought both challenges and opportunities for the industry in recent years. China Gas Society and the China Gas Association are committed to fostering technological innovation and the favourable development of China's gas industry. Our members come from government, regional associations, R&D institutes, universities, gas companies and related enterprises, with leading experts working in teams that cover all fields of the gas industry. We promote the development of clean burning natural gas for a sustainable energy supply which contributes to a healthier environment on earth.



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Web: www.chinagas.org.cn/



Progress Reports from the Committees

This chapter contains news and information from IGU's five Working Committees and five Programme Committees.

● Working Committee 1 – Exploration and Production

WOC 1's fourth meeting of the Malaysian Triennium was hosted by GDF SUEZ in Paris, France, September 27-29. The venue was the Sofitel Arc de Triomphe Hotel and 19 delegates from 10 companies in 10 countries attended.

CC Chairman, Ho Sook Wah briefed delegates on the latest activities of IGU and the Coordination Committee. He also gave a report on the Call for Papers for WGC2012. WOC 1 submitted 107 abstracts out of a final total of 712.

WOC 1's Chair, Amine Mazouzi welcomed Denis Krambeck Dinelli from Petrobras as the new Vice Chair replacing Hugo Repsold.

The Committee's Study Groups also held their meetings and presented their progress reports in the plenary session.

SG 1.1 *Recent advances in the exploration and production of natural gas*

Leader: Denis Krambeck Dinelli (Brazil)

The new Vice Chair of WOC 1 and leader of SG 1.1 reviewed work progress and outlined the topics covered in each chapter of the report:

- Resources and reserves – updated assessments of resources and reserves estimates for conventional and unconventional natural gas based on the IGU regions.
- Trends in exploration and discoveries – the Wood Mackenzie report "The future of the exploration programme", published in February 2011, was used as a reference.
- New frontier and exploration areas – a review of areas that are likely to be the focus of new exploration for the next decade.
- The latest technologies and standards for gas development – a review of technologies related to the development of conventional and uncon-



Delegates to WOC 1's fourth meeting pose for group photograph beneath the Eiffel Tower in Paris (ABOVE) and enjoy dinner during a cruise on the River Seine (OPPOSITE).

ventional gas. In order to help complete this chapter, it was agreed that members from Russia will write a section about recent technologies to explore and produce in the Arctic; members from China will write about tight gas technologies; and members from Malaysia will write about technologies to explore and produce natural gas that contains high levels of CO₂. Furthermore, Creties Jenkins, Vice President of DeGolyer and MacNaughton was asked to write a section about shale gas. He was also invited to present a paper based on his extensive knowledge and experience of unconventional gas in the USA.

SG 1.2 Current and future gas developments

Leader: Flavia Di Cino (Argentina)

The leader presented a report on the results of the Study Group's work. The report's main objective is to support the development prospects of E&P projects for conventional and unconventional gas worldwide by 2020.

It was noted that the methodology currently used to examine projects includes parameters such as timing, investment and gas prices to make these projects profitable. The issue of regulation is also applicable to unconventional gas.

Work programme for the next Triennium

Denis Krambeck Dinelli presented WOC 1's proposal for the 2012-2015 Triennial Work Programme. The main topics are:

Continuation of previous issues:

- Recent advances in E&P of natural gas; and
- Most significant new E&P gas projects + CO₂ reinjection for sequestration.

Focus on:

- Advanced recovery and field productivity;
- Unconventional gas (tight, shale and acid gas, CBM, hydrates): technical and environmental issues; and
- E&P in new horizon areas like the Arctic (winterisation, technology, etc.).



WGC2012 papers

The last day of the meeting was dedicated to reviewing authors' submissions using the Abstract Management System (AMS). The evaluation committee comprised five reviewers:

- Amine Mazouzi, WOC 1 Chair;
- Flavia Di Cino, leader of SG 1.1;
- Denis Krambeck Dinelli, WOC 1, Vice Chair and leader of SG 1.2;
- Vincent Trocmé Co-Chair of Committee Session 1.2; and
- Ilhane Dib, WOC 1 Secretary and Co-Chair of Expert Forum 1.A.

Eighty-six papers were downloaded of which 61 related to SG 1.1's work and 25 to SG 1.2's work.

Final meetings of the 2009-2012 Triennium

WOC 1's fifth meeting was hosted by Sonatrach in Oran, Algeria on March 1, following a two-day workshop on "Shale Gas: Challenges and Achievements – Impact on the Global Gas Industry". The workshop was organised by Sonatrach to mark Algeria's pilot shale gas drilling programme.

Working Committee 2 – Storage

WOC 2's fourth meeting was hosted by E.ON Gas Storage in Essen, Germany, November 15-17, 2011. It was attended by 40 people including E.ON Gas Storage employees who participated in the event.

As part of the programme there was a technical tour to the underground gas storage (UGS) facility in Epe, which is the largest gas storage cavern in Europe. E.ON Gas Storage operates 36 salt caverns in an area where around 100 caverns are operated by different companies.

Members contributed to a workshop, mainly focused on "Increasing demand for availability of UGS". There were four presentations:

- Maximising storage availability during revamping or development works", Remy Champavere, Storengy;
- "Inchukalnsky UGS modernisation" ,Ivars Scerbickis, JSC Latvijas Gaze, a new member of WOC 2;
- "Energy storage", Holger Matthiesen, E.ON Gas Storage; and
- "Sekihara UGS, underground storage gas reservoir in Japan", Tatsuo Shimamoto, INPEX.

New members from Algeria introduced their company (Sonatrach) and their interest in storage.

CC Chairman, Ho Sook Wah gave updates on IGU and CC activities and invited members to register for WGC2012.

WOC 2 Chair, Hélène Giouse briefly presented the Committee's sessions during WGC2012 and the papers selected:

- *Committee Session 2.1: "New UGS projects for new gas markets";*

- *Committee Session 2.2: "Optimising UGS capacities: challenges for operators and clients";*
- *Committee Session 2.3: "Competencies and innovative technologies for efficient UGS";* and
- *Joint Expert Forum WOC 2 + PGC A: "CO₂ capture, transport and sequestration: technologies involved and project developments to increase gas industry sustainability".*

Forty-two abstracts were submitted for WOC 2's sessions from most of the regions of the world, but some of them had to be re-allocated to other Committee sessions. Four members of WOC 2 reviewed the papers for selection. The participation of North America in WOC 2 sessions is under discussion but is not confirmed.

Hélène Giouse reported briefly on the IGRC2011 session she chaired, entitled "How can advanced geo-engineering impact bottom-line performance?", during which three papers related to storage were presented.

Progress of the sub-groups

SG 2.1 *Updating and improving the UGS database and promoting it as a reference Leader: Ladislav Goryl (Slovakia)*

Information on 197 storage facilities has been updated from completed questionnaires. US data was received separately via a WOC 2



WOC 2's fourth meeting included a technical visit to the Epe UGS facility.



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corresponding member. The basic statistics on global UGS are presented in *Table 1*.

Detailed statistics and analysis were presented during the meeting in Essen (by type of storage, regions of the world and nations). A forecast of capacities up to 2020 will be given in the report, a first draft of which was sent to WOC 2 members for comments after the meeting. Some work remains to be done to finalise the report and the database:

- Short national reports need to be written to present recent trends (for the biggest storage nations) and technical trends according to the answers to the questionnaire; and
- Consistency with UNECE data needs to be checked (this work has been done for GSE data) and also with forecasts in the 2030 outlook study being updated by PGC B.

SG 2.2 *Definition of some best practices in UGS operation and design*

Leader: H  l  ne Giouse (France)

Methane emission reduction
(Pierre Marion, France)

An article entitled "Efforts to reduce methane emissions in UGS operations" was published in the October 2011 issue of the IGU Magazine. It will be the basis of the report on this topic. The work outstanding is to check the consistency of the ratio of methane emitted by UGS facilities by cubic metre of working gas stored with other sources of information, especially Marcogaz for Europe.

Well integrity assessment
(H  l  ne Giouse, France)

The meeting in Essen was the opportunity to discuss both the orientation and content of the report on this topic. A general methodology and key recommendations will be presented in the report.

CO₂ sequestration (Herman Spreckels, Germany)

Work on this topic has been carried out in close cooperation with PGC A and a joint Expert Forum will take place during WGC2012. The abstracts were selected during a joint meeting in Amsterdam on October 25. WOC 2 has contributed to the PGC A report by writing the chapter on geological sequestration. A short abstract on that topic will be included in WOC 2 report.

Contribution to Best Practices Award

SG 2.2 has contributed to the selection of best practices in its field of competencies. This selection process is led by the IGRC2011 Technical Programme Committee.

SG 2.3 *Skills and competencies for UGS activities*

Leader: Vladimir Onderka (Czech Republic)

The organisation of the young professionals exchange programme (YEPP) was a success. This programme delivered three courses (in English) on geosciences, reservoir engineering and treatment of gas to young professionals working in gas companies. YEPP was launched in Moscow on June 20, 2011, coinciding with the beginning of the first course supported by Gazprom UGS and Gubkin University.

The two other courses took place in the Czech Republic with the support of the Technical Institute of Liberec and RWE, and the Institute of Chemical Technology and the Czech Gas Association, respectively. The courses were spread over six weeks in the summer of 2011 and attended by 15 people from China, the Czech Republic, Germany, Poland and Russia. A final assessment ranked the

BELOW
Table 1.

KEY STATISTICS FROM THE SG 2.1 UGS DATABASE

UGS parameter	2007	2010
Number of storage facilities	630	672
Total installed working gas volume (bcm)	322.5	344.3
Peak withdrawal rate (mcm/day)	5,205	5,559
Number of storage wells	22,728	23,013



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participants and the top three will have the opportunity to participate in the WGC2012 Youth Forum.

YEEP was presented during Essen meeting and the best student, Alexander Salzwedel (E.ON Gas Storage, Germany) gave a positive feedback on the programme.

A questionnaire was sent to human resources managers of storage companies in December 2010 and around 15 answers were received. The analysis of these results will form the basis of SG 2.3's report with a comparison with the global analysis done by TF 1.

Fifth meeting

WOC 2's final meeting of the Triennium was hosted by Enagás in Madrid, Spain, February 15-17.

● **Working Committee 3 – Transmission**

WOC 3's fifth meeting was hosted by GHD in Brisbane, Australia, November 9-11, 2011, and was attended by 28 members from 17 countries. For many it was an extraordinary experience to leave home during autumn and to land some

hours later in a country enjoying springtime. On arrival in the meeting room delegates were greeted by WOC 3's anthem "I can't give you anything but ..." played over the speakers with the text displayed on the projection screen for them to sing along. Barbara Jinks of GHD welcomed delegates and invited a professional singer to sing the Australian national anthem. Barbara then gave some practical information and wished everyone a pleasant stay in Brisbane.

WOC 3 Chair, Eric Dam welcomed delegates and thanked Ungku Aion Ungku Tahir, CC Secretary for her presence at the meeting. Eric also thanked Barbara Jinks from GHD and the external sponsors (APIA, APA Group, NACAP and the Australian Gas Industry Trust) for hosting the meeting and arranging an excellent programme.

Cheryl Cartwright from APIA/AGIT and John Ferguson from the APA Group gave a presentation on gas transmission activities and projects in Australia. Updates on the latest IGU and CC activities were given by Jeanet van Dellen from the IGU Secretariat and Ungku Aion Ungku Tahir, respectively. Ungku also gave an update on preparations for WGC2012. There were presentations by Paddy Krishnaswamy on developments at Energinet (Denmark) and Paul Rasmussen on developments at Gassco (Norway).

Moving forward, Rein Bolt, WOC 3 Secretary explained the working process and outcome of the WOC 3 paper evaluation by the review team. In total, WOC 3 received 109 abstracts from 25 countries. It was a real challenge for the review team to read and to score all the abstracts. In the end, the review team selected 19 papers for oral presentations at WGC2012, 15 papers for the Interactive Expert Showcase and four papers for the reserve list.

There was a roundtable and the following interesting presentations were given:

- "News of the gas industry in Argentina", Daniel Falabella (Argentina);



WOC 3's fifth meeting was attended by 28 members.

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The transmission system operated by Eustream represents an important energy link between Russia and the European Union. It is interconnected with major European trunk lines in Ukraine, the Czech Republic and Austria. The basic mission of Eustream is to transport natural gas in Slovakia and through Slovakia to the European markets. A large part of Eustream's work concerns international gas transit.

Since 1968, Eustream has secured the transmission of more than 2 trillion cubic meters of natural gas across the territory of the Slovak Republic and successfully continues in more than 40-year tradition of international gas transmission.

Eustream operates a large-scale high-pressure gas transmission system with the biggest compressor station in the EU at the Slovak - Ukrainian border. A total output of nearly 300 MW is allowing an entry flow of almost 300 million cubic meters per day. The annual capacity of the transmission system is over 90 billion cubic meters.

We build up relationships with all business partners by way of a professional approach; we allow accessing the gas transmission network on a transparent and non-discriminatory basis in full compliance with gas industry legislation and standards. We react to market demands and offer a broad range of transmission services.

Thanks to the continual modernization and upgrading of infrastructure, Eustream contributes to ensuring safe and reliable gas supplies to Central and Western Europe. The company is investing into new equipment and environmental technologies in order to minimize the environmental impact of transmission system activities and to increase the reliability and safety of transmission.

Eustream, in close co-operation with adjacent network operators, is currently reviewing gas flow directions and cross-border capacities in order to enhance further the security of gas supplies to Europe.



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WOC 3 members pose for a group photo in Brisbane.

- “Opportunities in India’s growing market for LNG: a customer perspective”, Ashu Shinghal (India);
- “Tsunami research September 2011”, Kenji Aizu (Japan);
- “Opening the Gate LNG terminal”, Rein Bolt (The Netherlands); and
- “Shale gas developments”, Hector Fajardo (USA).

The incoming WOC 3 Chair, Benjamin Guzman outlined the scope of WOC 3’s work for the 2012-2015 Triennium. Committee members were very happy with the selected issues.

The three Study Groups held their meetings a day before the Committee met and then presented their progress reports in the plenary.

SG 3.1 *Strategic gas transmission infrastructure projects*

Leader: Enno Freese (The Netherlands)

Enno presented his fifth progress report and shared some early and very interesting conclusions and recommendations. He said that the final SG 3.1 was 99% complete with only some editing work left. All SG 3.1 members will be requested to confirm their support for the content of the final report.

SG 3.1 is responsible for the organisation of one Committee Session (three papers and one invited speaker) and one Expert Forum (three papers and one invited speaker) during WGC2012. Enno presented the structure and organisation of these sessions and announced that the two invited speakers would be:

- Marcel Kramer, Chairman of the Board of Directors and CEO of the South Stream pipeline project; and
- Henning Kothe, Director Commercial Operations of Nord Stream.

SG 3.2 *Integrity of gas transmission systems and footprint reduction*

Leader: Mohd Nazmi bin Mohd Ali Napiah (Malaysia)

Nine SG 3.2 members attended the Brisbane meetings and discussed the draft report. Nazmi shared the most important conclusions and recommendations, and presented the organisation and structure of SG 3.2’s WGC2012 Committee Session (four papers) and Expert Forum (five papers). Nazmi finished his presentation with the words “We’ll make it!”.

SG 3.3 *Securing sufficient expertise to operate gas transmission systems safely and adequately*

Leader: Barbara Jinks (Australia)

Seven SG 3.3 members were present at the meeting. Barbara Jinks presented her progress report and outlined the content of the Study Group's report. Inputs for some case studies were still pending at the time of the meeting (the draft report was completed at the end of 2011). While only three submitted papers proved useful for the SG 3.3 Committee Session at WGC2012, an attractive programme has been structured by combining paper presentations and a panel session.

Technical and social programme

Peter Barnett from GHD gave an interesting presentation about special design considerations for large diameter pipelines. Together with her sponsors, Barbara Jinks organised a very pleasant social programme which included a visit to the XXXX Brewery and a dinner cruise on the Brisbane River. During this cruise, the Russian delegates gave an introduction to the next meeting in Moscow.

Next meeting

At press time, WOC 3's final meeting of the Triennium was due to take place in Moscow, Russia, April 25-27, by kind invitation of Gazprom.

For more information, please contact the Chair, Eric Dam at E.Dam@gasunie.nl or the Secretary, Rein Bolt at r.bolt@gasuniezuidwending.nl.

● Working Committee 4 – Distribution

The fifth meeting of WOC 4 was hosted by Geoplin Plinovodi in Ljubljana, Slovenia, September 20-23, 2011. The meeting went well over expected targets in terms of activities, results achieved and attendance, with 40 delegates from 21 countries taking part. New members were welcomed, thus increasing the basis of experience and knowledge that is the most important factor in achieving good work results. Moreover, 16 accompanying persons took part in a dedicated programme organised by

the host, enjoying the city and its history.

As usual, the meeting started with an introduction by the host company on its activities and the development of the national gas industry. Franc Cimerman of Geoplin Plinovodi looked at the characteristics of the Slovenian gas industry and developments in the country's gas distribution network.

Then CC Chairman, Ho Sook Wah updated members on IGU activities over the previous six months and presented the WGC2012 conference programme. He discussed the arrangement of WOC 4's sessions as well as details for the abstracts selection process, the main task for the Committee during the meeting.

After this introduction, the meeting continued with a workshop on unaccounted-for gas (UFG), which was run by Barbara Jinks, the leader of SG 4.3. The workshop addressed most of the main issues concerning UFG, analysing them in more detail and providing high-value inputs for WGC2012. There were presentations on the following topics:

- "Impacts of the meter reading cycles and allocation process", José Francisco Quinta Catela Pequeno, Galp Energia and Lilian Berterreche De Menditte, GrDF;
- "Fraud and theft risk at NGV refilling stations: analysis and mitigation", José Carlos Broisler Oliver, Comgas;
- "A set of three topics to diminish and control UFG", Jorge Doumanian, Gas Natural BAN – the application of artificial neural networks as a tool to fight frauds and thefts, contribution to a correct allocation of the calorific power and a meter testing programme;
- "Method to recalculate volumes of gas when the meters do not work properly", Paolo Del Gaudio, IREN;
- "The Canadian perspective on UFG", Lloyd Chiotti, Enbridge;
- "The management of methane emissions in Russia", Natalia Kruglova, Gazprom VNIIGAZ;



ABOVE AND INSET LEFT
WOC 4 members
at the Postojna
caves (ABOVE) and
enjoying a visit to
Lisjak wine cellar
(INSET LEFT).

SG 4.3 Unaccounted-for gas: identification, measurement, calculation and management
Leader: Barbara Jinks, GHD (Australia)

The Study Groups focused on selecting the abstracts to be presented at WGC2012 and allocating them to the different sessions. In some cases abstracts were redirected to other WOCs and PGCs, as they were more relevant to them than to WOC 4. The work was finalised at the end of October, after rating abstracts received from other WOCs and PGCs and recording the final ranking in the dedicated web tool.

WOC 4's sessions at WGC2012 will be arranged as follows:

- *Committee Session 4.1: "Gas distribution safety management systems"*, co-chaired by Alessandro Soresina (WOC 4 Chair) and Ben Lambregts (SG 4.1 leader), will start with presentation of WOC 4's report on the topic and will be followed by four selected papers;
- *Committee Session 4.2: "Smart metering systems: characteristics, technologies, costs"*, chaired by Kim Vrancken (SG 4.2 leader), will present the Study Group's work followed by

- "The replacement programme of metallic pipes in the UK", Rosemary McCall, GL Noble Denton; and
- "The renewal programme in Ireland", William Kearney, Bord Gáis.

From the afternoon the work went on via separate meetings of the three Study Groups:

SG 4.1 Gas distribution safety management systems
Leader: Ben Lambregts, Liander (The Netherlands)

SG 4.2 Smart metering systems: characteristics, technologies, costs
Leader: Kim Vrancken, Eandis (Belgium)

Growth that connects people

DEPA is the company that introduced natural gas to Greece's energy market by developing the necessary infrastructure and networks. It is a group of companies, consisting of DESFA, the Hellenic Transmission System Operator, and three Distribution Companies (EPA of Attica, Thessaloniki and Thessalia). DEPA also has a 50% stake in IGI POSEIDON S.A., the company responsible for the construction and operation of the offshore gas pipeline connecting Greece with Italy. Through IGI POSEIDON S.A. participates in ICGB AD, the company that will undertake the development and operation of the pipeline between Greece and Bulgaria.

DEPA participates in infrastructure projects of strategic value, namely the ITGI pipeline (Turkey-Greece-Italy Interconnector) that will facilitate natural gas flows to Europe through Italy, and IGB (Greece-Bulgaria Interconnector) that will supply with natural gas Southeastern Europe. Both projects have been of European interest, contributing to diversification of gas routes in Europe.

four papers on issues and best practices in smart metering;

- *Committee Session 4.3: "Unaccounted-for gas: identification, measurement, calculation and management"*, chaired by Barbara Jinks (SG 4.3 leader), will analyse the issue of unaccounted-for gas in gas distribution, starting from the main outcomes of the work developed by the Study Group and through four selected papers.
- *Expert Forum 4.A*, chaired by Dietmar Spohn (WOC 4 Vice Chair), and *Expert Forum 4.B*, chaired by Ben Lambregts (SG 4.1 leader), will address safety management, smart metering and unaccounted-for gas from a technical and a management perspective.
- Finally, very interesting papers will be presented in a dedicated poster session, called the *Interactive Expert Showcase*, during which the authors will present their work to the audience.

After the two work days, all Study Groups reached their targets. They concluded the selection of papers and discussed preparation of their final reports.

During the plenary session, there was a debate to give inputs to the incoming WOC 4 Chair for the study topics of the next Triennium. The plenary concluded with a presentation by colleagues from Iran on their experience with a national gas smart metering programme, followed by an active session of Q&A that gave more inputs to the activities of the Committee.

Traditionally, WOC 4 meetings are rounded off with a "social-technical" tour. This time, we visited some of Slovenia's landmarks in the Karst region: the Postojna caves and Lisjak homestead and wine cellar, where we had the opportunity to taste and enjoy a selection of award-winning wines.

Last meeting

WOC 4's last meeting of the Triennium was hosted by Gas Natural in Barcelona, Spain, February 28-March 2.

For more information, contact the Chair, Alessandro Soresina, at alessandro.soresina@a2a.eu

a2a.eu or the Secretary, Mario Pelizzoli, at mario.pelizzoli@a2a.eu.

● **Working Committee 5 – Utilisation**

WOC 5's fifth meeting was hosted by Sonorgás of the Duorogás Group in northern Portugal, September 11-15, 2011. Attendance set a record for the Triennium with 65 delegates and accompanying persons from 18 countries.

The first event was a welcome dinner in the beautiful city of Oporto, during which delegates were entertained by a performance of traditional Portuguese Fado music. Indeed, the programme was full of events in addition to the core business sessions. They included a technical tour of the combined-cycle gas turbine (CCGT) power plant in Gondomer, a visit to the LNG satellite station in Mirandela, a workshop on gas utilisation in Vila Real, a port wine lesson at the Hotel Vintage House in Pinhão and a relaxing cruise on the Duoro River.

The plenary session started with a welcome from the meeting host, Armando Moreira, Chairman of Duorogás. Then, Nuno Afonso Moreira, leader of SG 5.1 introduced the gas industry of Portugal and gave a profile of the Duorogás Group. CC Chairman, Ho Sook Wah followed and updated members on IGU activities and the preparations for WGC2012.

The three Study Groups concentrated on finalising their reports and the organisation of WOC 5's sessions at WGC2012.

SG 5.1 Industrial utilisation

Leader: Nuno Afonso Moreira (Portugal)

Deputy leader: Egidio Adamo (Italy)

Progress on SG 5.1's report and action plans for finalising it were discussed. Then details were shared of the contents of the report such as market situation, technologies and case studies on CHP, renewables, gas-to-power and rational use of energy. The team also agreed the structure plan for Committee Session 5.1 and Expert Forum 5.A.



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WOC 5 members at work during their fifth meeting (TOP) and posing for a group photo after their welcome dinner (ABOVE).

SG 5.2 Domestic and commercial utilisation

Leader: Martin Seifert (Switzerland)

Deputy leader: Frederic Pastier (France)

Progress on SG 5.2's report was discussed and the structure was finalised. The assignment of the contents, technological road-maps and responsibilities for each national report were also confirmed. The team discussed the structure of Committee Session 5.2 and six major topics to be presented in the session were defined: micro-CHP; low-power modulating boilers; hybrid gas heat pumps; fuel cells, gas applications; and gas and services.

SG 5.3 Natural gas vehicles (NGVs)

Leader: Eugene Pronin (Russia)

Deputy leader: Davor Matic (Croatia)

Progress on the joint report with UNECE was

presented and the remaining issues to be actioned were discussed. Members also exchanged information on NGV developments around the world including: CNG potentials – synergy and development; best practices for NGV refuelling stations; and on- and off-road NGVs (heavy duty trucks and buses, vehicles used in the aviation, rail and agricultural sectors).

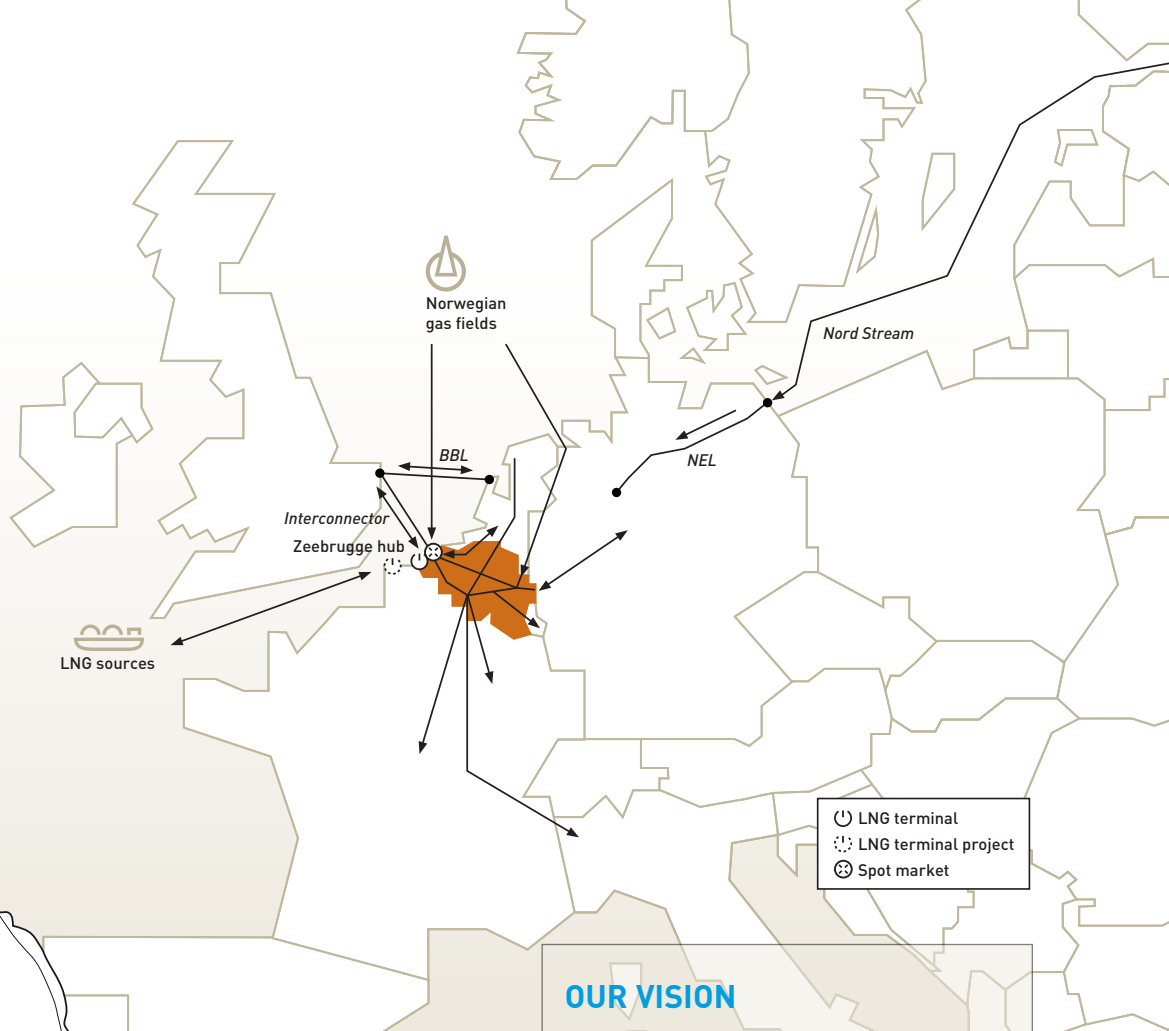
Workshop on gas utilisation

WOC 5 members visited the University of Trás-os-Montes and Alto at Vila Real on September 12 to attend the workshop on gas utilisation. The workshop was chaired by SG 5.1 leader, Nuno Moreira, who is a former graduate of the university and is now a professor there. CC Chairman, Ho Sook Wah gave a presentation on IGU's activities, while WOC 5's Chair, Tatsuo Kume and the Study Group leaders and advisors shared the results of WOC 5 studies conducted in the different fields of gas utilisation. The workshop was attended by local government officials, university teachers and more than 30 students, and offered an excellent opportunity for the audience to deepen their knowledge of IGU activities as well as understand the importance of natural gas in the downstream sector of the gas value chain.

Technical visits

The first of three technical visits was to Central Tapada do Outeiro at Gondomar, the largest CCGT independent power plant (IPP) in the Iberian Peninsula. This plant started commercial operations in 1999 and has a maximum capacity of 990MW. It generates 15-20% of Portugal's electricity.

The second visit was to the construction site of an LNG complex in the Mirandela region. This complex will supply CNG to fuel 60 trucks of the neighbouring refuse treatment plant and LNG is also directly transported for industrial gas demand in the vicinity, where it is stored in very small LNG reservoirs.



OUR VISION

The natural gas transmission market in North-Western Europe is evolving into a virtual cross-border unity. The companies of the Fluxys Group wish to play a key role in developing this integrating market into an efficient system for suppliers to move natural gas flexibly from any border point in the region to their customers.

BUILDING A STRONG NATURAL GAS MARKET IN NORTH-WESTERN EUROPE

- > Enhancing security of supply
- > Strengthening the well-functioning of the market
- > Promoting cross-border natural gas flows and transfers

Belgian network: natural gas crossroads

- **Excellent upstream interconnection: LNG and pipe gas**
 - > tied in to all pipe gas sources available to the European market
 - > capacity to accommodate Nord Stream gas flows
 - > worldwide LNG supply through the Zeebrugge LNG terminal
- **Optimum downstream destination flexibility: take away capacity to all neighbouring countries and systems**
- **Long-term storage opportunities**
- **Zeebrugge Hub: one of the leading spot gas markets in Europe**

Fostering integration

To foster the integration of the North-Western European natural gas market, the Fluxys Group develops a profitable set of stakes in and industrial partnerships with companies in the business of natural gas transmission and storage, LNG terminalling and spot market facilitation.

- Flows between the UK and the continent: Interconnector and BBL pipelines
- Downstream flows from Nord Stream through NEL pipeline
- Dunkirk LNG terminal: additional LNG into North-Western Europe



WOC 5 members enjoy a relaxing river cruise.

The last visit was to the LNG satellite station in the city of Mirandela, one of the five satellite stations operated by Sonorgás.

WOC 5 sessions at WGC2012

WOC 5 will host the following sessions:

- *Expert Forum 5.A: "How to integrate renewable power in the natural gas grid"* on Tuesday, June 5, 09:45-11:45;
- *Expert Forum 5.B: "Gas quality changes, impact and remedies"* on Thursday, June 7, 09:45-11:45;
- *Committee Session 5.1: "Industrial utilisation : technologies for efficiently stimulating gas demand"* on Tuesday, June 5, 16:30-18:30;
- *Committee Session 5.2: "Domestic and commercial utilisation: gas innovation roadmap for the new sustainable market demand"* on Thursday, June 7, 16:30-18:30;
- *Committee Session 5.3: "Natural gas vehicles: the solution for a low-carbon society"* on Wednesday, June 6, 09:45-11:45; and
- *Interactive Expert Showcase WOC 5 A & B* on Wednesday, June 6, 16:00-17:30.

Last meeting

The sixth and last meeting of WOC 5 in the Malaysian Triennium took place in Prague, Czech Republic, February 21-23.

For more information, contact the Chair, Tatsuo Kume, at tatsuo-kume@osakagas.co.jp or the Secretary, Ichiro Baba, at ichiro-baba@osakagas.co.jp.

● Programme Committee A – Sustainability

PGC A has 66 nominated members from around the world and held its fourth meeting in Moscow, Russia, September 6-9, 2011. This was a joint meeting with PGC C and it was hosted by Gazprom Vniigaz. A total of 39 delegates attended. On the first day of the meeting, six invited speakers gave presentations on topics of interest for PGC A and PGC C:

- "IGU scenarios for 2030 and why gas does better in the green one", Jaap Hoogaker, leader of Study Group B.1;
- "IEA scenarios for 2035. A golden age of gas?", Anne-Sophie Courbeau, IEA;
- "Security of demand and new investment in the upstream and midstream segments. Do renewables fit into this equation?", Vitaly Yermakov, IHS Cera;
- "Trends for the gas industry in the CIS", Tatiana Mitrova, Centre for International Energy Markets Studies, Energy Research Institute of the Russian Academy of Sciences;
- "European security of supply and the role of Iberia", Fabrizio Dassogno, CEO of Galp Energía; and
- "Natural gas and global warming", Vladimir Bashkin, Gazprom Vniigaz and leader of SG A.1.

PGC A's three Study Groups held their meetings after the presentations of the invited speakers.

Scope and objectives of the Study Groups

SG A.1 Sustainability and investment

Leader: Vladimir Bashkin, Gazprom (Russia.)

SG A.1's objectives are to:

- Design a hydricity (i.e. the complementary use of hydrogen and electricity) model in which the role of natural gas as a transition fuel will be analysed;

- Present the best hybrid solutions between renewable energies and natural gas in a video; and
- Study the state of development of CCS technology and analyse the implications for the gas industry.

The hydricity model will be discussed at a roundtable during a WGC2012 Expert Forum, which will be moderated by the Study Group leader. The main topics for this roundtable and a schedule for the Expert Forum were defined at the meeting in Moscow. The panellists will include representatives of the European Hydrogen Association, Tokyo Gas and organisations with experience of using hydrogen as a transport fuel, and invitations have been sent out. Four abstracts have also been selected for oral presentation.

As regards the video about natural gas and renewable energies, five of the individual presentations have been prepared and are now being edited for combination into the final video.



ABOVE AND TOP RIGHT PGC A held its fourth meeting in Moscow.

The projects being covered are:

- Double-effect solar – a gas cooling plant in Seville (Spain);
- Intelligent building in Burlington (Canada);
- Waste-to-energy incineration plant (Finland);
- Mini heat power station in a sewage plant (Russia);
- Parabolic solar gas in Abu Dhabi (UAE); and
- Gas heat pump in Milan (Italy).

The video will be shown as part of a Strategic Panel moderated by Klaus Schäfer, CEO of E.ON Ruhrgas. A schedule for the Strategic Panel was prepared during the meeting:

- Introduction with a small video;
- Presentation of four blocks: solar + biogas + wind + energy efficiency;
- Video projection; and
- Roundtable.

Robert Lesnick of the World Bank and Gertjan Lankhorst of GasTerra have confirmed they will be speakers at the roundtable. Some other speakers have been invited and they have yet to confirm.

The topic of CCS will be covered in a joint Expert Forum with WOC 2. The preliminary agenda for the Expert Forum was defined during the meeting with a report prepared mainly by PGC A forming the basis of the introduction. In addition, four papers were chosen from WOC 2 and PGC A and they will be presented in another part of the session moderated by WOC 2's Chair, H el ene Giouse or Herman Spreckels who is coordinating CCS work in SG 2.2.



PGC A in session.

After the meeting, in October, eight posters for PGC A's poster session were selected.

SG A.2 *Integrating other gases into the natural gas industry*

Leader: Elbert Huijzer, Liandon (The Netherlands)

SG A.2 aims to set the basis for the natural gas industry to take advantage of these gases, eliminating any possibility of impact on people's health and the useful life of installations.

During the meeting in Moscow, the draft of the Study Group's report was discussed. It was decided that the leader would restructure the report and responsibilities for filling some gaps were allocated. It was also agreed to collaborate with PGC E on the section dealing with economics rather than with WOC 5. After the meeting, in October, three abstracts on this topic were selected for oral presentation and three posters for PGC A's poster session.

SG A.3 *Reduction of gas emissions*

Leader: Satoshi Yoshida, Tokyo Gas (Japan)

SG A.3 aims to record best practices in the gas chain and develop a comprehensive industry reference guide to reduce gas emissions, which provides for a reduction in emissions in each process and in the environmental impact of each activity.

During the Moscow meeting the Study Group revised the draft report and agreed an agenda for the WGC2012 Committee Session. Three abstracts have been selected for oral presentation and three posters for the poster session. After the meeting, a shorter (90-page) version of the report was printed and circulated to the Chairs and Vice Chairs of the Technical Committees and to other institutions for reviews, recommendations and suggestions.

WGC2012 Programme

PGC A is organising the following sessions at WGC2012:

- *Committee Session 6.1: "Integrating renewable gases into the natural gas industry";*
- *Committee Session 6.2: "Greenhouse gas (GHG) emission reduction efforts";*
- *Expert Forum 6.A: "The role of natural gas in the design of a hydricity model";*
- *Expert Forum 6.B/2.A (jointly with WOC 2): "CO₂ capture, transport and sequestration: technologies involved and project developments to increase gas industry sustainability";* and
- *Strategic Panel 9* during which the video "Natural gas and renewables" will be presented in collaboration with PGC E and the CC.

Last meeting

PGC A's last meeting of the Triennium to finalise the plans for WGC2012 was originally scheduled to be held in Milan, Italy but was switched Venice, where it was held February 1-3.

● **Programme Committee B – Strategy**

PGC B held its fourth meeting in New Delhi, India on September 14-15, 2011. Thirty-three senior gas representatives from 22 different organisations in 17 countries joined in the working sessions and debate with leading global experts in Delhi. The meeting was generously hosted by GAIL, which was a fantastic opportunity to learn more about India's leading gas company.



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Reliable and flexible
pipeline transportation network.



The core objective of the meeting was for the Strategy Committee to share the outputs from the previous six months and continue the progress from the third meeting, which had been held in Washington DC in March 2011. Each Study Group held individual sessions, led by their respective group leader.

SG B.1 *World gas supply, demand and trade*

Leader: Jaap Hoogakker, GasTerra (The Netherlands)

There was an update on supply, demand and trade for each of the eight IGU regions, along with an update on global trade. Detailed analyses were presented and debated by experts responsible for different parts of the world, along with a high-level snapshot of development scenarios to 2030 for each region.

SG B.2 *Wholesale gas price formation*

Leader: Mike Fulwood, Nexant (UK)

There were presentations on the four core areas of investigation: price convergence; price formation; the impact of carbon taxes/cap and trade; and regional pricing models. Also presented were in-depth studies on the Indian gas market,

competing fuel analyses and a vigorous discussion about the “commoditisation” of natural gas.

SG B.3 *Corporate strategy and regulation*

Leader: Francisco de la Flor, Enagás (Spain)

There were presentations of corporate strategies and a technical paper on the US Federal Energy Regulatory Commission (FERC) and European Agency for the Cooperation of Energy Regulators (ACER). PGC B has contributed an article based on the FERC-ACER paper to this issue of the IGU Magazine (see pages 228-232). The meeting was also an opportunity to share and discuss several recently submitted corporate case studies, with a special focus on the GAIL case.

The Committee leadership team would like to thank GAIL, and in particular R. K. Jain and Vivek Neelam for their generosity and for making the meeting such a success.

PGC B’s final meeting of the Malaysian Triennium was hosted by the French Gas Association in Paris, February 21-22.

For more information please contact the Committee Secretary, Harry Whitaker (harry.whitaker@bg-group.com).



Delegates to PGC B’s fourth meeting pose for a group photograph at GAIL’s HQ in New Delhi.

Galp Energia

Galp Energia is an integrated energy operator with diversified activities across the globe in the oil and gas industry. With its refining and marketing activities centred on the Iberian Peninsula, Galp Energia has a strong presence in the resource-rich South Atlantic exploration and production area that covers Brazil's pre-salt Santos basin and the Angolan offshore. Galp Energia is present in 13 countries: Portugal, Spain, Brazil, Angola, Venezuela, Mozambique, Cape Verde, Guinea-Bissau, Swaziland, Gambia, East Timor, Uruguay and Equatorial Guinea.

The ongoing Exploration & Production projects support the strategy that will enable production goals to be achieved. Brazil and Angola are core countries for the execution of this strategy. The current base of hydrocarbon resources, which exceeds three billion barrels as identified by intensive exploratory work, is a solid foundation on which Galp Energia's strategy for its production business rests.

In Gas & Power Galp Energia is the leading company in Portugal for natural gas supply, distribution and sales with more than 900,000 clients and more than 4 billion cubic

metres (bcm) of annual sales. In Spain its presence started in 2008 as a natural gas supplier for the industrial market and increased significantly in 2010 with the purchase from Gas Natural of over 400,000 customers in the Greater Madrid region, adding about 0.3 bcm of annual consumption. With this acquisition Galp Energia became the second player in terms of customers served in the Iberian Peninsula. In the power sector, Galp Energia aims to become an important player in Portugal, both in terms of production and supply to the final market.

Galp Energia's priority is also to diversify its sources of natural gas by developing its ongoing projects in the Exploration & Production business segment, namely the recent discovery of natural gas in the Rovuma Basin in Mozambique's offshore.

In Refining & Marketing, Galp Energia is focused on extracting additional value from its assets, namely from its refineries and Iberian network for marketing oil products, which expanded significantly in 2008 following the acquisition of Agip and ExxonMobil's marketing platforms in the Iberian Peninsula.

Our energy crosses borders

Galp Energia leads the natural gas market in Portugal and is a major energy player on the Iberian Peninsula.



We are an integrated energy company exploring, producing, refining and marketing oil and natural gas across four continents. We deliver energy to millions of people every day.

● **Programme Committee C – Gas Markets**

PGC C held a joint fourth meeting with PGC A in Moscow, September 6-9, 2011. The aim was to debate the interaction between natural gas and renewable energies, and to analyse the demand for gas in a number of green scenarios that have been recently developed by international organisations such as IHS CERA, IEA and IGU.

The joint meeting was hosted by Gazprom Vniigaz at their modern conference and research facilities located in the Leninsky District of Moscow. Attendance set another record, with approximately 80 delegates from 30 countries, half of which were members of PGC C.

Delegates were welcomed by Sergey Balashov, Deputy Chief of the Department of Foreign Business Relations and Chief of the Directorate of International Organisations and Forums of JSC Gazprom, and Mikhail Petrovsky, Acting Deputy General Director of Gazprom Vniigaz, followed by Juan Puertas, Chair of PGC A, and João Batista de Toledo, Chair of PGC C.

Gas markets in a green scenario

Jaap Hoogakker (GasTerra), leader of SG B.1 (and the incoming Chair of PGC B) presented gas as the ideal partner in a green scenario. This is because it is highly flexible, with reserves and supplies that are abundant and diversified.



Members of PGCs A and C toured the Vniigaz research facilities

Moreover, its carbon emissions are low, especially when compared with coal. As an example, the production of 1 kWhe from coal in a modern plant with 80% CCS, which is rather challenging, produces 380g of CO₂, while the production of same amount of energy from gas without CCS produces only 360g, a number that can be further reduced to, say, 190g, if the production of power is combined with the production of heat (CHP).

Anne-Sophie Courbeau (IEA) presented a number of factors that could cause global demand for gas to grow significantly in the coming years. These are detailed in the IEA's "Golden Age of Gas" scenario, which was published in June 2011, but the basic assumptions involved are: (1) a more ambitious policy for gas use in China; (2) lower growth for nuclear power; and (3) a perspective of large availability and low prices for gas.



PGC C held its fourth meeting together with PGC A in Moscow.

Launching 2012

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* The sulphuredioxide rate in the air of Istanbul , which was 219 $\mu\text{g}/\text{m}^3$ in 1992 has been reduced to 7 $\mu\text{g}/\text{m}^3$ at the end of 2010 by the virtue of IGDAS.

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 **ISTANBUL METROPOLITAN MUNICIPALITY**

Vitaly Yermakov (IHS CERA) briefly described the global scenarios developed by his company, and explained that they seek to address three important uncertainties: (1) the degree of cooperation between stakeholders to increase global security; (2) the pace of change to a low-carbon economy; and (3) a possible recurrence of economic turbulence. The demand for gas can be expected to increase significantly as renewables continue to be expensive and the growth of nuclear power remains relatively uncertain.

The analyses presented diverged significantly in their reasoning, but the speakers were unanimous in affirming the critical role that natural gas will continue to play in the future.

Selection of papers for WGC2012

The Committee received nearly 50 applications, and most of them were rated in Moscow. High-quality panels are expected for all the PGC C sessions in Kuala Lumpur.

Study Group progress

SG C.1 ASEAN+4

The triennial report of SG C.1 is in its second draft, and will incorporate the comments organised by the PGC C Secretariat. In Moscow, the Study Group defined its key messages, calling attention to three important challenges faced by the region: (1) controlled prices and subsidies; (2) need of incentives for E&P activities; and (3) the importance of new investments in gas infrastructure.

SG C.2 North America

Of all Study Groups, this was the one that received the largest number of individual contributions for the triennial report. Valuable assistance came from Mel Ydreos, Chair of TF 3 and incoming CC Vice Chair, who organised an interesting introduction to the North American gas markets.

Industrial consumption is expected to remain relatively flat, as the recovery of demand destruction that has taken place over the last years will

not be fast. Moreover, the sustainability of current prices is a tough question to answer, as a number of uncertainties still surround the production of unconventional gas (such as decline rate, “refracking” potential and production costs).

SG C.3 Europe and Russia

Tatiana Mitrova (Centre for International Energy Markets Studies, Energy Research Institute of the Russian Academy of Sciences) drew the Study Group’s attention to the importance of the CIS region, which is expected to experience high economic growth during the next couple of decades. Primary energy demand is expected to grow accordingly, with gas sustaining its current share of 53% in the mix.

For a number of reasons, gas will continue to be the preferred fuel for power generation, in spite of a probable price increase in the medium term. It is the most economical alternative to replace old power plants, nuclear energy is capital intensive and nuclear plants require a long construction period, renewables require subsidies, and regional actions to reduce CO₂ emissions are more focused on efficiency gains.

The region presents a large export potential (about 280 bcm, of which 120 bcm from the Caspian, mostly from Turkmenistan), and producers are willing to diversify their portfolios geographically with significant investments in infrastructure.

Fabrizio Dassogno (Galp Energia) emphasised that in spite of the fact that the largest demand growth is expected to take place in Asia and the Middle East, where a large number of developing markets exist, European gas demand will grow significantly as well, with additions of approximately 4 bcm per year over the next 20 years.

This will be partially met by pipelines from Russian and Caspian areas, but LNG imports are expected to increase as well. Iberia hosts 46% of the current EU 27 regasification capacity, i.e., 3,000 GWh/d, but its maximum consumption is

only 1,900 GWh/d. As a consequence, investment plans have been announced to develop a regional hub-to-hub trading structure that will transform Iberia into a most important gateway to southern Europe (South Gas Regional Initiative, Work Plan 2011-2014).

A second draft of the triennial report is being prepared following the observations made the PGC C Secretariat. The goal is to prove that no other source of energy is able to deliver so efficiently in the three axes that constitute the focus of the European agenda for energy – sustainability, security of supply and competitiveness.

Thanks and final meeting

The leadership and members of PGC C register here their gratitude to the Russian hosts for their remarkable organisation and hospitality. A very productive meeting resulted as a consequence, with all pre-established goals achieved.

The last meeting of PGC C in the current Triennium took place in Paris, at the headquarters of the French Gas Association, February 15-16.

● Programme Committee D – LNG

PGC D's fourth meeting was hosted by Qatargas China in Beijing, September 26-28, 2011. It was attended by 37 of the Committee's 92 members.

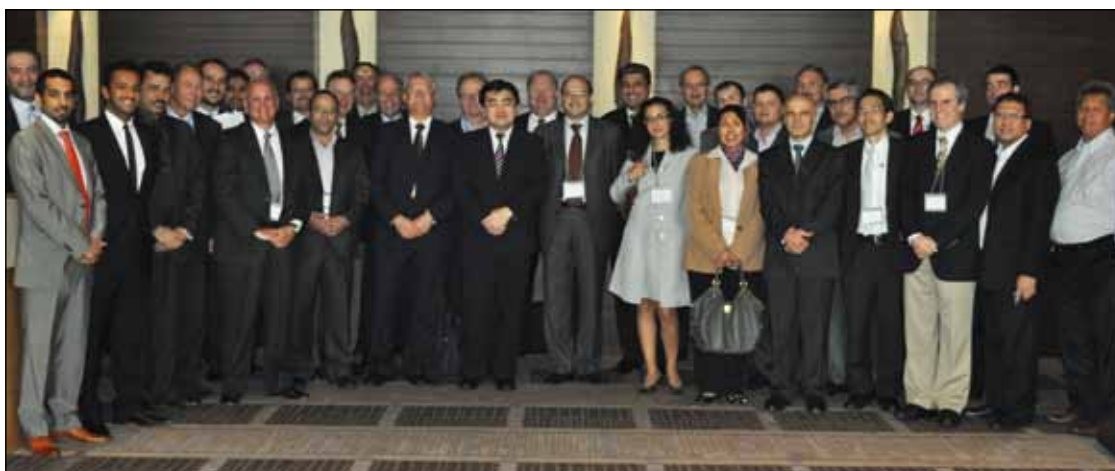
In their respective opening remarks, PGC D Chair, Alaa Abujbara thanked members for attending and Qatargas China for hosting the meeting; Abdulla Hijji, Manager of the regional Qatargas office in China extended his welcome to members; and Jupiter Ramirez outlined the programme for the two-day meeting.

Ye Yishu from CNOOC gave a presentation on LNG business activity in China and highlighted the fact that six more LNG receiving terminals have been approved. CC Secretary, Ungku Ainon Ungku Tahir then provided updates on IGU and CC activities as well as on the preparations for WGC2012. PGC D's Vice Chair, Dirk van Slooten shared possible topics for the 2012-2015 Triennium with members.

The group had a full programme during the two days, focusing their discussions on the draft report and the structure of PGC D's sessions at WGC2012. The Study Groups also held individual meetings.

SG D.1 Enhance the compatibility of LNG facilities Leader: Jean-Yves Capella, Total (France)

The team achieved good progress in their work, concentrating their attention on the draft report which will make a distinction between findings, recommendations and conclusions. Each chapter was discussed and subgroups were organised to



PGC D held its fourth meeting in Beijing where delegates posed for a group photograph.

draft them. Detailed plans for the session at WGC2012 were also discussed. For this issue of the IGU Magazine, SG D.1 has contributed the articles "Australia: Global LNG Hotspot" (see pages 180-185), "Gate Terminal Update" (see pages 188-191) and a report from Japan on the recovery of the Sendai LNG terminal (see below). It also coordinated a contribution from SIGTTO (see pages 178-179).

SG D.2 Penetrate new markets for LNG

Leader: Ted Williams, AGA (USA)

SG D.2's work is organised into four regional working groups (Americas, Asia, Europe and the Middle East) and good progress has been made in compiling initial lists of common themes from project experience, market drivers and barriers by regional market; on analysis including lessons learned and major challenges going forward; and drafting recommendations. Members also discussed the organisation of SG D.2's session at WGC2012.

SG D.3 Enhance efficiency in the LNG value chain

Leader: Rob Klein Nagelvoort, Shell (The Netherlands)

Members discussed the drafts for each chapter. Comments and feedback were solicited including shared experiences and development in different countries and companies to beef up the report. Members agreed to send their feedback and comments for the leader to integrate into the final report. The team also spent some time planning the session at WGC2012.

Last meeting

PGC D's fifth and final meeting of the Triennium was hosted by Repsol in Madrid, Spain, February 6-7, during which the final report was accepted.

For more information, please contact the Chair Alaa Abujbara, at aabubara@qatargas.com.qa or the Secretary, Abdulla Ahmad Al-Hussaini at aalhussaini@qatargas.com.qa.

Japan: Any news on the recovery/rebuilding of damaged LNG terminals?

By Yoichi Mori

Japan's most powerful earthquake since records began struck the north-east coast in March 2011 with a magnitude of 9.0, triggering a massive tsunami. It devastated about 250 miles of coastline from Tohoku to Kantou district, reaching up to 2 miles inland.

As regards our industry, the main impact was on the Sendai LNG regasification terminal (hereafter the Terminal). The tsunami knocked out the Terminal's LNG import/regasification capability as well as LNG truck loading for neighbouring satellite terminals for eight months.

The earthquake did not cause any major damage to the principal LNG facilities such as unloading arms and vaporisers which were supported by piled foundations; neither were there any serious incidents involving LNG spill and natural gas leakage. However, some LNG facilities such as small-diameter piping unsupported by piled foundations were swept away by the tsunami, while low-lying electrical and instrumentation facilities were flooded and became unserviceable.

The Terminal was able to restart city gas supplies shortly after the disaster via an undamaged pipeline. Work then began on repairs. Thanks to the hard work of the reconstruction team, LNG receiving operations were restored on November 29, followed by the LNG truck loading operation at the end of December. However, there is still some work to do, in particular, on the extra-high voltage equipment where damage prevents the sea water pumps from supplying electric power. Therefore, SCVs (Submerged Combustion Vaporiser) provided for peak shaving are regularly working for LNG vaporisation instead of inoperable ORVs (Open Rack Vaporiser).

By May, we hope to have worked on the extra-high voltage equipment to bring the sea water pumps back into service, thus restoring the Terminal's gas send-out capacity to the level it had before the tsunami hit.

Many parts working together— the only way to solve the world's energy challenges.

By 2030 we expect energy demand to be about 35 percent higher than it was in the year 2005, driven largely by people in the developing world seeking higher standards of living. Meeting this growing long-term demand requires that we develop all economic sources of energy—oil, natural gas, coal, nuclear and alternatives.

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exxonmobil.com



The image features four professionals—three men and one woman—standing in a row against a light blue background. Behind them are several large, interlocking gears of varying sizes, symbolizing integration and technology. To the right, there is a molecular structure diagram with blue and white spheres representing atoms and bonds. In the bottom right corner, the ExxonMobil logo is displayed, consisting of the word 'Esso' in a red oval and 'Mobil' in a blue oval, with 'Brands of ExxonMobil' written below. To the right of the logo is the slogan 'ExxonMobil Taking on the world's toughest energy challenges.' in red and black text.

● Programme Committee E – Marketing

PGC E's fifth meeting was hosted by DEPA in Athens, Greece, November 21-23, 2011. It brought together 24 members from 16 countries. The Committee currently has 66 members and two corresponding members from 26 countries.

During the three days in Athens, delegates had an extensive programme with various interesting presentations on the Greek gas market, its regulatory regime and major gas infrastructure projects. The Study Group meetings focused on finalising the reports as well as preparing the sessions for WGC2012.

SG E.1 *Natural gas and renewables*

Leader: Uwe Klaas, DVGW (Germany)

SG E.1 is identifying the position of, and opportunities for, natural gas in combination with renewables in the future energy market.

During the Athens meeting, members concentrated on the report, a good part of which had been written beforehand. The Study Group leader collected the necessary information from the members' case studies for inclusion in the report.

There was also a discussion with SG E.2 about organising a joint session at WGC2012. The session is entitled "New ways in marketing strategies – best practices leading to success" and will take place on Thursday, June 7, 16:30-18:30.

It was agreed that the session should be divided into two parts. The first part will focus on marketing strategies and start by presenting SG E.2's report. This report shows the results of a survey on business behaviour of wholesalers and retailers which was conducted during the first quarter of 2011. Furthermore, it is planned to present three selected papers coming via the call for papers process. The authors are from China, Germany and Colombia. It was decided to interview the authors on stage rather than having a series of presentations. This will give the proceedings a more lively character.

The second part of the session will be on natural gas and renewables. It will focus on the

results of SG E.1's report which consists of several case studies on natural gas and renewables. As during the first part of the session, there will be interviews with the authors of three selected papers, this time coming from Austria, France and The Netherlands. The session will round off with a brief panel discussion.

SG E.2 *Marketing campaigns*

Leader: Urs Zeller, Swiss Gas Industry Association (Switzerland)

SG E.2 is analysing business behaviour in marketing across different sectors. The target groups are wholesalers and retailers. A questionnaire was circulated to IGU members to collect information, and around 50 answers have been received and analysed. The Study Group report is a summary of this survey. In Athens, members reviewed the report and discussed its structure and the final conclusions.

The second part of the meeting focused on the preparations of the joint session with SG E.1 as mentioned above.

SG E.3 *Image of natural gas*

Leader: Hansch van der Velden, Nederlandse Gasunie (The Netherlands)

SG E.3 is investigating the image of natural gas and the drivers of successful communication and advocacy activity in this area. The Study Group's main purpose is to develop IGU guidelines on communications strategies to support the gas industry in improving the image of gas. For WGC2012 it is organising a session entitled "Energising the image of gas", on Wednesday, June 6, 09:45-11:45.

During the meeting, members finalised the study report. The main recommendations are as follows:

- Natural gas needs a strong and credible voice.
- Reputation is value: the oil and gas sector is still struggling with its reputation and it is time to react.



PGC E held its fifth meeting in Athens (ABOVE) and took a break from work to visit the Temple of Poseidon at Cape Sounion (BELOW).

- Natural gas needs a strong image proposition that demonstrates its unique contribution. We believe that the natural gas sector will benefit from being perceived as “Human, open and shaping the future”. This vision will be presented at WGC2012. The vision underlines how important it is for the gas industry to communicate personally and directly; to be open, transparent and pro-active; and to emphasise that gas has a role in the future energy mix. The industry also has to get better at communications – in what we say, how we say it and to whom and when. The report will have the following parts:

- Preface with the objective of the report “Recommendations on communications strategies to improve the image of gas”;
- Executive summary, “Human, open and shaping the future”;
- Findings from analysis, including country case studies; and
- Key recommendations for the sector and IGU.

SG E.3 has contributed an article to this issue of the IGU Magazine (see pages 206-209) based on findings from the report.

Besides the sessions prepared by the Study Groups for WGC2012, PGC E is organising an Expert Forum entitled “Renew your energies!” on Thursday, June 7, 09:45-11:45. This forum will

allow representatives of NGOs like Greenpeace, the Worldwatch Institute, Worldwide Fund for Nature (WWF) and National Resource Defense Council to debate energy supplies of the future. It is the first such an arena for NGOs has been organised at a WGC and we are very pleased that so many high-level speakers have accepted the invitation.

At press time, PGC E’s last meeting of the Triennium was due to be hosted in Zurich by the Swiss Gas Industry Association, March 19-21.

For more information, please contact the Chairman, Marc Hall at Marc.hall@bayerngas.de or the Secretary, Barbara Schmid at Barbara.schmid@bayerngas.de.



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- Odebrecht Latin America & Angola
- Odebrecht Venezuela
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Progress Reports from the Task Forces

This chapter contains news and information from IGU's three Task Forces.

● Task Force 1 – Building Strategic Human Capital

The fifth meeting of TF 1 was held on September 13, 2011 in Paris. It was hosted by the French Gas Association at the Palais des Congrès and was attended by 20 members. The meeting was preceded by a dinner on September 12, organised at a beautiful restaurant called L'Ecrevisse. Members had a wonderful time and enjoyed a sumptuous dinner.

Ieda Gomes, Chair of TF 1, opened the meeting by welcoming participants. She gave a brief update on the status of the Task Force's work and on the number of abstracts received for TF 1's paper presentation during WGC2012. Ieda also requested all colleagues to contribute one page each on the "issues and challenges in your company" and "best practices in the area of people management in your company".

Marius Popescu and Olivier Soupa provided an insight into the two surveys conducted by the Task Force in collaboration with Schlumberger Business Consultants. In 2010, TF 1 conducted its first demographic survey of the gas industry. This survey took a quantitative approach, and provided a snapshot of the HR resources across the gas value chain. The aim of the first survey was to map out the key issues impacting the industry today and tomorrow as well as to establish the HR commonalities and specificities across different regions and industry segments.

In 2011, TF 1 followed up with a detailed HR survey which took an in-depth approach by seeking detailed information on companies'



BELOW AND INSET LEFT TF 1 members at work (BELOW) and socialising (INSET LEFT) during their fifth meeting in Paris in September 2011.



various strategies towards attracting, developing and retaining talent. The aim was to compare and recommend best practices and innovative HR policies across the gas industry.

Manu Kohli, TF 1 Secretary, gave an update on a series of interviews which have highlighted a number of interesting ideas and patterns that are bound to shape the future of the gas industry. Some 19 interviews had been conducted prior to the meeting, some of them with young professionals in the energy industry. The insights have been quite enlightening and encouraging. A few clear themes have emerged:

- Gas will play an important role in the future;
- Gas will not compete with renewable energies but be a bridge between oil and greener fuels;
- The gas industry needs an image makeover;
- Nuclear and coal face major challenges going forward while gas is a good alternative and is abundant.

Manu also talked about a study conducted by Boston Consulting Group on “Responding to the challenge of an older workforce”. The study came out with some interesting revelations and observations and highlighted the concerns raised by the industry as a whole with regards to the ageing population. Some of the key themes that emerged from the study are:

- By 2050 the global population aged 60 years and older will exceed the number of people aged 15 and below, for the first time in history;
- Most countries in the world will be faced with labour shortage issues;
- Nations with large numbers of young people are not immune, as their workforce might migrate;
- Companies acknowledge the demographic risk but are unprepared. Only 9% of companies develop a sophisticated supply and demand workforce model; moreover, most companies plan their workforce needs only up to a five-year horizon;

● Two categories of demographic risks have to be considered by energy companies:

- *Capacity risk*, the supply shortage of workers, caused primarily by employee retirements; and
- *Performance risk*, the drop in performance as (i) young, less experienced, employees replace older ones; and (ii) the workforce gets older and employee productivity decreases in some roles.

Ungku Aion, CC Secretary, presented an update on the Coordination Committee’s recent activities and the status of the call for papers for WGC2012. The selected papers will be presented in the conference either orally or as posters. Rod Kenyon, TF 1’s Vice Chairman, talked about the proposed structure for the Task Force’s Triennium report.

Second workshop

The second TF 1 workshop was held in the afternoon of September 13; nine speakers from eight countries and a total of 50 participants joined the workshop. There were two panels representing European and Asian perspectives respectively. On the European panel were:

- Philippe Lazzarotto – GDF SUEZ, France, “Initiatives to reinforce attractiveness of our professions”;
- Marta Cydejko – Head of HR Office, Polish Oil and Gas Company (PGNiG), “Age Management in the Polish Oil and Gas Company”;
- Alberto Cabellos – Head of HR Governance, Gas Natural Fenosa, Spain, “Managing HR in a challenging environment”;
- Elena Volostnykh – Director, Centre for Advanced Education and Skill Development, Gazprom, Russia, “The corporate education and training system for personnel”.

On the Asian panel were:

- Daisuke Ozaki – Asst. Manager, Human Resources Development, Osaka Gas, Japan, “Human resource reinforcement measures of Osaka Gas”;



Some of the speakers and delegates to TF 1's second workshop pose for a group photograph.

- Kim Jeom Su – Head of Human Resources Department, Korea Gas Corporation – Global KOGAS, “Our vision, strategy and performance”; and
- Madam Nor’Aini Jalaludin – Leadership and Capability Development, Petronas, Malaysia, “Talent management in Petronas”.

There was also a presentation by Geertje Dam from Student Media, The Netherlands, on the NRG (Energy) Battle, a contest sponsored by energy companies with the aim of promoting a vigorous debate among students. The initiative has been successful, engaging young people in the field of energy and allowing companies to seed new talent.

The key insights from the workshop were:

- There is a staggering need to hire new people, particularly in technical sciences across all regions;
- Some companies are engaging in very aggressive hiring for petro-technical staff;
- Companies are differentiating pay structures to reward technical careers;
- Career plans, rewards and a clear progression path are seen as a selling point for hiring new talent; and
- Companies who are moving across the value

chain towards E&P projects are facing stiff competition from traditional E&P companies.

Sixth meeting

The sixth and last meeting of TF 1 was held on January 19 in Bilbao, Spain. It was hosted by Naturgas Energía at the Basque Country University (UPV/EHU) and was attended by 20 TF 1 members.

The day before the meeting, participants enjoyed a tour of the famous Guggenheim museum and dinner at the Michelin starred Basque restaurant Etxanobe located in the Euskalduna Palace. The dinner was also attended by Marta Margarit, Secretary General of the Spanish Gas Association (SEDIGAS), and representatives of the Basque Country Government, Xabier Garmendia, Deputy Minister of Industry & Energy and Pedro Luis Arias Ergueta, Deputy Minister for Universities & Research.

TF 1's sixth meeting started with a welcome from Juan Arraibi, Chairman of Naturgas Energía Transport & Distribution. He was followed by José Cambra, Vice Dean of the Faculty of Engineering of UPV/EHU, who briefly described the Faculty's work and its innovative collaboration with Naturgas Energía. Next up was Marta Margarit, who announced that SEDIGAS would be chairing PGC E in the next Triennium and that her Association holds human talent in high regard. “Without talent, companies have nothing,” she declared.

After the introductions, Ieda Gomes gave an update on the progress of TF 1's work and reminded participants that the deadline to complete the report on human capital was March 1. Ieda also announced that all speakers had been confirmed for TF 1's two sessions at WGC2012: a technical session in the morning of Tuesday, June 5, and a Strategic Panel “Winning the race for talent” in the afternoon.

Marius Popescu then took the floor and presented the preliminary results of TF 1's detailed

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TF 1 held its sixth meeting in Bilbao in January.

HR survey. Amongst other things, the preliminary results show that the demographic profile of technical staff in Europe is ageing, whereas the Latin American and Middle Eastern regions have a younger base of technical staff. Furthermore, the

BELOW
Figure 1.

findings show that upstream companies have the highest interest in compensating for the retirement rate and developing critical technical capabilities, while midstream companies have a high interest in developing local talent (see Figure 1). The full results of the survey will be available in TF 1's final report.

Marius was followed by Ho Sook Wah, CC Chairman, who presented the highlights of the CC, EXC and Council meetings which were held in October 2011 in Dubrovnik. Ho also presented the programme for WGC2012 and announced that a record number of papers had been submitted.

The morning presentations were followed by a discussion about TF 1's draft report. Participants recommended that the report include powerful recommendations to IGU and gas associations, taking into account that different gas markets have their own specificities. While one experience or recommendation can have positive effects in a specific setting, it might fail to have the sought-after effects if applied in other parts of the industry or in other markets.

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Source: IGU HR Survey 2012.



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The afternoon session consisted of three presentations. Juan Ramon Arraibi introduced the Aula project to encourage students to pursue research in the field of natural gas, which is sponsored by Naturgas Energía in partnership with the Faculty of Engineering of UPV/EHU. The main research topics are safety and environment, energy efficiency and environmental sustainability (see pp208/9 of the October 2011 issue of the IGU Magazine for a report on the Aula project).

Dr Gustavo Esteban of the Faculty of Engineering and one of the tutors for the projects gave a presentation on two of the Aula projects under his supervision.

The first project examined the technical feasibility of using the existing natural gas pipeline network to transport hydrogen as a mixture with natural gas. The project's main findings are that the use of hydrogen in the existing gas pipeline system induces embrittlement and that the maximum percentage of hydrogen content in the mix cannot exceed 18.5% to keep the mixture interchangeable with natural gas. Despite these drawbacks, using a mixture of hydrogen with natural gas can help with pressure drops in the pipeline network.

The second project supervised by Gustavo examined the technical feasibility of using the existing gas natural pipeline network to transport biomethane or biogas as a mixture with natural gas.

The final presentation was given by Laura Barrio. She described the activities of UPV/EHU's Chemical and Environmental Engineering Department, which focuses on two areas: thermal processes and catalytic processes.

TF1's sixth and last meeting ended with an open discussion amongst the Task Force members and the representatives of UPV/EHU. Topics such as the collaboration between companies and universities and state policies on universities and students were debated, and the conclusions of the discussion will be reflected in the TF 1 report.

● **Task Force 2 – Nurturing the Future Generations**

Since the third meeting in Paris in March 2011, which was covered in the last progress report, the TF 2 team has achieved several key milestones.

A fourth meeting was planned to be held in Singapore, courtesy of Shell, but did not materialise due to unforeseen circumstances. Nevertheless, work has continued.



TF 2 Chair, Soh Mey Lee (centre with white jacket) at an event for final-year engineering students organised in December 2011 as part of the Malaysian Gas Association's Prestige Programme.

Overall, TF 2 membership has grown as more young people have joined. However, the Tier 1 team lost Antony Seigel of BG Group, UK when he resigned from BG and left the Task Force. TF 2 would like to thank Antony for his valued contribution. There are now approximately 40 members, whose support will be needed to execute events on-site during WGC2012.

A strategic study has been completed to assess the efforts of governments, corporations, academic institutions and industry associations of 10 selected gas producing and consuming nations to stimulate the interest of young people in science, technology, engineering and mathematics (STEM). The study also incorporates recommendations for the global gas industry to address key issues in nurturing the future generations.

A Youth Programme will run concurrently with the main WGC2012 event and will be held in a dedicated venue nearby. The fit-out contract for the venue was awarded in August 2011, and design, concepts and planning are in progress.

The main events of the Youth Programme include the following:

- A four-day Youth Conference and Carnival for young people aged between 18 and 30 featuring a moderated discussion forum, keynote addresses, panel sessions, luncheon addresses and knowledge cafes;
- A Strategic Panel Plenary Youth Roundtable where selected young people will be engaged in a forum with industry CEOs on the stage at the main WGC2012 event;
- A night out and dinner with the theme "Masquerade Movie Magic";
- A four-day "Fun with Natural Gas Carnival" at Petrosains, The Discovery Centre for young people aged between five and 30;
- A dinner at Petrosains, The Discovery Centre hosted by Petronas; and
- The world edition of the prestigious NRG (Energy) Battle, in which multidisciplinary teams work on challenging cases from the energy



Participants in the Petrosains-IGU Career Day held on October 31, 2011 enjoy a science show by science communicator, Nur Fakhri Nordin.

sector, will run concurrently at the same venue. The teams will have four days to work on the case before presenting their idea or solution in a three-minute pitch to an expert jury of CEOs and directors of energy companies. The jury will short-list three teams, and WGC2012 delegates will then choose the final winner.

As part of the TF 2 project, a dedicated website (www.itsnotmagicitsscience.com) went live in April 2011. An on-line E-essay competition was held to select candidates for the roundtable, and 171 essays were submitted by the closing date of December 15, 2011. The authors of the top 20 essays were then asked to submit a five-minute video sharing their views on the given topics by February 20. In the final stage of the competition, candidates will be interviewed by a teleconference link to assess their eloquence, confidence and knowledge. So far, four industry CEOs have confirmed their participation in the Youth Roundtable. CNBC has been appointed to moderate the roundtable and part of it will be broadcast live.

As a build-up towards WGC2012, the Task Force has been engaging with school children and undergraduates to discuss careers in the gas industry and give talks on STEM education. This work has been supported by Petrosains, The Discovery Centre.

IGU Charter Members have been invited to nominate young people to take part in the Youth Programme. Nominees must be aged between 18 and 30 and the sponsoring organisation is responsible for paying for their air travel and ground transportation. The fee of \$700 per delegate is subsidised by TF 2 and includes:

- Accommodation for six nights on a twin-sharing basis;
- Participation in the Youth Conference and Carnival;
- Attendance at the Strategic Panel Plenary Youth Roundtable;
- The Masquerade Movie Magic night out;
- The dinner at Petrosains, The Discovery Centre;
- WGC2012 Opening and Closing Ceremonies;
- Meals (morning coffee breaks, lunch and afternoon tea breaks) during WGC2012;
- Door gifts and souvenirs; and
- Youth Conference material.

Competition and sponsorship

To increase traffic on the youth website, a photo competition entitled "Gas, Camera, Action!" has been launched with the prizes sponsored by GasTerra. The competition will run until May 14.

Other sponsorship and brand partnership opportunities include corporate booths and thematic discussion rooms, which are offered at RM30,000 (\$10,000) each, and advertisements in the Youth souvenir programme book.

● Task Force 3 – Geopolitics and Natural Gas

Significant effort has been dedicated to solicitation of sponsors for the work of the Task Force. We are pleased to report excellent support on this front, with the following line-up of sponsors:

- Royal Dutch Gas Association (KVGN), premium sponsor;
- Chevron, WGC2012 strategic panel sponsor;
- Gazprom Export, general sponsor;
- Eni S.p.A., general sponsor;

- CPC Corporation, Taiwan, partial regional roundtable sponsor;
- TAQA Arabia, regional roundtable co-sponsor;
- Oman LNG, regional roundtable co-sponsor; and
- Brazilian Petroleum, Gas and Biofuels Institute (IBP), regional roundtable sponsor.

We would like to formally thank those organisations that have committed to provide financial support for the work of the Task Force.

Since our last update, activity has been largely focused on conducting a series of regional roundtable events to build understanding of regional geopolitics and related impact on gas market development.

The third of these roundtable events, looking at on the South American region, was held in August 2011 in Rio de Janeiro, Brazil. Attended by a wide cross-section of 28 senior people from the gas industry and academia, the workshop was focused



Host João Carlos De Luca of the IBP greets CC Chairman Ho Sook Wah at the South American regional roundtable in August 2011.



From left, Jonathan Stern, Mel Ydreos, Datuk Abdul Rahim Hashim, Bernard Bot, Coby Van der Linde, Dick De Jong and Ho Sook Wah engage in discussion at the Europe-CIS roundtable in September 2011.

on developing a deeper understanding of regional geopolitical issues.

Our generous hosts at the Brazilian Petroleum Gas and Biofuels Institute began the event with an informal evening reception on August 21. The meeting was then convened on August 22 at Hotel Sofitel, located on Copacabana Beach in Rio.

The discussion began with observations and dialogue related to a discussion paper developed for the workshop by Sylvie D'Apote and Agustin Castaño from Gas Energy S.A., who served as a subject matter experts for this event. Participants offered regional perspectives on their themes as well as key themes in the draft report on Geopolitics and Natural Gas from the Clingendael International Energy Programme (CIEP). Please refer to the following article for a summary of some of the issues raised during the meeting.

A month after this event, the fourth in the series of TF 3 regional roundtables was held in Amsterdam.

Hosted by our generous premium sponsors, the Royal Dutch Gas Association (KVGn), with support from Gasunie and GasTerra, the event began with a formal dinner at Geelvinck Hinlopen Museum, on September 29.

The following day, the roundtable forum was held at the Grand Hotel. Prior to the event, participants had reviewed a discussion paper authored by Jonathan Stern, Chairman and Senior Research Fellow, Oxford Institute for Energy Studies, who served as a regional subject matter expert for this event. Attended by a wide cross-section of 35 senior people from the gas industry and academia, dialogue facilitated by our friends at CIEP was focused on the following key themes:

- Transit;
- EU market reform;
- "Roadmap 2050" and security of demand;
- Security of supply;
- Gas markets and resource ownership;
- The role of international organisations; and
- The geopolitical sensitivity of natural gas.

Please see the article below, prepared by Jonathan Stern after incorporating input from participants at the roundtable, for a summary of one topic area discussed at the event.

Immediately after the meeting, participants enjoyed a tour of the Hermitage Museum in Amsterdam.

Following completion of our fourth regional roundtable, the International Energy Agency



From left, Coby Van der Linde, Mel Ydreos, Marcel Kramer and Dick De Jong enjoy a light moment at a reception during the IEA meeting in Paris in October 2011.

hosted a smaller meeting in Paris, France on October 24. Attended by 21 representatives from a number of international organisations, this meeting focused on themes that had emerged for consideration as CIEP finalised their report on Geopolitics and Natural Gas.

TF 3's last meeting of the Triennium was held in Paris, February 15-16 and focused on reviewing the final report from CIEP and finalising plans for the World Gas Conference.

● **Natural Gas and Geopolitics in South America**

By *Sylvie D'Apote and Agustin Castaño*
Natural gas versus renewables in South America's energy mix

South America is a region well endowed with energy resources: it holds 17% of global oil proven reserves and 4% of global gas proven reserves, and these reserves are due to rise when the huge pre-salt discoveries in Brazil are fully quantified and proved. The region also has some coal resources (1.5% of the world's total).

Aside from fossil fuels, the region is rich in renewable energy resources: mainly hydropower and biomass-derived fuels, some geothermal resources, with solar and wind starting to be developed. The region already has a well-

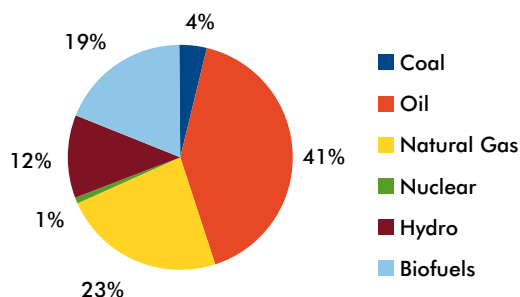
developed hydropower capacity, supplying 70% of the regional electricity demand and accounting for 20% of the world's hydropower generation, with substantial remaining hydro potential. The region is also leader in the use of biomass to produce commercial fuels (i.e. ethanol from sugarcane, and also biomass-fired power generation).

Figures 2 and 3 show the energy supply mix and the power generation mix of the region as a whole. Two things are immediately noticeable. First, the average share of gas in the energy supply mix in the region is basically the same as the world's average (22%); however, the share of gas in power generation is much lower (14%, compared with 21% for the world), due to the high share of hydro. Secondly, the share of renewables, both in the energy mix and in power generation is much higher than the world's average, indicating



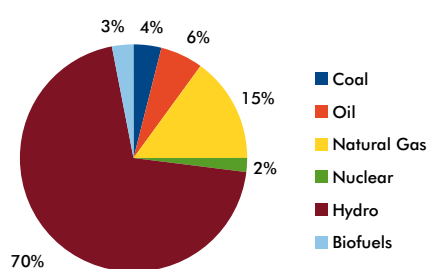
South America's energy reserves are being boosted by the huge pre-salt discoveries in Brazil such as the Tupi field (ABOVE). The region already has significant hydropower capacity (OPPOSITE TOP RIGHT).

REGIONAL PRIMARY ENERGY SUPPLY MIX



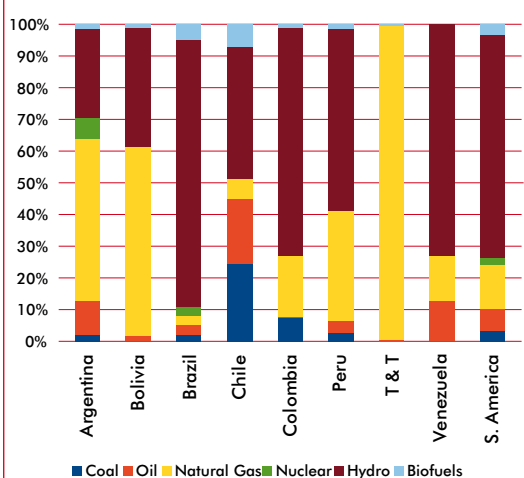
Source: Gas Energy, IEA statistics.

REGIONAL POWER GENERATION MIX

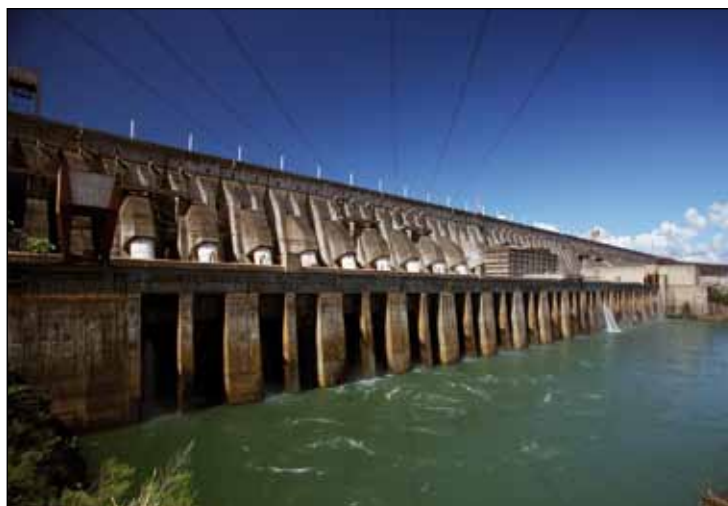


Source: Gas Energy, IEA statistics.

POWER GENERATION MIX BY COUNTRY



Source: Gas Energy, IEA statistics.



that there is less scope to advocate for gas as a cleaner fuel, but a good opportunity to position gas as a complementary and transition fuel.

Average regional statistics are strongly influenced by Brazil, which accounts for half of total regional primary supply and half of total regional power generation. Indeed, the regional picture is quite diversified on a country-by-country basis. As shown in *Figure 4*, gas share of power generation is high or very high in just a few countries, and very low or null in all the others.

Natural gas: A relatively recent history in South America

Natural gas has a relatively recent history in South America. With the exception of Argentina, most countries only started to develop natural gas markets in the last 10-15 years.

In some cases, gas market development was supply-driven: domestic or export markets needed to be found for associated gas, produced as a result of successful oil exploration. Brazil is a case in point.

In other cases, it was the opposite: the opening of new market opportunities (the construction of an export pipeline or LNG export terminal and the signing of export contracts) generated a surge of exploratory activity, which in turn led to growing

TOPLEFT
Figure 2.

MIDDLE LEFT
Figure 3.

BOTTOM LEFT
Figure 4.

reserves and production capacity. This happened, for example, in Bolivia and Peru.

As in other parts of the world, reserves are not always close to markets, thus gas market growth required the construction of a number of cross-border gas pipelines: Bolivia to Argentina; Argentina to Chile, Uruguay and Brazil; Bolivia to Brazil; Colombia to Venezuela. It has to be emphasised, however, that these cross-border pipelines never amounted to a real regional (or even sub-regional) integration, but were merely a series of bi-national pipelines connecting a producing area with a market. Essential conditions for solid regional integration, such as harmonised regulation and common pricing, continue to be lacking in South America.

Furthermore, in some of the main exporting countries, the success in expanding markets was not matched with an equal effort in expanding reserves and production capacity. In Argentina, for example, natural gas production nearly doubled between 1990 and 2010 while proven reserves halved. This led to export cuts to Chile, Brazil and Uruguay, and generated a strong distrust and diffidence towards regional integration.

A few years ago, it would have been easy to classify South American countries into natural gas exporters and importers, but the supply-demand situation is evolving rapidly and roles are changing: Venezuela, which has the eighth largest gas reserves in the world and was eager to export gas to Colombia, Central America and even Argentina, is still a gas importer; Argentina used to be an exporter and is now an importer; Brazil, a traditional importer, might become a net exporter in the mid term; Peru has now become the second regional LNG exporter after Trinidad and Tobago.

Specificities of natural gas markets in South America

Natural gas markets in South America present some particularities which have and will continue to influence their development:

- Preponderant presence of hydropower in some countries (e.g. Brazil), limiting the role of gas-fired power generation as an “anchor”.
- Low use of gas in the residential and commercial sector because of little or no need for space heating (with the exception of Argentina and Chile).
- Low population density and geographical obstacles, making it expensive to develop interconnected natural gas networks. Because of this, creative solutions involving distribution of natural gas by CNG or LNG trucks or barges are being developed (virtual pipelines).
- High use of natural gas in the automotive sector (CNG). Argentina and Brazil have the second and third largest CNG fleets in the world. Other countries (Bolivia, Peru and Colombia) are launching successful CNG programmes. However, the abundance and cost competitiveness of sugarcane-based ethanol is a challenge to natural gas use in the transport sector.
- Predominance of integrated state-owned oil and gas companies.

Natural gas and geopolitics in South America

South America as a whole is relatively free of broadly expanded regional geopolitical and social conflicts that could significantly impact the evolution of the natural gas sector. However, there are a few specific, and geographically-focused, issues, which can be divided in two categories: those that are genuinely geopolitical and those that reflect the impact of national internal policies and politics.

In the first category are included the historical tensions between Chile, Bolivia and Peru linked to past border disputes, which have impeded the export of Bolivian LNG through Chile, and the construction of a pipeline from Peru to Chile. Another example is the dispute between Argentina and the UK about the Malvinas/Falkland Islands,

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which will likely generate different obstacles (from diplomatic to logistic ones) to natural gas exploration and production in that area.

In the second category (internal policies having regional impacts) are the natural gas supply cuts from Argentina to Chile, which generated tensions between the two countries and led Chile to develop alternative sources, and the political and/or social tensions in Bolivia and Peru with regards to natural gas exports versus supply to the domestic market.

Although there have been some specific bilateral difficulties in the past, which have been caused by, or have had impact on, natural gas trade and investments, we see little or no potential for major regional geopolitical and social conflicts impacting the natural gas sector. Nor is energy in general, and gas in particular, likely to be the cause of regional conflicts because of the availability of diversified energy resources.

Looking towards the future, there are four main factors that will have a significant impact in the future supply-demand balance of the region, and on potential geopolitics:

- The construction of several LNG regasification terminals coupled with the abundance of LNG in the world market;
- The Brazilian pre-salt discoveries;
- The potential role of unconventional resources; and
- The roles of NOCs and private companies and their interaction.

All four factors will likely change the “rapports de force” between countries, allowing importing countries previously tied up to one supplier to diversify their sources of gas and/or become self-sufficient.

TF 3 members Sylvie D’Apote and Agustin Castaño are consultants with Gas Energy S.A. (www.gasenergy.com.br), a leading South American consulting company with a focus on natural gas and related sectors.

● **The Southern Corridor and South Stream: How European Gas Supplies Became a Geopolitical Football Game**

By Jonathan Stern

Since 2000, the European gas industry has spent much time discussing the South Stream gas pipeline from Russia, and a “Southern (pipeline) Corridor” from the Caspian/Middle East Region, to southern and central European countries. The project details have been rehearsed many times: South Stream is currently projected to start deliveries in late 2015 building up to 63 bcm/year through two pipelines by 2020. Starting from 2015, Southern Corridor pipelines – Nabucco, Italy-Turkey-Greece Interconnector (ITGI), Trans-Adriatic Pipeline (TAP) and White Stream – are variously projected to start deliveries comprising some combination of Azeri, Turkmen, Iranian, Iraqi and Egyptian gas with throughputs of individual pipelines ranging from 8-31 bcm/year.

Energy researchers have attempted to look at the commercial wisdom of these pipelines in relation to: gas supply availability, gas demand requirements, investment costs, and likely contractual arrangements, including pricing of supplies and transportation tariffs. However, the vast majority of the political, academic and media commentary has taken on a geopolitical character to the point where gas issues have become relatively unimportant. Rather these pipelines have come to resemble symbols of which side is “winning or losing” a geopolitical football game, with the Russian government managing “the South Stream team”, and the European Commission “the Nabucco team”.

Security, diversity and geopolitical competition

The original ideas of both the South Stream and Southern Corridor pipelines were sound: Europe is seeking to diversify its sources of gas away from the three existing “corridors”, but particularly away from Russian gas. Russia is seeking to diversify its exports to Europe away from existing transit

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Gazprom's Alexey Miller (*fourth from left*) discusses cooperation on South Stream with a delegation from Eni led by Paolo Scaroni.

routes, particularly through Ukraine. But instead of being seen through a diversity lens – supply for Europe, transit for Russia – these pipelines have been posed as competitive projects, and far from being seen as an improvement for security, have been portrayed in opposite terms by each side.

South Stream has been characterised by many in Europe as an attempt to prevent Southern Corridor pipelines from going ahead, and as a “geopolitical bluff” which would be called (i.e. abandoned) as soon as the Nabucco pipeline began construction. This view softened somewhat post-January 2009 when it became clear that the principal victims of the Russia-Ukraine crisis were south-east European countries which would be the principal beneficiaries of South Stream closest to the landing point of the line. However, the European South Stream geopolitical narrative (like Nord Stream before it) has been characterised in terms of Russian attempts to “isolate” transit countries, and to continue its domination of gas markets by preventing the New EU Member States and Accession countries from accessing alternative supply sources in order to maintain Russian political and strategic influence.

The Southern Corridor – and specifically the Nabucco pipeline – has been continually derided by Russia as a pipeline with no supply, no markets and no financial backing; a commercial construct

pursued by the European Commission for political – and specifically anti-Russian – reasons. The 2011 EU initiative to begin negotiations on a legally binding treaty with Azerbaijan and Turkmenistan to build a Trans-Caspian pipeline – unlocking a major potential source of supply from Turkmenistan for the Southern Corridor, was construed in Moscow as a violation of the legal status of the Caspian Sea and disregard for its fragile ecosystem. Moscow reaffirmed its view that pipelines across the Sea can only be permitted following agreement between all of the five littoral states, and that bilateral agreements would not be legally acceptable. This position has the support of Iran, a state which has its own geopolitical reasons for wishing to frustrate both EU and US energy initiatives in the Caspian region. Whether Azerbaijan and Turkmenistan will choose to proceed with pipeline construction in the face of opposition from Russia and Iran will be as much a political, as a legal and commercial, decision.

In these discussions, there has been a tendency to lose sight of the geopolitical position of both the producing and the transit countries. Azerbaijan and Central Asian countries find themselves in one of the least enviable geostrategic locations in the world sitting as they do between: Russia in the north, China in the east, Iran and Afghanistan in the south, and Turkey (with Europe beyond) in the west. Surrounded by powerful geostrategic players, it is not surprising that these countries – and particularly Azerbaijan and Turkmenistan – have tended to agree, or at least not to reject, pipelines (however unrealistic) proposed by their powerful neighbours. These countries have taken the very pragmatic view that they will cooperate widely with those wishing to create infrastructure, as long as the latter are willing to provide the finance.

And where do transit countries – and particularly Turkey which is the key player in both South Stream and the Southern Corridor – stand in this geopolitical game? To some extent, Turkey is playing the roles of both referee and player. South

Stream must pass through the Turkish sector of the Black Sea (the alternative being the Ukrainian sector which is hardly likely to be possible), and the majority of Southern Corridor pipelines must also transit Turkey, with the latter likely to be the largest single market for that gas at least up to 2020. Turkey is the second largest importer of Russian gas, the largest importer of Iranian gas, and has important political relationships with both countries. It is playing an important geopolitical game – but an equally important commercial game – with both teams. Whatever the outcome of discussions it can look forward to earning significant transit fees from Southern Corridor pipelines across its territory, but it can choose to accelerate or delay any or all pipeline options as its political and commercial interests dictate. Likewise, south-east and central European countries on the route of South Stream and Southern Corridor pipelines have signed agreements with all pipeline companies in the hope of obtaining significant transit rents.

So what is the likely outcome of this game in relation to European gas? Well actually nothing very dramatic and certainly nothing very soon. It is possible that in the second half of the 2010s, South Stream will carry increasing quantities of gas currently transited through Ukrainian net-

works. By 2020, up to 10 bcm of gas could reach Europe via Southern Corridor pipelines. In the 2020s, both projects could become much more significant but, in terms of gas supplies, it will be at least a decade before either side will be able to credibly claim victory for itself, or defeat for the other team.

But as European geopolitical games continue around these pipelines, it should be sobering for all parties to reflect that, in less than a decade, China has created an “Eastern Gas Pipeline Corridor” which by 2015 will be transporting volumes of Central Asian gas greater than the throughput of South Stream or two Nabucco pipelines. While this development also has interesting geopolitical implications for natural gas relationships between China, Russia and Central Asia, the principal lesson that Russians and European should draw from China’s Eastern Corridor are that a country with a pressing need for gas supplies has committed substantial financial resources and has focused on pipeline construction rather than geopolitical gamesmanship.

Jonathan Stern is Chairman of the Natural Gas Research Programme and Senior Research Fellow at the Oxford Institute for Energy Studies (www.oxfordenergy.org).

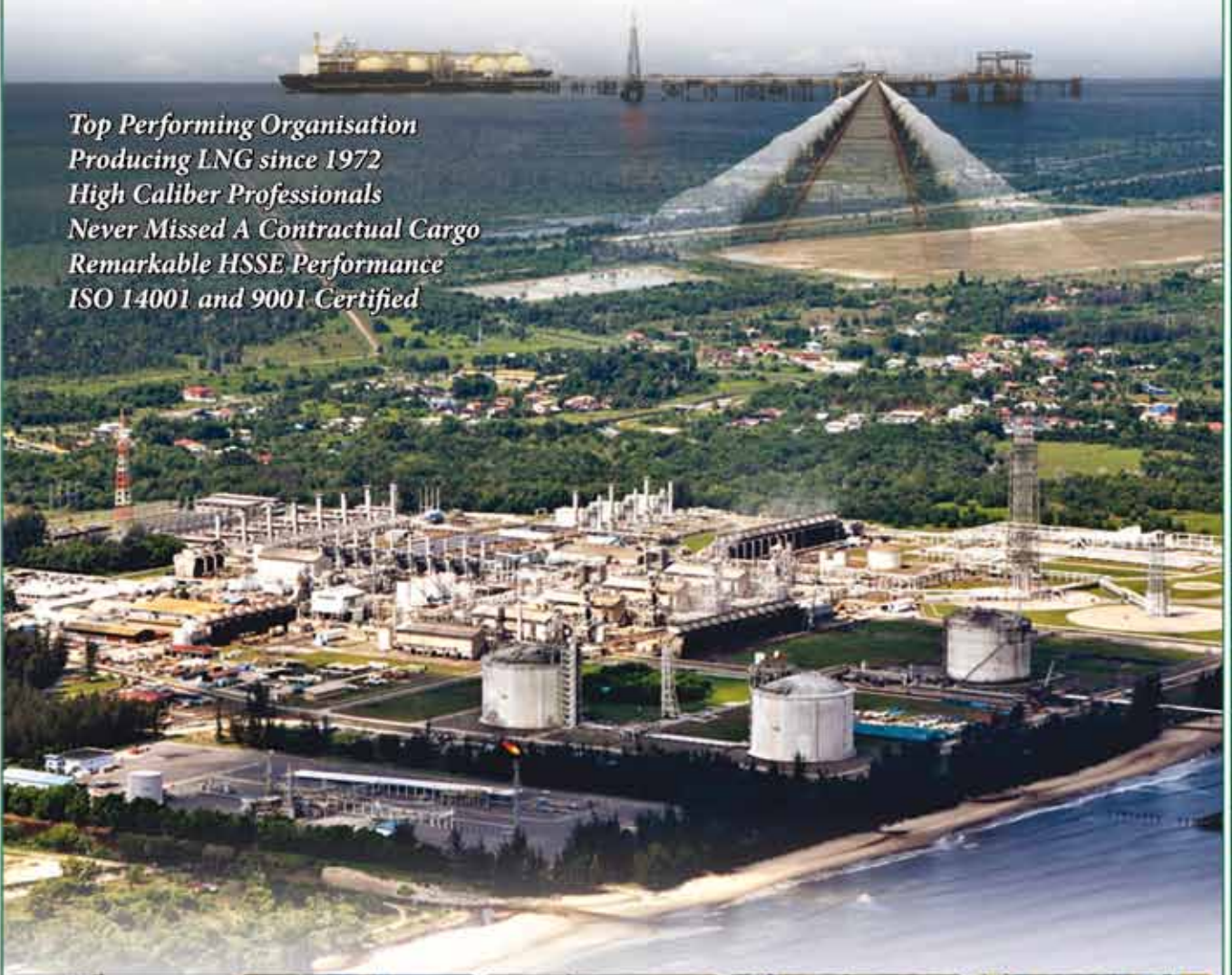


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FEATURES

This issue's features section starts with coverage of the UN Climate Change Conference in Durban, where IGU organised a gas symposium. Then we have an article from the World Bank-led Global Gas Flaring Reduction partnership, which is celebrating its 10th anniversary, and an interview with Dr Kandeh Yumkella, Director-General of UNIDO and a member of IGU's Wise Persons Group.

An overview of LNG developments drawing on IGU's *World LNG Report* is followed by a focus on Australia, which is set to overtake Qatar as the top LNG exporter by the end of the decade, a contribution from SIGTTO on turning an LNG import terminal into an export terminal, a report on the entry into service of Europe's latest LNG receiving terminal, Gate, and a contribution from GIIGNL on a new standard contract for short-term LNG shipping.

With Pearl GTL on track to reach full output by the middle of this year, we have an update on developments in the gas-to-liquids liquids sector, followed by articles on marketing, increasing sustainable gas production, smart gas grids, gas heat pumps, power to gas, unaccounted-for gas and a comparison of the US and European regulatory agencies.

We round up with profiles of IGU's four new Charter Members, a description of the publications and documents available from the Secretariat and the events calendar.

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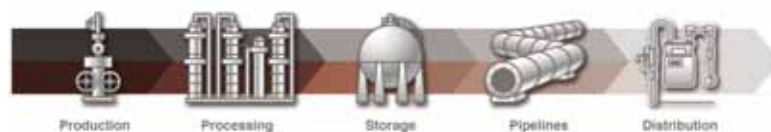
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Mixed Response to Durban Agreement

By David Adam

Of all the immediate reactions to the latest round of the United Nations climate talks, held in Durban on the South African coast in late 2011, perhaps the best came from David Waskow, the Climate Change Programme Manager of Oxfam America. "I've just returned," he wrote on the group's website, after sitting through the marathon negotiations. "With the outcome, an important page was turned in the climate talks, but the next page in the negotiations is still utterly blank."

Waskow's diagnosis came in the exhausted days that immediately followed the conclusion of the talks, but it will almost certainly endure. The annual meetings, known as Conferences of Parties (COPs) to the UN Framework Convention on Climate Change (UNFCCC), have long been an example of political realities squashing scientific demands, but the COP17 meeting in Durban took it to a new level. How else to explain the wildly differing responses to the final text agreed by delegates? To Chris Huhne, Energy and Climate

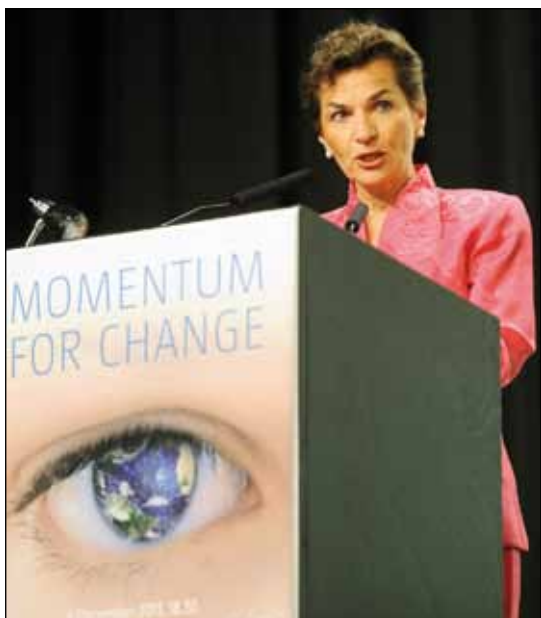
Change Secretary of the UK, it marked a "great success for European diplomacy", while the US Special Envoy for Climate Change Todd Stern said: "In the end, it ended up quite well". And Christiana Figueres, UNFCCC Executive Secretary, declared: "I salute the countries who made this agreement. They have all laid aside some cherished objectives of their own to meet a common purpose, a long-term solution to climate change." Note her use of the phrase "long-term", as this is where the divergence in opinion begins.

Kumi Naidoo of Greenpeace International led the dissent: "Right now the global climate regime amounts to nothing more than a voluntary deal that's been put off for a decade." Sarah-Jayne Clifton of Friends of the Earth International said: "Ordinary people have once again been let down by their governments." And Mohamed Adow of Christian Aid stated simply: "It is a disastrous, profoundly distressing outcome – the worst I have ever seen from such a process."

Politicians and environment campaigners rarely see eye to eye on such matters, but the degree of discord here is greater than usual. A clue to why comes from Adow, who added: "This Durban outcome is a compromise which saves the climate talks but endangers people living in poverty."



COP17 was held in Durban, November 28-December 9, 2011 under the presidency of South Africa's Foreign Minister, Maite Nkoana-Mashabane (centre).



UNFCCC Executive Secretary, Christiana Figueres hailed COP17 as providing “a long-term solution to climate change”.

While the outcome of the Durban meeting may please those who were directly involved, in that the deal is better than the prospect of a failure to agree anything, which loomed large as the final hours ticked away, it fails in what should be the fundamental function of the whole enterprise: to control global emissions.

● The Durban Platform

So, what does the outcome of the meeting, known as the Durban Platform, do, and what does it fail to do? In essence it abandons the ambition of the last few years to secure a new legally binding treaty to regulate greenhouse gas emissions, which was supposed to come into force in the next 12 months or so. The timing is important as this year will see the end of the first phase of the 1997 Kyoto Protocol – the world’s only binding treaty on carbon emissions. The great hope was that, by now, Kyoto could somehow have been extended and expanded to other countries, or that a wholesale replacement treaty could have been hammered out and introduced – either would have done so long as the new arrangement was in

place for when the first phase of Kyoto ended. That was seen as important because, under the Kyoto arrangements, a multi-million dollar carbon market has been established, and its future was unclear without a seamless transition.

According to the Durban Platform, this effort to find a new treaty to come into force any time soon has now been abandoned. Negotiations on a new global treaty along these lines are not due to be completed until 2015, with any treaty that those talks agree unlikely to come into force until 2020. Kyoto will limp on, as European countries did pledge in Durban to take on new commitments under the protocol, effectively taking it, and the carbon markets, into a second phase. But attempts to find a way to bring together Europe, China, the United States, India, Brazil and the other major polluters around the world – the focus of intense diplomacy and political effort for the last few years – are effectively on hold. As a result, at a time when scientists warn that emissions must start to peak and then come down to stand any chance of restricting global warming to 2°C above pre-industrial levels, the vast bulk of global pollution driving the problem will be allowed to increase without restriction. Hence the dismay at the outcome from those who view climate change as a



Kumi Naidoo of Greenpeace International led the dissent.

scientific crisis, rather than a political problem. And it explains the relief from those whose main objective was to make sure they could reconvene for the next round of talks in Qatar later this year. Like the proverbial shark, the UN process must keep moving forwards, however slowly, lest it perish.

How did it come to this? Just a few years ago in Bali, the same nations produced a roadmap that was supposed to produce a new agreement, which should have been sorted in Copenhagen in 2009 and in place by now. But the weaknesses in that approach were evident even then. The result was that under the UN process, two separate tracks were pursued: one of which looked at how to extend the Kyoto Protocol, while the other investigated an altogether more vague aim of long-term cooperative action. This division reflected the reality that the United States was never going to sign up to a Kyoto extension, or indeed to anything that looked like it. While Kyoto was a pioneering agreement, it split the world into rich and poor in a way that looks anachronistic now. It fails to represent the rise of China, and to

a lesser extent India and Brazil, in recent years. With those nations excused legal cuts under Kyoto, the agreement being continued in any form was a non-starter for the US. (And even though the Durban Platform will see Europe continue with Kyoto, the emissions cuts that the continent plans in the next decade, and beyond, were already in place, under a series of voluntary pledges made in Brussels. The new round of Kyoto merely rebrands these targets.)

The track that examined a new approach to long-term cooperative action fared little better. The (always optimistic) official line was that it could be developed in parallel to the Kyoto talks, and then the two could somehow be merged or bridged into a single agreement. But with the US sticking to the demand that China would need to take on binding targets, if not now then later, and China reluctant to do so, the result was the chaos of Copenhagen, where the Bali deadline to agree a new treaty was missed. Instead, the Copenhagen meeting produced a number of voluntary pledges from most of the important countries. Durban was widely viewed as the last opportunity to convert those to binding targets, but well before delegates boarded their planes to South Africa, it was clear that wasn't going to happen.

● **Some progress**

So, what did happen? Well, there was some progress on the broad design of a Green Climate Fund, which is intended to channel money from rich countries to help poor countries cut their emissions and adapt to the impacts of a changing climate. Those rich nations have said that up to \$100 billion will be available by 2020, but Durban did not determine where that money will come from.

In one sense, those who talked up the achievements of the Durban meeting were correct: it could have been much worse. Under the terms of the COP discussions, all countries must agree to everything in the final text produced, even if it is



The US Special Envoy for Climate Change, Todd Stern makes a point to members of the Brazilian delegation.



Connie Hedegaard, EU Commissioner for Climate Action, led the European delegation.

just a vague promise to keep on talking. In this case, the Europeans for one will argue, the text goes much further than that. Led by Connie Hedegaard, EU Commissioner for Climate Action, the European delegation held a strong line that, if no immediate agreement was pending, then future negotiations had to break down the firewall between the supposed rich and poor countries and make sure that emissions regulation applied to all. In return, it offered its unilateral extension of Kyoto, and crucially, it was backed in its demands by a broad group of the least developed countries. This kicked away the political defence used by the larger developing nations against emissions targets in the past – that it was an unfair request made by bullying rich nations to keep developing countries in their place.

Under pressure, Jayanthi Natarajan, India’s Minister of Environment and Forests, dug her heels in. “Am I to write a blank cheque and sign away the livelihoods and sustainability of 1.2 billion Indians, without even knowing what [the new agreement] contains?” she said. “I wonder if this is

an agenda to shift the blame on to countries who are not responsible.” While the EU wanted the Durban meeting to commit countries to work out a future “protocol” or “legal instrument”, the Indians preferred the more ambiguous goal of a “legal outcome”.

Faced with a stalemate, the South African Foreign Minister, Maite Nkoana-Mashabane, who was chairing the talks – by now dragging well on into the small hours – told Natarajan and Hedegaard to resolve their differences in an informal huddle. They did so, in the middle of the main conference room and in full view of other delegates and the press. Some have already called it the “huddle to save the planet”. After some hard words and hard stares, a compromise was reached: the wording would read “an outcome with legal force”.

Reflecting on the outcome a few weeks later, in a piece for India’s Economic Times, Hedegaard said: “While protecting our respective interests, we both gave a bit of ground to get a result for the global community. That is what UN negotiations are about. This is what a successful outcome for almost 200 different parties looks like.”



Jayanthi Natarajan, India’s Minister of Environment and Forests (second left) addresses delegates.

● Looking ahead

What the outcome means in practice currently seems anybody's guess – and lawyers from all sides will be working on their own interpretation before the talks resume, but to those at the Durban event, it was job done. They had stepped back from the brink of collapse, and agreed, at least in principle, that they would work together on a future deal.

What happens now? The 2015 deadline for a new agreement will seem a long way distant to those politicians who must fight for re-election soon, including President Obama, and the climate topic is one his team will be hoping to keep off the agenda.

Outside the Kyoto zone in Europe, emission cuts, for now, will be purely voluntary, and made according to the voluntary pledges put forward by nations in Copenhagen. The results, even if all the targets are met, will not be enough to limit global

warming to 2°C; in fact, estimates published at the Durban talks suggest they could see temperatures rise by up to 4°C. The Durban Platform recognises this deficit and says that countries will explore ways to close this “ambition gap”.

All of which means that, as Waskow at Oxfam America pointed out, the curtain has fallen on the first act of the world's attempts to tackle the problem of global warming. The script for the rest has yet to be written, and a first draft is unlikely to surface much before the end of the 2015. To some, the Durban meeting marked a retelling of story they had heard many times before, while others found it a tear jerker. To most it should appear as a cliff hanger, and one in which the ending is far from clear.

David Adam is an editor for the journal Nature (www.nature.com) and covered the COP negotiations for The Guardian from 2005-2010.



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IGU's Forum on the Future at COP17

By Georgia Lewis

IGU continued the tradition of holding a natural gas symposium to coincide with the annual UN Climate Change Conference, with the 2011 event held on December 4 in Durban, South Africa, alongside COP17.

"Natural Gas: Powering the Low-Carbon Economy and Facilitating Access to Energy" was the theme of the symposium, which was supported by the South African Department of Energy and iGas, and sponsored by E.ON Ruhrgas and Statoil. It was attended by around 60 people.

The symposium was divided into two parts: Facilitating Access to Energy and Mitigating Climate Change and moderated by IGU's President, Datuk (Dr) Abdul Rahim Hashim, who underlined the need for "enhanced dialogue

between policymakers and industry to help natural gas regain its rightful place as the fuel of choice for a clean, sustainable energy future".

IGU Secretary General, Torstein Indrebø opened proceedings with an overview of IGU's work and highlighted the important role natural gas can play in mitigating climate change, forging a low-carbon economy and improving access to energy. He stressed the importance of striving to achieve these goals in light of the latest figures on world population, currently at 7 billion and projected to rise to 9 billion by 2050. He also pointed out that the accident at Fukushima's nuclear power plant following the tragic earthquake and tsunami in March 2011 underlined the importance of safety when it comes to world energy needs.

"Natural gas is an essential part of the global solution to climate change, in particular as a preferred fuel in the power sector. Gas-fired power plants are also an ideal partner to complement the intermittency of wind and solar power," Mr Indrebø declared.



Dr Pradeep Monga, Director of the Energy and Climate Change Branch, UNIDO opened the first part of the symposium. Behind him at the table from right to left are: Muzi Mkhize, Chief Director for Hydrocarbons, Department of Energy, South Africa; IGU President Datuk Abdul Rahim Hashim; Professor Jiang Kejun, Director of the Energy Research Institute of China's National Reform and Development Commission; and Ho Sook Wah, Chairman of IGU's Coordination Committee.

● Facilitating Access to Energy

Dr Pradeep Monga, Director of the Energy and Climate Change Branch, UN Industrial Development Organisation (UNIDO) opened the first part of the symposium with a presentation entitled “Energy Access: Time for Action”. He started by putting the access issue into a global context by stating that 2.5 billion people worldwide still rely on traditional biomass fuel but stressed that improved access is a realistic goal.

“Energy access for all is possible and achievable with forward-looking policies, political will and adequate investments,” he said.

Muzi Mkhize, Chief Director for Hydrocarbons, Department of Energy, South Africa, spoke about how natural gas contributes to clean access to energy and outlined some of the major issues in exploiting natural gas resources, such as effective infrastructure, establishing an effective legal and regulatory framework, and putting long-term contracts in place.

Mr Mkhize also outlined the natural gas situation in South Africa, pointing out that while reserves were small in the country, partnerships with nearby countries, such as Mozambique and Namibia may help increase the proportion of natural gas in South Africa’s energy mix.

Professor Jiang Kejun, Director of the Energy Research Institute of China’s National Reform and Development Commission, explained that China has far more abundant reserves of coal than of natural gas and that electricity generated from gas costs twice as much as electricity from coal-fired power stations. However, he also pointed out that the price of coal has increased at a higher rate compared to natural gas and that expanding the use of gas is currently high on the agenda in China.

He said that China is committed to increasing the use of natural gas in the energy mix, with annual consumption forecast to increase to 260 bcm by 2015 compared to 109 bcm in 2010, and that China is planning to close down all coal-fired



Muzi Mkhize outlined the natural gas situation in South Africa.

power stations by 2050, regardless of the quantity of coal reserves.

Ho Sook Wah, Chairman of the IGU Coordination Committee, rounded off the first session with a presentation on how natural gas can play an important role in providing easy access to meet the global energy challenges.

“The world needs more affordable, clean, safe energy and natural gas provides that as part of a long-term solution,” he said, adding that there is enough natural gas available globally to last more than 250 years.

He echoed the sentiments of Mr Mkhize on the poor public opinion of nuclear power plants, as well as coal-fired power plants, neither of which he said are as acceptable overall as gas-fired facilities. But he also said that further public education is required to improve the image of gas and outlined the Natural Gas CARES strategy, a campaign using the acronym to put forward the message that gas CARES for the world as it is clean, affordable, reliable, efficient and secure.

After the four speakers, there was a question-and-answer session in which Dr Monga responded to a question from Dr Michael de Pontes representing iGas. He said that aiming for just level 1 (or basic household) access to energy should not be



Saya Kitasei, Sustainable Energy Fellow with Worldwatch Institute (left) and Ambassador Richard H. Jones, Deputy Executive Director of the IEA (right).

the priority and countries should aim for level 2 access, whereby access to energy extends beyond households and to the broader community, such as schools and businesses. Dr Monga also gave examples of clean cook stove success stories in Mozambique and said that for some LDCs, economies of scale won't necessarily be effective and energy infrastructure development needs to happen at a regional or sub-regional level.

Adam Kuleit Ole Mwaraby Lemareka, from Tanzania's Parakuiyo Pastoralists Indigenous Community Development Organisation commented that energy companies need to ensure the benefits of their development trickle down to communities in developing countries and that they are consulted throughout the development process. He cited land evictions as an example of energy companies not acting in the best interests of rural African communities and the speakers agreed that community consultation is an essential part of the development process.

● Part 2: Mitigating Climate Change

Ambassador Richard H. Jones, Deputy Executive Director of the International Energy Agency (IEA) gave a presentation with the theme "Natural Gas in a 450ppm Energy System". Referring to the

450ppm CO₂ emissions goal, Ambassador Jones agreed that natural gas is cleaner than oil or coal, but pointed out that it is not a renewable energy source.

"The low carbon intensity, technical advantages and abundance of reserves may point to us entering a golden age of gas ... but gas is still a fossil fuel," he told the symposium. He went on to say that gas "may play a useful bridging role" while alternative energy sources such as solar and wind power are still being developed.

Citing the example of Spain as a world leader in maximising the use of renewable energy, Ambassador Jones said that gas is still an important part of the energy mix and advised that it is best used as a back-up to renewables rather than as the main fuel source. He also said that it is important for the gas industry to continue developing carbon capture and storage technologies.

Following on from Ambassador Jones, Saya Kitasei, Sustainable Energy Fellow with Worldwatch Institute said that natural gas has enormous potential in conjunction with renewable energy sources.

To ensure natural gas stays on target to reduce CO₂ emissions and be a responsible player in the energy mix, Ms Kitasei said that three conditions need to be met. Firstly, she said policies and regulations need to be in place to ensure natural gas displaces coal but does not displace renewable energy sources. Secondly, she said that the natural gas industry must "continue to decarbonise" so that an "immediate, rapid reduction in greenhouse gas emissions" is achieved. Thirdly, she said that the natural gas industry needs to do more to ensure prevention of any kind of water and air pollution as well as being more transparent.

Hege Marie Norheim, Statoil's Senior Vice President, Climate, led the industry speakers on climate change with a presentation entitled "The Case for Natural Gas". Describing gas as a "winning fuel", she emphasised the robustness and abundance of gas as well as its role in the future energy mix. Speaking of the "friendliness of



Kevin Yule
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Hege Marie Norheim, Statoil's Senior Vice President, Climate, described gas as a "winning fuel".

gas", Ms Norheim said that gas is a strong "partner or neighbour of other fuels in the energy mix" and that it continues to be a greener alternative to oil or coal.

Ms Norheim also spoke about the versatility of gas with its uses for residential and business customers as well as in the transport industry. She said the future of road transport for a low carbon future should include natural gas vehicles as well as electric vehicles and infrastructure needs to be developed accordingly. Due to increased global demand for gas, Ms Norheim also stressed the importance of developing the unconventional gas industry.

Dr Achim Hilgenstock, Vice President, Technical Cooperation Projects, E.ON Ruhrgas, offered the German industry perspective, operating in a political climate of clear target-setting for reducing CO₂ emissions. The target is a drop in emissions by 80-95% by 2050 to try and achieve climate change of no more than two degrees and part of this strategy is to reduce the use of fossil fuels.

"The future of natural gas [in Germany] is part of a complex scenario," said Dr Hilgenstock who then went on to explain that more biogas has been added as part of the "greening of the gas system". Other strategies Dr Hilgenstock discussed included developing better short- and long-term



Dr Achim Hilgenstock, Vice President, Technical Cooperation Projects, E.ON Ruhrgas, offered the German industry perspective.

storage solutions for gas, such as hydrogen integration, smart grids, greater use of biomethane and synthetic natural gas from biomass (bio-SNG) and using natural gas to complement renewables.

G rard Moutet, Total's Vice President, Climate and Energy, reiterated Ms Norheim and Dr Hilgenstock's thoughts on natural gas being an important fuel source for the future, especially as a partner for renewables in the global bid to mitigate the worst effects of climate change. He also said that there are "significant gas resources yet to be produced"



G rard Moutet, Total's Vice President, Climate and Energy, pointed out that there are significant gas resources yet to be produced.

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The symposium concluded with an address from HE Elizabeth Dipuo Peters, South Africa's Minister of Energy.

especially in the unconventional sector, including coal-bed methane, shale and tight gas.

"Total anticipates higher rates of gas production and the need for a coherent strategy to maximise gas valorisation and to meet our objectives to diminish flaring of gas in Nigeria, Russia and Gabon," said Mr Moutet.

Mr Moutet outlined a three-point strategy for Total's future, including the development of solar, gas and biomass energy. He said the company already has pilot solar programmes operating in Cameroon, Kenya and Indonesia as well as growing international LNG exchanges. Total is also a partner in the Shams project in Abu Dhabi, UAE, which Mr Moutet cited as an example of using a gas booster to ensure continuity at a solar energy facility.

A second session of comments and questions from the floor followed with Dr Hilgenstock reiterating the German commitment to phase out nuclear power, creating long-term opportunities for the gas industry. Ambassador Jones and Ms Kitasei responded to a question about whether natural gas-powered vehicles have a strong future by saying that while they have been largely trialled as municipal transport, such as buses and garbage trucks, their development as passenger cars needs greater policy and infrastructure support

from governments. Ambassador Jones and Ms Norheim elaborated further on the need for carbon capture technologies to be improved as another means of reducing greenhouse gas emissions.

Mr Lemareka challenged the panel on their definition of "clean" and commented that as well as meeting environmental responsibility targets, the "clean" definition should also include meeting human rights obligations, especially in communities of developing countries such as Tanzania. The panel agreed that human rights obligations are very important for the credibility of the natural gas industry.

The symposium concluded with an address from HE Elizabeth Dipuo Peters, South Africa's Minister of Energy. Picking up on Mr Lemareka's comments on inclusion for communities in Africa, Ms Peters said that it was essential to consult with communities and involve them in the development process so that "buy-in" would be achieved and natural gas infrastructure development would be seen as "a blessing, not a curse".

"In South Africa, we believe that no energy carrier should be thrown aside so we can increase the efforts of access," she said.

Ms Peters acknowledged that South Africa has great potential in the area of unconventional gas but there is currently a moratorium on the further exploration and development of shale gas "so we can go deeper and get answers [on environmental and economic concerns]".

"We are working with UNIDO to ensure we can speak up about integrated energy access, which is very important to South Africa," she said.

Torstein Indrebø rounded up the symposium by thanking the speakers and delegates for their valuable contributions saying the event offered "much food for thought". The Secretariat is planning a similar symposium during COP18 in Doha later this year.

Georgia Lewis is the Deputy Editor of International Systems and Communications.

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GGFR Celebrates 10th Anniversary and Progress on Gas Flaring

By Bent Svensson and Mauricio O. Ríos

Kazakhstan, one of Central Asia's major oil-producing countries, has cut gas flaring associated with oil production by a third in just five years, according to satellite estimates, thereby reducing CO₂ emissions equivalent to the ones emitted by one million cars.

Kazakhstan is one example of a country that has achieved important flaring reduction results by implementing projects like the one undertaken by Tengizchevroil (TCO). In 2010, the company completed a four-year \$258 million Gas Utilisation Project which has eliminated routine gas flaring in the giant Tengiz oil field.

TCO, a joint venture that includes Chevron, ExxonMobil, Kazmunaigaz and LukArco, has reduced flaring emissions by over 94% since 2000, while simultaneously increasing crude oil production by 147%.

The fact that Kazakhstan, Chevron and ExxonMobil have achieved this flaring reduction is no accident. All three are members of the Global Gas Flaring Reduction public-private partnership (GGFR). This partnership, launched by the World Bank in 2002, marked another milestone in 2010 with satellite data estimating a 9% drop in gas flaring worldwide.

As the GGFR partnership gets ready to celebrate its 10th anniversary, this is some encouraging news. However, there still is too much flaring around the world, at least some 130 bcm of gas is burned or wasted every year. While it is clear that GGFR partners are making some good progress (almost 100 million tons of GHG reduced over the past five years), it is also imperative to scale up flaring reduction efforts.

Launched at the World Summit on Sustainable Development in August 2002 in Johannesburg, the GGFR partnership brings around the table representatives of governments of oil-producing countries, state-owned companies and major international oil companies so that together they can overcome the barriers to reducing gas flaring by sharing global best practices and implementing country-specific programmes.



Unlocking the value of wasted gas requires a concerted effort by governments, industry and stakeholders.

This article looks into both some of the lessons learned over the past decade, and some of the challenges ahead.

● Downward trend

For the fifth consecutive year for which statistics are available, flaring of gas associated with oil production registered a drop worldwide: between 2005 and 2010, gas flaring decreased by 22% from 172 bcm to 134 bcm, according to satellite estimates commissioned by the World Bank-led GGFR partnership. This reduction is almost equivalent to 100 million tons of GHG emissions.

The reduction from 147 bcm in 2009 to 134 bcm in 2010, occurred despite a two-million barrel-a-day increase in crude oil production over the same period. This also confirms a 15% drop in gas flaring intensity (ratio of gas flared to oil production volumes) since 2002 (see Figure 1).

The 13-bcm decline in 2010 is roughly equivalent to 30 million tons of CO₂ emissions, or to taking almost six million cars off the road.

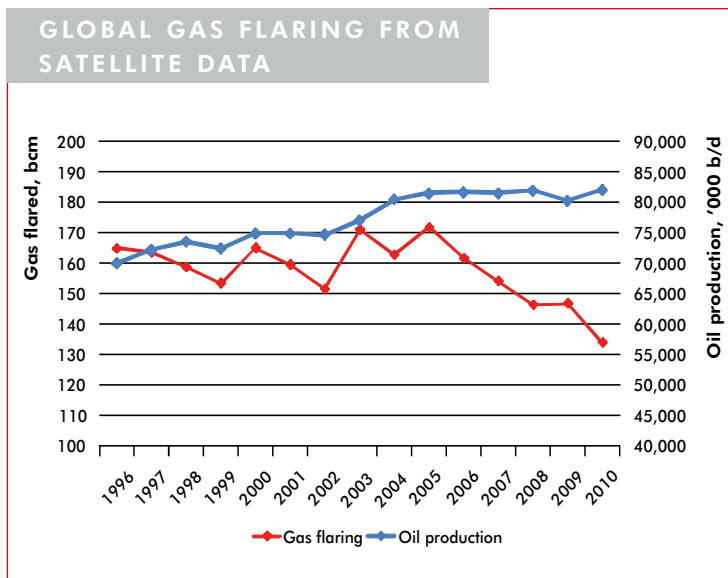
Most of 2010's estimated reductions were achieved in Russia and Kazakhstan, where public and private stakeholders have increased investments in associated gas utilisation projects.

Overall, Russia and Nigeria have seen the largest reductions but still topped the list of flaring countries in 2010, which also includes Iran, Iraq, Algeria, Angola, Kazakhstan, Libya, Saudi Arabia and Venezuela. Satellite data for 2011 is still being processed, and will be released later this year.

The 134 bcm of gas flared worldwide in 2010 is equivalent to almost 30% of the European Union's yearly natural gas consumption. Overall, the flaring of gas adds about 360 million tons of CO₂ in annual emissions, roughly equivalent to the annual emissions from 70 million cars. Some flaring also emits black carbon, or soot.

● Public-private collaboration

The GGFR partners have established a collaborative Global Standard for gas flaring reduction.



This Standard provides a framework for governments, companies and other stakeholders to consult each other, take collaborative action, work on projects across two or more countries, and reduce barriers to associated gas utilisation. GGFR partners commit to avoid flaring from new projects, and to eliminate continuous production flaring, except where no economic alternatives exist.

In sum, GGFR facilitates viable solutions to gas flaring reduction and helps partners unlock the value of currently wasted natural gas to improve energy efficiency, expand access to energy, and contribute to climate change mitigation and sustainable development.

Specifically, the partnership helps developing countries overcome barriers to reducing flaring, including:

- High costs of capturing and utilising the associated gas currently flared;
- Undeveloped domestic gas markets and limited access to international markets;
- Lack of financing to put the necessary gas infrastructure in place;
- Undeveloped regulatory frameworks; and
- Inefficient gas pricing systems (mostly due to subsidies).

ABOVE
Figure 1.

To help governments and companies overcome these barriers, GGFR's work focuses on:

- Commercialisation of associated gas by identifying potential uses;
- Regulations for flaring and venting, and the use of associated gas;
- Implementation of the Global Standard for flaring and venting reduction; and
- Capacity building to obtain carbon credits for flaring and venting reduction projects.

"By reducing flaring oil producing countries and companies are making an important contribution to energy efficiency and climate change mitigation," says Paulo de Sa, manager of the World Bank's Oil, Gas and Mining unit. "Other emerging oil producers also need to join these global efforts."

● **Lessons learned**

There are important lessons learned on critical conditions or success factors that are needed for countries and companies to overcome the associated gas utilisation barriers and achieve faster gas flaring reduction, including relevant fiscal and regulatory policies.

Although all stakeholders tend to agree that routine flaring and venting is not desirable, countries and companies often face significant barriers to reduce gas flaring and venting, including: limited access to international gas markets as well as incipient local markets to commercialise the gas; lack of funding to put in place the necessary infrastructure to use the associated gas that comes with oil production; and ineffective regulatory and fiscal frameworks for using the associated gas.

Over the past decade GGFR partners have accumulated a wealth of experience, lessons and best practices about gas flaring reduction, so they now better understand what the critical success factors are, including:

- More accurate data to gauge the magnitude of the practice at the country and company levels.

- Governments need to have not only effective regulations but also clear policies with the right incentives for operating companies, so that the necessary infrastructure is put in place and markets for gas utilisation are developed.
- Country buy-in, high-level support and an effective local partnership between government and industry are key ingredients to ensure success in gas flaring reduction. There should no longer be any doubt that government and the private sector need to work as real partners if tangible results are to be achieved.
- Leadership and commitment play a critical role in both the public and private sectors in order to sustain progress over the long term.

Thus, "unlocking" the value of wasted gas requires a concerted effort by governments and industry, as well as other stakeholders including multilateral financial institutions and technology developers.

GGFR's main role is that of a catalyst that brings key stakeholders around the table, facilitates the establishment of a common ground with clear targets, and does not allow them to give up or get distracted from the ultimate objective.

The following sections briefly look into some of the crucial aspects that governments and companies in oil producing countries need to consider in order to "unlock" the value of wasted natural gas.

● **Effective policies**

An enabling environment for gas flaring reduction can be established through effective legislation, regulation and market/economic measures.

Specific policy measures will depend on each country's circumstances and are likely to include both upstream and downstream sectors. However, some generic lessons can be drawn from successes in associated gas utilisation already achieved by a number of oil producing countries, such as Algeria, Canada, Kuwait, Norway, Qatar, Saudi Arabia and the UK.

Some of these lessons include¹:

- Oil & gas legislation, and oil & gas concessions/licences should be clear, comprehensive and unambiguous on the treatment of associated gas.
- Fiscal terms should encourage gas utilisation investments. Special fiscal treatment of associated gas investments may be needed to overcome the high up-front capital cost of associated gas infrastructure.
- The gas market should encourage and enable associated gas utilisation with:
 - Oil & gas companies given the right to monetise gas, including gas for export;
 - Open and non-discriminatory access to infrastructure, including gas processing and transmission facilities, access to electricity grids (to sell electricity produced on-site from associated gas); and
 - Market-based energy pricing.
- Flare and venting regulation should be clear, with effective monitoring and enforcement: Right market conditions and investment incentive schemes should be complemented by flare and vent regulation in order for operators to evaluate gas utilisation options.
- Reduction in legacy flaring requires a comprehensive and methodical approach: A generally accepted approach in addressing legacy flares and vents is (i) to establish a realistic flare/vent-out plan; (ii) create the environment enabling gas utilisation investments; (iii) coordinate operators' investment programmes; and (iv) closely monitor them to ensure that they are implemented on time. Developing these flare reduction plans should be done as a cooperative approach with consultation with key stakeholders, particularly with operators.
- Although stakeholder consultations will take time and effort, they typically add value by:
 - Establishing a challenging but realistic flare-out deadline;
 - Identifying key issues and risks in implementation of operators' associated gas utilisation programmes, which in turn allow these to be addressed in a timely fashion;
 - Developing a fiscal framework consistent with the country's flare and vent reduction policy;
 - Transforming the potential of the policy into results on the ground through greater trust, ownership and commitment by stakeholders.
- New oil developments should include provision for associated gas utilisation: In new oil developments, associated gas utilisation should be an integral part of the field development planning process. Addressing flaring and venting retroactively is more costly and often more technically challenging.
- An integrated plan should be developed for both associated and non-associated gas: Flaring and venting reduction and non-associated gas development should be integrated into the country's integrated gas master plan and/or energy sector strategy.

BELOW
Table 1.

GGFR PARTNERS AROUND THE WORLD

Countries	Nigeria	PetroEcuador
Algeria	Norway	Qatar Petroleum
Angola	Qatar	Shell
Azerbaijan	United States	SNH
Cameroon	Uzbekistan	SOCAR
Ecuador		Sonangol
Equatorial Guinea	<i>Oil companies</i>	Sonatrach
France	BP	Statoil
Gabon	Chevron	TOTAL
Indonesia	ConocoPhillips	
Iraq	Eni	<i>Other partners</i>
Kazakhstan	ExxonMobil	EBRD
Khanty-Mansiysk (Russia)	KOC	European Union
Kuwait	Marathon Oil	World Bank
Mexico	Maersk Oil & Gas	Wärtsilä
	Pemex	

¹ *Guidance on Upstream Flaring and Venting, Policy and Regulation*, GGFR, Washington DC, March 2009.



- Finally, a combination of the above measures is essential to achieve significant reduction in flaring and venting.

● **Regulations and incentives**

GGFR has carried out two major studies of global gas flaring regulation. In 2004, GGFR published a study of 44 oil producing countries investigating the role of regulation in the context of gas flaring and venting.² The study found that most developing countries that produce oil lack efficient and effective gas flaring and venting regulations and have inadequate institutional capabilities with often overlapping responsibilities among institutions. In many developing countries, companies that are supposed to be regulated are responsible for carrying out regulatory functions.

More recently, GGFR launched a review of the international experience of gas flare reduction regulation and policies in a number of partner countries. The conclusions are that government commitment to reduce flaring is critical to success and industry consultation mechanisms are important in ensuring flaring targets are feasible and regulations are realistic.³

On the regulatory aspect, an emphasis should be placed on encouraging industry to look for opportunities to utilise associated gas economically. Deadlines or other limits on flaring need to be seen as part of a package of other market enabling measures, as deadlines by themselves are unlikely to be effective or will result in reduction of oil production unless backed up by measures such as creation of viable downstream markets. On the other hand, only enabling markets without effectively enforced regulation of flaring will not reduce flaring to minimum levels. Any penalties must be set at levels that are realistic deterrents

2 Regulation of Associated Gas Flaring and Venting: A Global Overview and Lessons from International Experience, World Bank/GGFR Report Number 3, February 2004 (www.worldbank.org/ggfr).

3 International Regulatory Best Practices: forthcoming on the GGFR website: www.worldbank.org/ggfr.

but should be used only in combination with market enablers.

● **Regulatory regimes and enforcement**

The regulatory regime establishes what is regulated and how it is regulated. Key features of a good flaring and venting regulatory regime include: definitions and boundaries; regulatory approval; economic evaluation; measurement and reporting; monitoring and enforcement; and public dissemination.


A regulatory regime should be set forth in secondary legislation, while the operator should be required to have a focal point to be responsible for compliance with flaring and venting regulation and interactions with the regulator on all flaring and venting issues.

Enforcement is perhaps the most important element of a flaring regulatory framework since, regardless of the design of the framework, it is unlikely to bring expected results unless regulatory infringements are spotted and effectively pursued by the regulator. Therefore, a flaring regulatory regime should be designed in a way that makes enforcement feasible given the regulator's financial and staffing constraints, as well as the country's institutional development and regulatory traditions.

● **Global Standard**

Today, most GGFR partners have endorsed the Global Standard for Flaring and Venting Reduction, introduced by GGFR in 2004⁴. GGFR partners that have endorsed the Global Standard are committed to no venting, no routine flaring in new projects, and to eliminate continuous production flaring from existing production within 5-6 years of their joining the GGFR, unless there are no feasible alternatives. While the agreement on no flaring in new projects is a major achievement and has significant impact on future gas flaring, the elimi-

4 A Voluntary Standard for Global Gas Flaring and Venting Reduction, Report No. 4 (www.worldbank.org/ggfr).



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nation of flaring from existing production has taken longer than anticipated.

● **Fiscal framework**

There are two groups of instruments that could be used by host countries to promote investments in flare and vent reduction projects, namely incentives and penalties. Incentives, or preferential fiscal regimes, can be applied to both upstream operations and downstream investments, while penalties are imposed on upstream activities, namely flaring and venting of associated gas. In general, incentives prove to be more effective than penalties and it is important to find the right balance between the two to create economic outlets for the gas. What's more important, if a penalty-based approach is used to address flaring and venting, a number of conditions should be met, including the right level of penalties and the presence of a strong and empowered regulatory body.

● **Conclusion and challenges**

As the international community looks for ways to reduce greenhouse gas emissions and move toward low-carbon economies as a way of mitigating the impact of climate change, natural gas is increasingly becoming an attractive component of the energy mix in countries around the world, along with renewable energies.

One of the attractions of natural gas is that it is the less polluting amongst the fossil fuels. Yet, in several oil and gas producing countries, vast amounts of natural gas are still being flared or wasted.

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 tons of CO₂ in annual emissions.

In order to address this wastage, the GGFR partnership aims to help 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.

GGFR has already achieved some milestones with almost 100 million tons of GHG emissions reduced over the past five years. However, a significant reduction of global gas flaring still needs to be achieved in order to complete the mission with the desired impact.

Thus a major challenge for the next phase of the GGFR partnership (2013-2015) is to bring other key players on board. Although more than 80% of global venting and flaring occurs in fewer than 20 countries (and GGFR has worked with most of them in one way or another) some important flaring countries and oil companies still are to join the GGFR partnership, including Libya, China, Brazil and Russia's major oil companies.

Another challenge is the need for faster implementation of gas flaring reduction projects so that countries and companies can deliver concrete results and global gas flaring continues to decline in greater volumes. For this to occur, all relevant stakeholders – government, industry, technology developers and financial institutions – need to do their part to “unlock” the value of this wasted gas.

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

At their 10th anniversary, GGFR partners need to take these achievements to the next level.

Bent Svensson is Programme Manager and Mauricio O. Ríos is Communications Officer of the Global Gas Flaring Reduction Partnership (www.worldbank.org/ggfr).



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- Gas project engineering, construction, operation, maintenance, reparation
- Pipe coating (anti-corrosion, insulation and concrete weight coating...)



Dr Yumkella's Goals as an IGU Wise Person

By Georgia Lewis

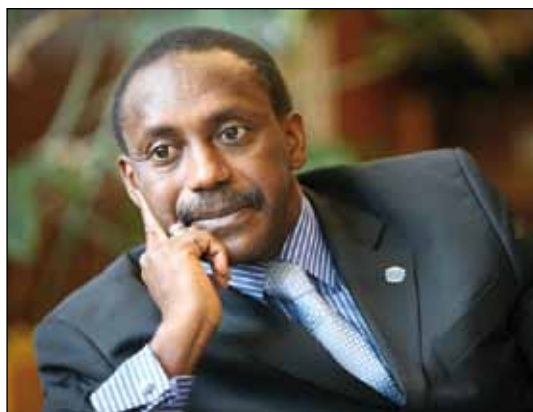
Dr Kandeh Yumkella became a member of the IGU Wise Persons Group in 2010 and is keen to use this as an opportunity to further his contributions to the areas of climate change and energy poverty.

Currently the Director-General of the United Nations Industrial Development Organisation (UNIDO), Dr Yumkella has also served as Director of the Africa and LDCs Regional Bureau and Director of the first UNIDO Regional Office in Nigeria. Before joining UNIDO, Dr Yumkella was Minister of Trade, Industry and State Enterprises of the Republic of Sierra Leone. He has also worked as an Assistant Professor and Lecturer at Michigan State University and Assistant to the Dean in the College of Agriculture at the University of Illinois. He has a Bachelors Degree in Agriculture and a Masters and Doctorate in Agricultural Economics.

On the issues of climate change and energy poverty, Dr Yumkella says that while there is "broad consensus" on many of the issues, "the challenge is to move from rhetoric to action". He cites practical examples of UNIDO working together with public and private sector stakeholders to improve access to energy while still being environmentally responsible, such as installing photo-voltaic (PV) systems and creating more energy-efficient manufacturing plants.

"Now we are discovering oil and gas in places where we did not expect it, or even where it seemed impossible to reach," says Dr Yumkella. The new gas finds in poorer and developing countries, such as Uganda, Chad, Mauritania, Niger, Sudan and Sierra Leone provide special challenges for the governments and the gas industry in terms of governance.

"We cannot be blind to the emerging challenges of global energy governance – for



Dr Kandeh K. Yumkella: challenge is to move from rhetoric to action.

example, the political economy of energy security or diversification of energy supply for the US, China or the EU, must include a serious consideration of political security and stability in developing countries and must also address the rights of their citizens to energy access and economic growth," he continues.

Dr Yumkella has a very personal experience with living with energy poverty, coming from a village in Sierra Leone that still does not have running water or electricity. Sierra Leone's emerging oil wealth, natural gas discoveries in neighbouring Liberia and potential for hydro power should have some impact on the country's future, he believes. "Will my grandchildren be at least guaranteed electricity so that they do not live the fate of their forefathers?" he asks.

● Improving access to energy

Dr Yumkella says that the gas industry can play a big role in improving access to energy as well as helping developing countries in other ways: "How we capture these opportunities for wealth and job creation, for education and local manufacturing will be the key to unlock any real revolution."

Three African countries are cited by Dr Yumkella as examples of initiatives that will improve access to energy and he believes the gas industry has the potential to play a role in some of

these projects, especially as a back-up to renewable energy sources.

In Ethiopia, the Climate Resilient Green Economy initiative is about the country's aim to be a low-carbon middle income economy by 2025. This initiative has a focus on renewable and efficient sources of energy and clean production processes in agriculture and industry.

Kenya's Vision 2030 initiative is a development strategy aimed at transforming Kenya into, "a newly industrialising, middle-income country providing a high quality of life to all its citizens".

Meanwhile, in South Africa, the South African Renewables Initiative (SARi) has been set up by the government to rapidly and ambitiously scale up renewables, "in a manner that delivers economic, social and environmental benefits without incurring unacceptable domestic cost burdens".

In his role as an IGU Wise Person, Dr Yumkella also hopes to encourage gas industry stakeholders to work towards meeting the goals of the UN Secretary-General's Sustainable Energy for All (SE4All) Initiative. He says the initiative has been launched, "in a time of great economic uncertainty, great inequity, high urbanisation and high youth unemployment", but that it is also a time where

there is "emerging consensus on the need to act cohesively towards global issues such as climate change and sustainable development". The three objectives of this initiative are to ensure universal access to modern energy services, double the rate of improvement in energy efficiency and double the share of renewable energy in the global energy mix.

Meeting these goals, says Dr Yumkella, will "require catalysing action from a broad array of stakeholders".

To this end, the UN General Assembly has named 2012 as the International Year of Sustainable Energy for All. "We must do considerably more than scratch the surface for an issue that deeply impacts all our lives," says Dr Yumkella. "This means commitment from many different stakeholders and ways to track progress – organisations like IGU are critical to achieving our goals.

"The gas industry is at an important juncture in history, and all of its companies, innovations and services will be required to be an important part of the energy future."

Georgia Lewis is the Deputy Editor of International Systems and Communications.



UN Secretary-General, Ban Ki-moon (centre) with Dr Yumkella and other members of the High-Level Group on Sustainable Energy for All.

POWER TO THE PEOPLE







IGU's LNG Report Highlights Dynamic Business

By Mark Blacklock

The latest edition of IGU's *World LNG Report* will be launched at the 25th World Gas Conference and highlights the dynamism and strong growth of the LNG business since WGC2009. After a record 2010, when trade surged 22% to 224 mtpa, the market grew 10% in 2011 and is forecast to increase by 6% a year to 2020 when Australia will have overtaken Qatar as the largest exporter.

"The past few years have been transformational for the LNG industry," says IGU's President, Datuk (Dr) Abdul Rahim Hashim, "with a boom in demand matched by an equally sharp increase in supply. While long-term contracts will continue to underpin new investments, they are being increasingly supplemented by a growing short-term and spot trade. More than a fifth of the world's LNG trade in 2010 was in the short-term market, and the volume is expected to grow further in the next few years."

Since WGC2009, Yemen and Peru have joined the ranks of LNG exporters, while Qatar has

achieved its target capacity of 77 mtpa, Tangguh in Indonesia has brought a second train on line and Malaysia has completed the debottlenecking of MLNG Dua. Now Angola LNG and the Pluto project in Australia are starting up. However, the US has ceased exports from the Kenai LNG plant in Alaska temporarily, while Libya suspended production during the civil war. In total, liquefaction capacity has increased by a net 55 mtpa to reach 286 mtpa, with 18 countries exporting.

When the new capacity was being planned the US was forecast to be a growing market. Although the shale gas revolution has resulted in US demand for LNG imports falling, growth in other markets has offset this. A total of 26 countries are now importing LNG led by Japan. The driving factors in Asia-Pacific have been strong economic growth coupled with the impact of the earthquake and tsunami of March 2011 on Japan's nuclear sector; and in Europe declining domestic gas supplies continue to boost the LNG market. Meanwhile, in the Middle East, Dubai in the UAE has joined Kuwait as an LNG importer.

The boom in LNG trade has turned around the fortunes of tanker operators who were facing significant fleet oversupply at the time of WGC2009.





Qatar has renamed the highway to Ras Laffan "Route 77" to commemorate achieving its target LNG capacity of 77 mtpa.

The world's LNG tanker fleet now stands at around 360 vessels.

● **New liquefaction capacity**

At press time, Angola was set to become the latest country to join the ranks of LNG exporters. Angola LNG is a single-train plant with a capacity of 5.2 mtpa, and its primary source of supply during the early years of operation will be gas associated with crude oil production that was previously flared. The Angola LNG project partners –



Yemen started LNG exports from its first train just after WGC2009; the second train started production in April 2010.

Chevron, Sonangol, Total, BP and Eni – are all members of the World Bank-led Global Gas Flaring Reduction partnership.

Australia's latest project, Pluto, is also starting up, and the country has taken over from Qatar as the driving force behind growth in global liquefaction capacity. Pluto LNG's partners are Woodside, Tokyo Gas and Kansai Electric. The

BELOW

Pluto is the latest LNG project to start up in Australia, which is set to overtake Qatar as the world's largest LNG producer by the end of the decade.





Australian Prime Minister Julia Gillard (second from right) at the ground-breaking ceremony for the Gladstone LNG plant in May 2011.

feedstock gas comes from the Pluto and Xena fields 190km north-west of Karratha, Western Australia, and the liquefaction plant with a single 4.3 mtpa train is located between the North West Shelf Project and Dampier Port on the Burrup

Peninsula. Up to two more trains could be built depending on gas reserves.

Pluto brings Australia's liquefaction capacity to 24.1 mtpa. A final investment decision (FID) has been reached on a further 61.2 mtpa including the first floating LNG project and the first to use coal-bed methane (CBM) as a feedstock, and there are more projects in the planning stage.

Three CBM (known in Australia as coal-seam gas) projects have reached FID. All will be supplied from the Bowen and Surat Basins and pipe their feedstock gas 400-600km to liquefaction plants on Curtis Island in Queensland. The first exports are expected in 2014 from Queensland Curtis LNG (owned by BG Group), followed in 2015 by Gladstone LNG (partners Santos, Petronas, Total and Kogas) and Australia Pacific LNG (partners ConocoPhillips, Origin Energy and Sinopec). Their combined capacity will be 25.3 mtpa.

The floating LNG (FLNG) project will be located above the Prelude field, some 200km offshore north-western Australia. It is being developed by



Prelude LNG's plant will be the world's largest floating facility with a displacement of 600,000 tonnes. It will be built by the Technip Samsung Consortium at Samsung Heavy Industries' shipyard in Korea.



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Health, safety and environmental best practices remain a priority and are the standards Sonangol will continuously improve to achieve excellence.



Shell and will have an LNG capacity of 3.6 mtpa in addition to condensate and LPG production. Shell is moving the Prelude FLNG project forward at a rapid pace, with first production of LNG expected some 10 years after the gas was discovered. Shell discovered the Prelude gas field in 2007.

Australia is also building the world's second LNG plant (after Snøhvit in Norway) with carbon capture and storage. Gorgon LNG's partners are Chevron (operator), ExxonMobil, Shell, Osaka Gas, Tokyo Gas and Chubu Electric Power, who have teamed up to develop the Greater Gorgon Area gas fields, located about 130km off the north-west coast of Western Australia. The liquefaction plant with three 5 mtpa trains is being built on Barrow Island and start-up is expected in 2014. When all trains are in operation by 2015 Gorgon will be injecting 3.6 mt of CO₂ a year into a saline aquifer.

Wheatstone LNG will follow Gorgon on line with start-up expected in 2016. Chevron is the operator and the other partners are Apache, Kuwait Foreign Petroleum Exploration Company, Shell and Kyushu Electric. The liquefaction plant will be located at Onslow in Western Australia with an initial two trains fed by gas from the Wheatstone and Iago fields and a capacity of 8.9 mtpa. Wheatstone has government approval for an ultimate capacity of 25 mtpa.

The first LNG project to reach FID in 2012 was Ichthys, which will produce 8.4 mtpa of LNG in addition to LPG and condensate from the Ichthys field in the Browse Basin. The two-train processing facility will be built at Blaydin Point near Darwin and start-up is scheduled for 2017. The main partners are Inpex and Total, with Tokyo Gas, Osaka Gas and Toho Gas having small stakes.

Awaiting FID are the Arrow and Browse projects, both with start-up envisaged in 2017.

Arrow is a joint venture CBM project of Shell and PetroChina. It was originally planned for an initial two trains of 4 mtpa each, but the recent acquisition of Bow Energy has increased the resource base. The plans are now for a total

capacity of 9.2 mtpa in the first phase and over 16 mtpa ultimately.

Woodside is the operator of the 12 mtpa Browse LNG project, with BHP Billiton, BP, Chevron and Shell as partners. Feedstock from the Brecknock, Calliance and Torosa gas and condensate fields in the Browse Basin would be processed at a three-train plant 60km north of Broome.

Woodside is also the lead partner of the 4 mtpa Sunrise LNG project and has teamed up with ConocoPhillips, Shell and Osaka Gas to develop the Greater Sunrise fields. These are 450km north-west of Darwin, Australia and 150km south-east of Timor-Leste and both countries have an interest. However, the project has been put on hold due to a dispute about processing the gas. The Sunrise partners maintain that a floating LNG plant would be the most cost-effective option while the Timor-Leste government wants the gas to be landed and processed in Timor-Leste to aid industrial development there.

Elsewhere in Asia-Pacific, Papua New Guinea will become an LNG exporter in 2014 with 6.6 mtpa of capacity, while Indonesia will add a 2 mtpa train. The partners in the two-train PNG LNG project are ExxonMobil, Oil Search, National Petroleum Company of PNG, Santos, JX Nippon Oil & Gas Exploration, Mineral Resources Development Company and Petromin, while Donggi-Sonoro LNG in Sulawesi, Indonesia is a joint venture of Mitsubishi, Pertamina, Medco and Kogas.

Both countries have projects awaiting FID. In Papua New Guinea, Gulf LNG is a project for a floating 2 mtpa LNG plant and an onshore condensate plant fed by gas from the onshore Elk and Antelope fields. The partners are Flex LNG, InterOil, Pacific LNG and Liquid Niugini Gas. The separate Papua New Guinea Floating LNG project is a venture of Petromin, Hoegh LNG and Daewoo Shipbuilding & Marine Engineering. In Indonesia, a third train of 3.8 mtpa is proposed for Tangguh in 2018, while Inpex is working on a 2.5 mtpa floating LNG project to exploit the Abadi field.



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A third train is proposed for Tangguh LNG in Indonesia.

In Africa, the world's first commercial LNG exporter, Algeria, is set to inaugurate the 4.7 mtpa GL3Z plant at Arzew later in 2012 followed in 2013 by a 4.5 mtpa train at Skikda (GL1K) to replace three smaller trains destroyed in an explosion in January 2004.

Nigeria has plans to expand its LNG business significantly with the two-train, 10 mtpa Brass project closest to FID, while Cameroon and Mozambique are evaluating LNG projects.

In North America, both Canada and the US are nearing FID on projects.

There are three projects to install liquefaction capacity at receiving terminals on the US Gulf coast. These are Cheniere's Sabine Pass in Louisiana (an initial two trains with a combined capacity of 9 mtpa for 2015 with approval for

two more trains), Freeport in Texas (three trains for a total capacity of 12 mtpa for 2016) and Lake Charles in Louisiana (four trains for a total capacity of 15 mtpa for 2017). The timescales for these projects fit in with the expansion of the Panama Canal, which is due for completion in 2014. New locks will allow its use by larger vessels en-route to Pacific markets.

Kitimat LNG on Canada's west coast in British Columbia is planned for an initial 5 mtpa train with a possible second train. It is a joint venture of Apache, EOG Resources and Encana with a proposed start-up in 2015.

● **Regasification terminals**

Asia-Pacific is the biggest regional market for LNG accounting for around 60% of imports.

Thailand became the sixth country in the region

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North West Shelf Venture





Sweden's LNG import terminal at Nynäshamn was officially inaugurated on May 27, 2011 by (from left to right) Jan Bäckvall, CEO AGA Northern Europe, Per Unckel, Governor of Stockholm County and Dr Aldo Belloni, The Linde Group.

to import LNG last year, and four others are building or planning import terminals.

The Thai terminal at Map Ta Phut in the province of Rayong received its commissioning cargo in June 2011. It is operated by a consortium led by PTT and has a capacity of 5 mtpa. Singapore is building a 6 mtpa terminal on Jurong Island to trade in LNG as well as to provide for local consumption, and Bangladesh is working on a floating storage and regasification (FSRU) project off Moheshkhali Island in the Bay of Bengal. Both are slated for completion in 2013. Vietnam is nearing FID on a 3 mtpa terminal in the province of Binh Thuan, which would enter service in 2015. The Philippines is evaluating the import of LNG from 2016.

Meanwhile, traditional producers Indonesia and Malaysia are also building regasification terminals to cater for rising domestic demand while continuing to meet long-term contractual



Dubai has opted for the FSRU route to import LNG and is leasing the converted *Golar Freeze*.

export obligations. Both countries have opted for the conversion of LNG tankers into FSRUs.

Indonesia will initially use domestic LNG supplies and its first regasification terminal, 15km offshore Jakarta in West Java, entered service in January. Nusantara Regas, a joint venture of Pertamina and Perusahaan Gas Negara (PGN), is leasing the *Khannur* from Golar with a capacity of 3 mtpa. Each partner also has a separate, 100%-owned project: Pertamina is working on a 3 mtpa terminal in Central Java and PGN on a 1.5 mtpa terminal North Sumatra, with both due to start up in 2013.

Petronas plans to inaugurate its first regasification terminal in July in Melaka in peninsular Malaysia. It will have a capacity of 3.8 mtpa, while a second terminal is planned to be completed around the middle of the decade in Johor.

In Europe, 10 countries are now importing LNG, The Netherlands and Sweden having opened their first terminals in 2011. The Dutch terminal in Rotterdam is operated by Gate, a joint venture of Gasunie and Vopak, and the Swedish terminal in Nynäshamn is operated by AGA, part of the Linde Group.

Meanwhile, Polskie LNG, which is owned by the Polish transmission company Gaz-System, is being constructed at Swinoujscie near Szczecin and is expected to open in 2014. Lithuania is also working on a project with Klaipėdos Nafta proposing a floating LNG import terminal at Klaipėda.

And in the Middle East, Dubai in the UAE joined Kuwait as an importer when the Jebel Ali terminal received its commissioning cargo in December 2010. Dubai has opted for the FSRU route and is leasing the converted *Golar Freeze* from Golar.

No capacity expansion is expected in the Americas for the time being.

● Looking ahead

Between WGC2012 and the end of 2015 some 53.6 mtpa of LNG capacity is scheduled to come

online with the bulk in 2014 and 2015 (see *table*). Given the strong factors underpinning demand around the world, the market is likely to remain buoyant albeit with a temporary tightness of supply in 2013.

Mark Blacklock is the Editor-in-Chief of International Systems and Communications. The World LNG Report has been prepared under the supervision of IGU's Programme Committee D – LNG and is available from www.igu.org.

LNG CAPACITY SCHEDULED TO START UP WGC2012-END 2015

Country	Facility	Capacity (mtpa)
2012		
Algeria	Arzew (GL3Z)	4.7
2013		
Algeria	Skikda (GL1K)	4.5
2014		
Australia	Queensland Curtis LNG Train 1	4.25
Australia	Gorgon LNG Train 1	5
Australia	Gorgon LNG Train 2	5
Indonesia	Donggi-Sonoro LNG	2
Papua New Guinea	PNG LNG Train 1	3.3
Papua New Guinea	PNG LNG Train 2	3.3
2015		
Australia	Gladstone LNG Train 1	3.9
Australia	Gladstone LNG Train 2	3.9
Australia	Queensland Curtis LNG Train 2	4.25
Australia	Gorgon LNG Train 3	5
Australia	Australia Pacific LNG Train 1	4.5
Total		53.6

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At the other end of the scale, Technip has built a 2-train mid-scale liquefaction plant in China, nonetheless the largest in this country.

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Turning an LNG Import Terminal into an Export Terminal

By Craig Jackson

The economical extraction of shale gas, particularly in the USA, has had a dramatic impact on the international trade of LNG. This has resulted in a significantly reduced demand for imported LNG to the USA, which, in turn, has meant that many LNG terminals have or are considering converting from import terminals to dual purpose import and export terminals.

Converting an import terminal to an export terminal could in its simplest form result in the addition of some transfer pumps and the addition of some piping and valves. Whilst this might suffice to get the LNG from the storage tank to the vessel,

there are a number of other factors that need to be considered, some of which are covered below.

● Emergency shut-down (ESD) parameters

A vessel needs to be able to initiate an ESD-1 to stop the shore pumps and initiate closure of valves. When an ESD is initiated at a receiving terminal the vessel stops its pumps and the rate will drop rapidly; approximately 30 seconds later the vessel's ESD valves are closed and there is no flow of LNG. When the pumps stop there is a negative surge in the shore lines; the terminal will have been designed to take this into account and will have pipes, valves and a sequence of valve closures to manage such effects.

When converting to an export terminal the picture relating to surge is reversed, ESD-1 stopping the shore pumps and initiating ESD valve closure. The shore pipelines will experience surge initiating in a different location and progressing in a different direction; the pressures involved are



Freeport in Texas is one of the US receiving terminals which is now authorised to re-export.

likely to be higher than when receiving and could cause significant damage if not managed.

Export terminals typically use surge drums located near or on the jetty and timed valve closure or other management systems to manage such surge; receiving terminals are rarely built with surge drums or systems to mitigate surge at the jetty.

Surge effects are, in essence, the result of dissipating the kinetic energy in the flowing liquid. One way to mitigate the effects of surge is to reduce the transfer rate; however, this may have commercial implications since the berth occupancy time will increase.

Pipeline valves may be constructed to be tight in one direction or fail safe in either the open or closed position as appropriate; when the LNG flow is in the opposite direction to the initial design condition, the suitability of the valves for these new conditions will need to be assessed.

Whilst ESD operation is likely to be the principle cause of surge, consideration needs to be given to surge pressures should a vessel's tank valve shut unexpectedly or a pump come on line rapidly. A receiving terminal may close its ESD valves after the ship's in order to prevent over pressurisation of the hard arms; an export terminal may have the terminal ESD valve close before the vessel's valve. It is important that the sequencing of ESD operations is configured to protect the infrastructure and minimise surge.

LNG is a particularly challenging fluid to model; under fluctuating pressures vapour pockets may form and collapse instantaneously and may result in higher surge pressures.

● Information from SIGTTO

Converting an import terminal to an export terminal is not a simple task and requires a thorough review of the design parameters of the transfer system and a detailed evaluation of surge under ESD conditions and fault conditions. The results of these studies need to be fully assimilated and



Converting an import terminal to an export terminal is not a simple task.

incorporated into the redesign process. Further information is available in a number of publications of the Society of International Gas Tanker and Terminal Operators (SIGTTO). These include "ESD Arrangements and Linked Ship/Shore Systems for Liquefied Gas Carriers" (2009, free download from the SIGTTO website) and "Guidelines for the Alleviation of Excessive Surge Pressures on ESD" which is currently under revision.

Craig Jackson is SIGTTO's Technical Advisor (www.sigtto.org) and a member of Programme Committee D – LNG.



Australia: Global LNG Hotspot

By Graeme Bethune

Australia is now the scene of the world's greatest LNG construction boom.

While there's no official database to test that claim, looking back at the growth of the global LNG industry fails to show any country at any time building more projects than Australia is currently.

Eight projects are under construction, with a combined capacity to produce 65.5 mtpa once commissioned. This is over three times the combined capacity of Australia's two existing LNG projects – the North West Shelf (16.3 mtpa) and Darwin LNG (3.5 mtpa).

Capital investment in the eight new projects totals more than \$180 billion, which is a figure truly of boom proportions. And that's still not

the whole story as several other projects are in the pipeline.

Australia is currently the world's largest exporter of coal and iron ore and, with the current developments underway, is likely to emerge as the world's leading exporter of LNG. By 2020, Australia could be supplying 10% of China's gas needs, 30% of Japan's needs and 30% of Korea's needs.

● Project go-aheads

The Australian LNG boom accelerated quickly last year.

At the beginning of 2011, Australia had three LNG projects under construction — Woodside's Pluto, Chevron's Gorgon and Queensland Curtis LNG, a coal-bed methane (CBM)-to-LNG project operated by BG Group. These will add 4.3 mtpa, 15 mtpa and 8.5 mtpa respectively to Australia's annual LNG exports.

During 2011, FID was reached on four more projects — the Santos-Petronas Gladstone LNG



The North West Shelf venture began LNG exports in 1989 with two trains and now there are five with a combined capacity of 16.3 mtpa.

(7.8 mtpa), the Origin Energy-ConocoPhillips Australia Pacific LNG (9.0 mtpa), Chevron's Wheatstone (8.9 mtpa) and Shell's Prelude (3.6 mtpa). Then, in January 2012, the Inpex-Total Ichthys project (8.4 mtpa) got the go-ahead.

Prelude is particularly significant as the world's first floating LNG project (FLNG). The project is based on two fields in the remote Browse Basin, 475km north-northeast of Broome, Western Australia. During 2007, Shell discovered the Prelude gas field and in March 2009 discovered the Concerto gas field.

Prelude and Concerto have around 84 bcm of liquids-rich gas. The relatively small size of the gas fields and the remote location make them an ideal candidate for development using FLNG technology as it would not be economic to develop the gas via a conventional onshore LNG processing plant. FLNG reduces both the project costs and environmental footprint of an LNG development. The Prelude FLNG project will be the largest floating

facility ever built. The FLNG facility itself will be 488m long and 74m wide, and when fully loaded will weigh around 600,000 tonnes.

Once constructed the facility will be towed to a location where it will be permanently moored by four groups of massive mooring chains in 250m-deep water. Each mooring chain will be held to the sea floor by suction piles the size of small houses and the FLNG facility has been designed to withstand severe weather, even a Category 5 cyclone.

Chevron accounts for the lion's share of new LNG capacity under construction in Australia, with Gorgon and Wheatstone adding a total of 23.9 mtpa, or over a third of the capacity of all new projects expected to be under construction in Australia by the middle of next year.

Gorgon (see box on page 185) is due to begin production in 2014, with natural gas for the domestic market in Western Australia scheduled to follow 18 months later. Wheatstone is two years



Darwin LNG was the first LNG plant to use aero-derivative gas turbines and started exports in February 2006.



Wheatstone LNG was given the go-ahead in September 2011. From left, Roy Krzywosinski, Managing Director Chevron Australia, Hon. Colin Barnett, Premier of Western Australia, George Kirkland, Vice Chairman Chevron Corporation and Hon. Martin Ferguson, Australian Minister for Resources and Energy.

behind Gorgon, with first LNG cargoes expected in 2016.

The capital investment required for both projects is challenging even for an oil major. Gorgon, which ranks as one of the world's largest gas projects, is budgeted to cost \$37 billion, while Wheatstone is expected to cost \$29 billion to develop.

Chevron's confidence in its Australian LNG projects is highlighted by the fact it is already talking about the possibility of sanctioning a fourth train at Gorgon by 2013. This follows a series of major gas discoveries in the surrounding area. A fourth train would boost Gorgon's annual LNG production capacity to around 20 mtpa, overtaking even the North West Shelf.

Production from the new wave of Australian LNG projects was set to begin at press time, with Woodside's Pluto expected to ship its first cargoes in March. The 4.3 mtpa project was approved for development in 2007, and has a long head start on other new LNG projects under construction.

Gorgon and Queensland Curtis will be the next new LNG projects to begin production in 2014, followed by Gladstone in 2015.

● Large gas endowment

The Australian LNG success story has happened for a number of reasons, but in simple terms the country has been in the right place at the right time.

First of all, Australia is naturally endowed with large gas reserves – offshore and onshore.

Many of the offshore gas fields were discovered by oil explorers decades ago off the north-western coast of Australia, where they sat "stranded" for decades until market forces and technology made it viable to monetise them as LNG.

But today's LNG projects are not just a product of accidental gas discoveries in the 1970s and 1980s. In recent years, explorers have added hundreds of bcm to existing reserves through impressive exploration successes in the Carnarvon and Browse Basins. Geoscientists believe we have only scratched the surface in these prolific basins.

The richness of Australia's onshore gas reserves has also been a big factor in the rapid development of the LNG industry. Since the middle of the previous decade CBM players in Queensland have used technical innovations in well completion and horizontal drilling to unlock vast reserves onshore. These are now the basis of three LNG projects under construction in Queensland – Gladstone LNG, Australia Pacific LNG and Queensland Curtis LNG.

A second major factor in the LNG success story is geography. Australia is adjacent to new and rapidly growing markets in the Asian region, which is replacing the North Atlantic as the epicentre of global economic activity. As this shift occurs over coming decades, Australia is well placed to meet Asia's soaring demands for energy.

Australia also has the advantage of being a free-market OECD economy open to foreign investment.

Is there anything that can slow the Australian boom?

The biggest challenges are not external market forces, but internal factors such as costs, resources,

changing government policies, natural disasters and local politics.

In particular, the developers of the CBM projects are grappling with challenges new to the industry on a number of fronts.

While eastern Australia has over 2.5 tcm of CBM reserves and resources, ensuring sufficient deliverability to keep six LNG trains full is a major technical challenge, involving management of thousands of wells plus hundreds of megalitres of associated water (and the resulting salt from water treatment). The signs so far are that the companies need to drill more wells than originally expected and extend their production areas.

CBM LNG developers are also being challenged by the location of their projects in populated areas – a first for the LNG industry in Australia. Historically, most Australian gas development has either been offshore or in remote onshore areas. While all the projects undertook extensive community consultations and environmental impact statements prior to approval, the massive scale of development is only now being realised and is creating tensions with some farmers and local communities. The companies are making a big effort to improve communication and be good neighbours, and the projects retain government support. However, Australia has a fiercely competitive political climate, with political parties constantly jostling for power and numerous interest groups keen to express their views. There are also inevitable uncertainties about the environmental impact of such massive development, particularly on agriculture. These issues are all increasing what is already a substantial level of regulation over development.

Environmental and community issues are not restricted to the CBM projects. Woodside’s proposed 12 mtpa Browse LNG project, which will deliver over \$1 billion of benefits to local disadvantaged indigenous groups, is also being challenged by environmental and some local groups.

Costs and resources are a challenge for all projects. Australia is a high-cost country in which to develop major projects and the number of projects under development means that labour resources are stretched. Companies have a range of strategies to deal with these issues. The LNG plants under development have a large degree of modularisation and companies are also recruiting internationally for labour. However this creates tensions with local industry and labour unions. The Pluto project has already suffered delays and cost blow-outs due to lower productivity and the need to rectify work that was not of the appropriate standard. The US dollar cost of projects is also increasing due to the relative strength of the Australian dollar.

While companies have generally anticipated the challenges of labour costs and resources, adverse weather is harder to anticipate and manage. One of Australia’s best-loved poets, Dorothea Mackellar, once described Australia as a land of “drought and flooding rains”. After years of

AUSTRALIAN LNG PROJECTS

<i>Project</i>	<i>Type</i>	<i>Capacity (mtpa)</i>	<i>First LNG</i>
North West Shelf	Conventional	16.3	1989
Darwin	Conventional	3.5	2006
Pluto	Conventional	4.3	2012
Gorgon	Conventional	15.0	2014
Queensland Curtis	CBM	8.5	2014
Gladstone	CBM	7.8	2015
Australia Pacific	CBM	9.0	2015
Wheatstone	Conventional	8.9	2016
Ichthys	Conventional	8.4	2017
Prelude	Floating	3.6	2017
Browse	Conventional	12.0	Awaiting FID
Arrow	CBM	9.2	Awaiting FID

Source: EnergyQuest.



The development of Gorgon LNG on Barrow Island is subject to stringent environmental safeguards.

drought, Queensland was hit by massive floods early in 2011 and continues to experience higher than expected rain in the CBM development areas, delaying development work. The Carnarvon Basin, the centre of offshore LNG development is also prone to cyclones.

These challenges are unlikely to be “deal-breakers” individually but cumulatively are leading to delays, higher costs and lower profitability.

With a record number of new LNG projects already under construction in the one country at the one time, and the consequent challenges, we might have expected little interest in further projects but that is not the case.

● **Awaiting FID**

In addition to the large number of LNG projects already sanctioned, there are an almost equal number of advanced projects that have yet to reach FID.

The biggest of the possible projects offshore is Pilbara LNG, based on the remote and deepwater Scarborough field owned equally by BHP Billiton and ExxonMobil.

Other potential offshore projects are the Woodside-operated Sunrise, which Woodside wishes to develop as a floating LNG project with capacity of about 4 mtpa. The Timor Sea project has stalled for years because of a stalemate between Woodside and the Timor Leste Government, but relations are thawing under Woodside’s new CEO.

Onshore, the Shell-Petrochina Arrow LNG project, based on Queensland CBM, is currently in FEED for a development of 9.2 mtpa.

Notwithstanding the fact that Eni has recently discovered over 500 bcm offshore Mozambique, the same company has just invested in the stranded Evans Shoal gas field offshore Darwin for a possible LNG project.

Australia looks like being an LNG hotspot for some time to come.

Graeme Bethune is CEO of EnergyQuest (www.energyquest.com.au), an Australian-based oil and gas consultancy, a Director of the Australian Gas Industry Trust, the Australian IGU Charter Member, and a member of Programme Committees B, C and D.



AUSTRALIA: A NATURAL PARTNERSHIP

By Richard Lammons

A nature reserve is an unlikely site for a major new energy plant, but Chevron is showing how it can work.

Barrow Island, a Class A nature reserve 70km off Australia's west coast, is home to the Gorgon Project, which will tap into vast natural gas resources 70km north-west of the island to produce LNG for export and pipeline gas for domestic consumption. The island's rich and unique biodiversity has remained intact since its designation as a wild-life refuge a century ago. It is home to more than 350 species of native plants, 14 species of mammals, 100 species of birds and 54 species of reptiles. Some of them are found in no other place on Earth.

Chevron has been producing oil from Barrow since 1967 while minimising its footprint on the island. Building on this environmental stewardship involves a mix of advanced technology and a commitment to detail, addressing everything from greenhouse gas (GHG) emissions to local concerns over light levels from the operations on Barrow's beaches where turtles lay their eggs.

Gorgon will include the world's largest CO₂ injection project, which will inject 40% of the project's GHG emissions 2.6km beneath the island into a deep sandstone reservoir. This will make Gorgon one of the world's least GHG-intensive LNG facilities. The Australian government has contributed \$51 million to the injection project as part of its Low Emissions Technology Demonstration Fund.

The seismic survey of the underground geology where CO₂

will be injected was modified to minimise its impact. A conventional survey, consisting of clearing paths to accommodate heavy trucks that haul necessary equipment, would have disturbed about 283ha. Instead, a freight helicopter did most of the heavy lifting – approximately 15,000 separate lifts – while lighter equipment was carried by foot. By the end, fewer than 19ha were disturbed.

Rigorous quarantine

To prevent invasive species and other pests from being brought onto the island, Chevron has a rigorous quarantine management procedure. Goods being shipped through the Dampier supply base are tagged with one of three colours to make sure the required procedures are taken. Nothing is shipped to Barrow without a green tag. There is a quarantine wash-down area at the Australian Marine Complex in Henderson and a larger-than-life hair dryer that cleans vehicles and goods bound for the island. And the process doesn't end when the freight is put on ships. At the island, inspectors can stop goods and return them to the mainland on the next barge. Today, Barrow is the only island in the region free from introduced species such as cats, rabbits, rats and mice.

Yet another environmental consideration is the night-time lighting necessary for the LNG plant. Four species of sea turtles nest on Barrow, and light can cause them and their hatchlings stress. The plant's lighting systems were engineered to not disturb turtles and

to comply with the stringent environmental approval conditions and applicable safety laws and standards while not compromising safe operability.

Business and nature coexist

At \$37 billion, Gorgon represents the single biggest resource project in Australia's history and will employ 10,000 people at peak construction. There is a commitment to Aboriginal employment and, under the Chevron-operated Gorgon Project Cultural Heritage Management Plan, Aboriginal people are involved to help the project avoid heritage sites. This collaborative approach played a significant role in developing the native title agreements with the Kuruma Marthudunera people in June 2010 and the Yaburara Mardudhunera people in November 2010 for the Gorgon Project's domestic gas pipeline.

Chevron has been working with Harry Butler, Ph.D., one of Australia's premier conservationists, throughout oil production and Gorgon development to minimise any impact to the island ecology.

"Today, all the species I experienced when I first visited Barrow Island in 1963 remain," he said. "When you have a world-class quarantine process supported by a workforce that truly cares for the environment, this is what you can achieve."

Richard Lammons of Chevron is a member of PGC D. This is an edited version of an article originally published in Chevron's 2010 Corporate Responsibility report.

WINGAS Selects RMG by Honeywell for Revolutionary European Pipeline Natural Gas Metering Project

“We partnered with RMG by Honeywell because the task of measuring and metering natural gas is critical. When the pipeline goes into operation, enormous amounts of gas will have to be measured and metered, and the supplies will be more than half of Germany’s annual demand.”

Klaus Haussmann, Project Manager, WINGAS TRANSPORT GmbH

Benefits

Germany-based WINGAS GmbH & Co. KG is embarking on a project to revolutionize the energy supply in Europe by providing a direct natural gas link between Russia and Germany. The project, called the Nord Stream Pipeline, will be completed in 2012, and construction relies on the latest technologies and safety and security measures. When it’s complete, the two parallel pipeline legs will be the longest “pipe in the water” in the world, each more than 1,200 kilometers long and carrying 55 billion cubic meters of natural gas per year. Measuring and metering such huge amounts of natural gas exactly is a challenge, so WINGAS needed a reliable partner with proven experience in the gas metering industry.

WINGAS chose RMG by Honeywell to install ultrasonic gas meters, flow computers and gas chromatograph systems in this groundbreaking project.

Working with RMG, WINGAS was able to install advanced ultrasonic meters ensuring the highest accuracy and stability available. Benefits included:

- Highly accurate measurements of gas reading data thanks to path geometry, six-path technology and signal amplitude.
- Conformance with all applicable international gas standards.
- High stability against turbulences thanks to six measuring paths in three levels.
- Long-term stability of measurements.
- Exchange of sensors without recalibration.

Background

WINGAS GmbH & Co. KG is a joint venture of Wintershall Holding AG, Germany’s largest crude oil and natural gas producer, and Russia’s OAO Gazprom. WINGAS has been active in gas distribution since 1993 and supplies natural gas to public utilities, regional gas suppliers, industrial companies and power plants in Germany and other European countries.

The WINGAS Transport pipeline network, which is over 2,000 kilometers long, connects major gas reserves in Siberia and the North Sea to the growing markets in Western Europe. In Germany, two pipelines called OPAL (Ostsee-Pipeline-Anbindungs-Leitung) and NEL (Nordeuropäische Erdgasleitung) will take natural gas from the Nord Stream Pipeline and feed it into the existing European natural gas grid. OPAL and NEL may well constitute the biggest energy infrastructure projects in Europe in the past few decades. They will guarantee a safe and secure supply of natural gas to Germany and Europe in the decades to come.

Challenge

The Nord Stream Pipeline will transform energy supply to Europe. Two parallel legs will carry natural gas from Russia to the European Union. The intention is to secure the future natural-gas demand of the EU member states thanks to a direct link between Russia and Germany. Because of the enormous amounts of natural gas involved, the biggest challenge for WINGAS is to plan



Nord Stream Lubmin Landfall Facility

The Lubmin landfall facility is the logistical link between the Nord Stream Pipeline system and the European long-distance gas network.

and carry out precise metering of gas quantities and qualities and to handle data processing and communication safely and reliably.

“About 55 billion cubic metres of natural gas will flow through the meters every year, providing safe energy to the European market,” said Klaus Haussmann, Project Manager WINGAS TRANSPORT GmbH. “The quality of the readings must not be compromised.”

Solution

WINGAS awarded the contract to measure and meter the natural gas volumes and qualities to RMG by Honeywell because of the company’s vast experience in the natural gas industry. WINGAS and RMG partnered closely to engineer and design the system, and have put the highest priority on measuring quality during the planning and implementation phases. The project managers of RMG by Honeywell and WINGAS cooperated closely and coordinated their schedules so as to make sure that all works are carried out smoothly and on time.

When complete, both the OPAL and NEL pipelines will be over 400 km long with a diameter of 1.4 metres each, and will have a combined transport capacity of 55 billion cubic metres of natural gas per year. RMG is providing the following metering and measuring equipment:

ERZ 2000 Flow Computer Series – microcomputer for optimal flow correction, which provides parallel calculation of compressibility according to all established methods. When carrying out corrections using density and standard density, the speed of sound effect is measured and calculated.

PGC 9000 VC Process Gas Chromatograph – a system to analyze 11 different components and calculate calorific values, standard density, Wobbe index and density ratios of natural gases on the basis of standards and weight legislation.

USZ 08 Ultrasonic Gas Meter – a device for custody-transfer metering, which measures the flow velocity of the gas from which it calculates the flow rate at

measurement conditions. The ultrasonic flow meter is an advanced measuring system meeting the requirements for accurate and stable measurements.

The RMG solutions will provide the following capabilities to the WINGAS Nord Stream Pipeline:

- Wide measuring ranges, allowing the ultrasonic flow meter to be used even in measuring stations where flow rates vary greatly.
- Virtually no pressure loss during operation due to the fact that no components are located within the cross section of the pipe.
- Safely protects against overloading since the gas meter has no sensitive components.
- Shortened response time due to the entirely electronic measuring method.
- High accuracy of measurement thanks to multistage correction methods.

Klaus Haussmann concluded, “When the pipeline goes into operation, enormous amounts of gas will have to be measured and metered. RMG has proven to be a very capable partner, helping to drive the success of the project.”



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www.rmg.com

Landfall of the Nord Stream Pipeline

The terminating point of the Nord Stream Pipeline is located at the energy hub Lubminer Heide near Greifswald, which covers an area of about 12 hectares, including the receiving terminal of the connecting pipelines OPAL and NEL.





Gate Terminal in Service

By Sander Lemmers

Gate (Gas Access to Europe) on the Maasvlakte of the Port of Rotterdam is The Netherlands' first large-scale LNG receiving and re-gasification terminal. Full commercial operations started on September 1, 2011, just under four years after the FID was made in December 2007. Looking back at the terminal's development, there is great satisfaction at having achieved a very good safety performance, combined with delivery of the project on time and budget.

The Gate project was developed by NV Nederlandse Gasunie and Koninklijke Vopak NV to meet the growing demands for natural gas in The Netherlands and north-west Europe. The partners set up Gate terminal BV to develop, construct and operate the LNG terminal.

Work started in early 2005 with a site screening exercise, followed by an extensive feasibility study and project preparation phase. The latter included

a public tender process to select the engineering, procurement and construction (EPC) contractor. The EPC contract was signed at time of the FID.

The terminal has an initial regasification capacity of 12 bcm/year + 20% swing on send-out, combined with a near zero send-out capability via a high-pressure boil-off gas (BOG) compressor that can compress BOG generated when there is no desire to despatch material quantities of natural gas to the national transport grid. After some modifications to the waterfront, the terminal also has the capability to back-load LNG into small-scale LNG carriers to support future "break-bulk" operations in addition to receiving conventional LNG carriers up to the Q-max class for unloading and back-loading.

The project has been designed – and has obtained the necessary permits – to be extended to a 16 bcm/year + 20% swing send-out capacity; and has the ability to add a fourth LNG storage tank in addition to the three 180,000 m³ full containment storage tanks constructed so far. The terminal has two jetties, each able to receive all types of LNG carriers.



With the Gate terminal Rotterdam aims to become Europe's LNG hub.

Gate will play an important role in the development of the Port of Rotterdam as a main energy handling facility, by acting as the LNG hub for north-west Europe. It may also support downstream development of the LNG market in the Port of Rotterdam hinterland by supplying LNG for road and water-way transport.

The Gate terminal is the first in Europe to be designed and built fully compliant to European Code EN1473:2007 Installation and equipment for liquefied natural gas – Design of onshore installations.

● **Start-up and commissioning**

Arrival of the first LNG carriers

After a design and construction period from January 2008 to June 2011 with an excellent safety record, the Gate terminal went through the pre-commissioning phase and was prepared to receive its first LNG shipment in the commissioning phase.

The first LNG carrier to moor at Jetty 1 was BP's *British Trader* contracted by Merrill Lynch Commodities. The vessel arrived in the early hours of June 13, 2011 as per a nautical admission policy agreed with the Port of Rotterdam, which restricts initial arrivals to between 00:00 and 04:00 hours. After the familiarisation phase the arrival window will be extended to 24 hours.

The first discharge of LNG for the cool-down of the unloading arms and unloading system started shortly after arrival, the unloading system and the first LNG storage tank having been pre-cooled with nitrogen a few days before. The original plan for the end of pre-commissioning was only to pre-cool the large diameter LNG unloading lines with nitrogen, and to use LNG for cool-down of the first LNG storage tank. However, in coordination with the EPC contractor, this plan was changed to extend the use of nitrogen and pre-cool the first tank as this only marginally increased the cost and reduced the time required for the first LNG carrier to stay in port.

Further commissioning cargoes were delivered via the spherical type LNG carrier *Arctic Voyager*

and the Q-max vessel *Al Samriya*. The *Al Samriya* arrived on July 27, 2011 and was the final commissioning LNG cargo for the start-up and commissioning phase of the terminal. It also marked the delivery of the first Qatari LNG from Qatargas to The Netherlands.

Cool-down and performance tests

The cool-down of the LNG terminal used nitrogen for the unloading and recirculation system and the first LNG storage tank. To avoid any liquid nitrogen formation on the LNG storage tank floor, extra care was taken when introducing liquid nitrogen via the spray-ring. The unloading and re-circulation system was pre-cooled with vaporised liquid nitrogen to a temperature of about -120°C to -140°C, enabling a fast introduction of LNG into the system.

The second and third tanks were cooled down with LNG. The cool-down was carefully controlled with particular attention paid to allowing adequate time for the cooling down of vertical sections to avoid any uncontrolled thermal stresses. Line monitoring was continuously performed on site and from the dedicated cool-down graphics in the distributed control system (DCS) to check on undesirable movements caused by the cool-down. Skin-type temperature measurement sensors were installed with adequate spacing on the top and bottom of the unloading and recirculation system.

After the introduction of LNG in the first tank, the terminal operations established natural gas send-out and had the vapour handling system and associated BOG re-condenser operational as quickly as possible to process the BOG generated. The aim was to minimise the time that the ignited vent/flare had to be operational.

As part of the commissioning phase of the LNG terminal the following performance tests were defined:

- A maximum unloading test to demonstrate that the LNG terminal could unload at 12,500 m³/hour and sustain this during the unloading



The arrival of the *Bu Samra* on September 1, 2011 marked the start of Gate's operational life.

period whilst maintaining stable LNG storage tank pressure;

- A minimum send-out test to demonstrate that the contractual requirements for minimum send-out were met;
- A maximum send-out test to demonstrate that the LNG terminal can send-out at its nameplate capacity of 12 bcm/year + 20% swing;
- The BOG generation rate of the LNG storage tanks was evaluated to ensure it did not exceed the contractual value based on pure methane;
- A net-working volume test to ensure that there is 180,000 m³ of working volume available for each LNG storage tank;
- String tests were performed to test each and every individual LP pump, HP pump and open rack vaporiser.

Initially the BOG generation in the LNG terminal was not completely in line with the heat and material balances. After investigation it was discovered that the LNG terminal was not 100% thermal stable and was still cooling down. In addition, some small bypass valves for cold keeping purposes were open more than they should have been. This was resolved and at the end of the commissioning period design values were met.

The performance of the LNG terminal during the maximum unloading rate test showed that the terminal is performing according to design and

capable of unloading at its maximum unloading rate of 12,500 m³/hr, whilst maintaining steady LNG storage tank pressure. To maintain this pressure one BOG compressor was running at 100% and one other at 25% to half of its capacity. This was well within the design heat and material balance for this operational mode.

The BOG generation from the LNG storage tanks was also within the design requirement, and the net-working volume tests were passed easily. The maximum performance test of re-gasifying a total of 12 bcm/year + 20% met the design requirements, whilst the terminal also demonstrated its ability to comply with the minimum send-out requirements.

First commercial cargo and grand opening

During the commissioning phase the project delivery responsibility of the LNG terminal was still with the EPC contractor. The ready for operations date marked the hand-over of the terminal from the EPC contractor to the operations and maintenance team of Gate Terminal BV. The LNG carrier *Bu Samra* arrived on the morning of September 1, 2011, marking the start of Gate's operational life. The unloading of this carrier took place at the maximum rate and most likely set a record time for unloading a Q-max LNG carrier.

To celebrate the successful completion of the Gate terminal project, and its impact on improving the energy supply situation for The Netherlands and north-west Europe, the new terminal was opened by HM Queen Beatrix of The Netherlands. The opening ceremony on September 23, 2011 was attended by hundreds of foreign dignitaries as well as national and international guests.

Performance so far

At press time, Gate had received nine shipments and demonstrated stable operations in the unloading mode, holding mode and minimum send-out mode of operation. The LNG carriers that have been received range from the normal Mediterranean

class to the Q-max carriers, and both the spherical type and membrane type. Gate has also handled an LNG carrier that holds the world record for the shortest route from loading point to unloading point. An LNG carrier was loaded at Zeebrugge in Belgium and travelled 220km for unloading at Gate to make up for a missed delivery from another supply source.

● **Future developments**

Gate's send-out capacity can be increased to 16 bcm/year by the addition of extra equipment, and storage can be enhanced via construction of a fourth tank. The vapour handling system comprising BOG compression and a BOG re-condenser has already been designed for this future capacity which is fully permitted. There is space for even further expansion in the longer term.

Extra capacity will be needed if the Port of Rotterdam achieves its ambition of becoming Europe's LNG hub. There are plans to break-bulk

LNG and back-load into smaller LNG carriers (7,500 m³ to 25,000 m³) to serve remote areas lacking pipeline gas. The Dutch LNG industry has investigated the legal and regulative barriers for development of the small-scale LNG chain. Nautical quantitative risk assessments for the small-scale shipping activities have also been performed.

In addition to break-bulk of LNG for re-export, the terminal may also serve as an enabler to introduce LNG as a fuel for shipping in the Port of Rotterdam. LNG bunkering facilities from shore to bunker barges and subsequent side-by-side transfer of the LNG to the end-user will need to be developed.

LNG can be used as a fuel for road transport, and thus in parallel the addition of LNG truck-loading facilities are being considered as a further expansion step.

Sander Lemmers of Vopak LNG is the Secretary of Study Group 1, Programme Committee D – LNG.



Queen Beatrix opened Gate by symbolically opening a valve. With her from left to right are: Eelco Hoekstra, Chairman of the Executive Board of Vopak; Paul van Gelder, Chairman of the Executive Board and CEO of Gasunie; and Branko Pokorny, Gate's Managing Director.



GIIGNL Launches Standard Contract for Short-term LNG Shipping

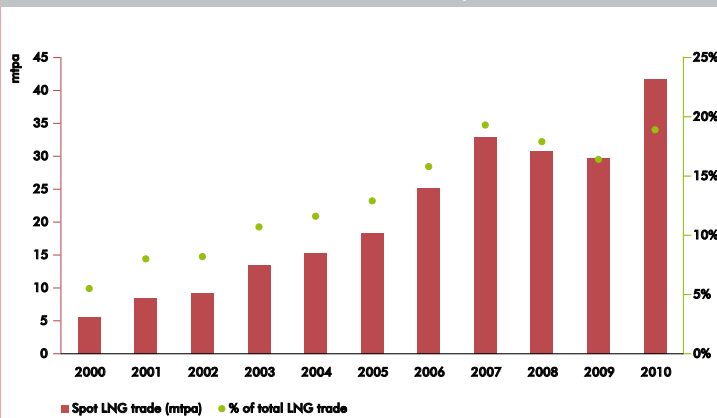
By Jean Vermeire

In February 2012, the International Group of LNG Importers (GIIGNL) launched its pro forma Voyage Charter for LNG ships. This is the first of its type.

The LNG industry has traditionally favoured transportation on time charter terms, conventionally for a period of up to 20 years, and short-term charters are generally concluded using a more concise form of a long-term time charter party. However, given that a growing number of trips are being arranged on a short-term basis in line with the rise in “flexible cargoes”, i.e. spot or short-term trades or cargoes under long-term contract which are deviated from their regular destination, the need for a more voyage specific charter party format has materialised. *Figure 1* shows the rapid growth in spot and short-term trades over the last 10 years and in particular

BELOW
Figure 1.

SPOT AND SHORT-TERM LNG TRADE AND SHARE OF TOTAL LNG TRADE, 2000-2010



*Note: Short-term trade denotes trades under contracts of a duration of four years or less.

since 2006. From GIIGNL’s latest statistical review¹ it is estimated that for 2010, approximately 19% of all LNG flows fall in this category, a share that is certain to have increased since with the continued interest in arbitrage by major producers and portfolio players as well as due to the post-Fukushima supply situation.

The LNG shipping arrangements for shorter-term trade have evolved slowly and are still, to a large extent, using time charter terms, typically adapting Shell LNG Time 1². As there is no available equivalent for carriage of LNG on voyage charter terms, GIIGNL decided to introduce its own form for a voyage charter party (VCP). This avoids having to adapt the provisions of a time charter to the circumstances of the shorter trade, to remove the provisions that do not apply and add some specific terms that are usually missing from time charters (such as demurrage and lay time). The VCP is structured as a two-document contract where the key commercial terms are negotiated in the primary document (freight rate, voyage length, lay time, demurrage, specific ports, etc.) whilst the secondary document containing the mechanics of the VCP generally remains unchanged from voyage to voyage. This allows the counterparties to very quickly negotiate a spot charter transaction.

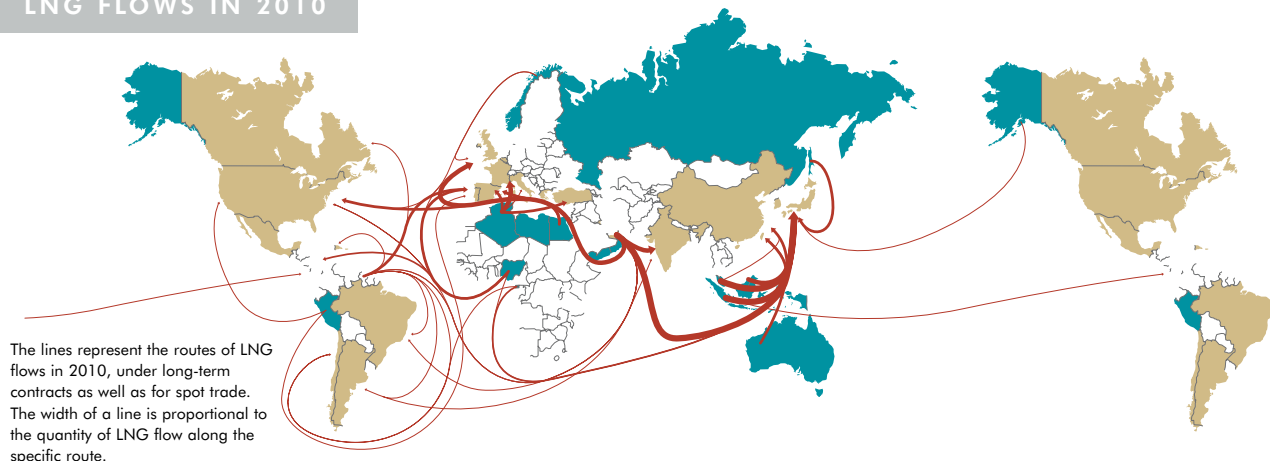
As the creation of the VCP required specialist expertise on shipping law issues, the law firm Stephenson Harwood in London, UK was chosen to assist in drafting this new form.

The standard VCP is available on the public domain of the GIIGNL website (www.giignl.org) under “publications”. Hereunder, a few illustrative examples of major voyage charter provisions are discussed and the conceptual differences with time charter terms are highlighted.

1 The 2012 edition covering “The LNG Industry in 2011” is due to be published at the end of April and will be available from the GIIGNL website.

2 A time charter party designed by Shell specifically for LNG vessel charters.

LNG FLOWS IN 2010



● Risk of delay

Where goods are carried on time charter terms, the risk of delay during the voyage rests primarily with the charterer. Thus, unless an off-hire event occurs for which the owner under the charter terms accepts responsibility, hire is payable and bunkers are consumed at the charterer's cost if the voyage is delayed.

In contrast, for carriage on voyage charter terms, the ship owner bears the risk of unforeseen delay. He receives the agreed freight based on the anticipated voyage, not the actual voyage, and thereby assumes the risk of unforeseen delay, and additional consumption of bunkers. The charterer is nevertheless liable to compensate the ship owner for delay during the loading and discharging process.

● Boil-off

In time charters, the consequence of delay for an LNG vessel, using boil-off for propulsion, is that cargo will inevitably be lost, as it will be used as fuel. If the cause of delay falls within the off-hire provisions for which the ship owner has accepted responsibility, the charterer will be compensated for the loss of time and reimbursement of additional boil-off, applying the usual time charter off-hire provisions. In the event of delay caused by reasons not falling within the off-hire provisions, the charterer agrees to accept this risk, including

additional fuel costs for the period of such delay.

However, in voyage charter terms, there is no similar provision entitling the charterer to compensation for additional boil-off during a period of delay for which the ship owner is responsible, and indeed no method of calculating such delay or such loss. Therefore, the challenge in drafting an LNG voyage charter is how adequately to compensate the charterer for lost boil-off during a period of delay for which the ship owner is responsible. Various suggested methods were considered similar to those used in time charters, but the decision was made through the GIIGNL sub-committee that the simplest form of compensation would be more consistent with the nature of a voyage charter, which is intended to be simple in form and predictable in its terms.

The VCP states that the ship owner should compensate the charterer for boil-off in excess of an agreed maximum for the anticipated sea passage. The overall maximum would be calculated by applying the usual guaranteed maximum daily boil-off to the expected length of sea passage. However, the daily guaranteed maximum would itself apply only to delay occurring in port for reasons for which the charterer is not responsible. The maximum guarantees would be dependent on the vessel type and would be negotiated along with the freight rate.

ABOVE
Figure 2.

● Other provisions

Various other amendments to standard tanker voyage charter terms were incorporated to take account of the specific nature of LNG carriage; in particular, the allocation of liability for gassing up and cooling down, and the provision of LNG heel. These terms differ from typical time charter terms in that under a time charter, the charterer is entitled to give and amend orders to the vessel, which the master is obliged to follow. However, in voyage charters, the terms and conditions of the voyage are fixed in the charter terms, including provision and responsibility for the loading condition of the vessel.

One topic of lengthy debate was the potential liability of the ship owner for failing to present the vessel ready for loading by the relevant cancelling date. It is standard in voyage charters that the charterer should have an absolute right of cancellation, regardless of the cause of delay, even though the charterer's right to recover compensation would be dependent on such cause. Thought was given to whether an alternative arrangement would be suitable for LNG carriage, bearing in mind that the right of cancellation may be an ineffective remedy for a charterer who may have difficulty in quickly fixing an alternative LNG vessel.

However, it was decided that, given that it is unlikely that a ship owner would agree to pay penalties for late arrival, and such penalties may be unenforceable, it would be better for the charterer to maintain, in the usual way, the right to claim its damages for its actual loss, in the event that the delay is attributable to the ship owner. Thus, the ship owner, when fixing the voyage charter, would be required to estimate the expected date the vessel would be ready to load. Although the ship owner would not be liable in the event that the vessel arrives late due to unforeseen circumstances, the ship owner would nevertheless be potentially liable to the charterer for late arrival if such expected readiness date was not specified in good faith. By this means, the ship owner

would not be able to offer a vessel for loading a cargo in the hope that the vessel may arrive in time, whilst expecting her to arrive late – the ship owner would be required to have a reasonable expectation that the vessel could arrive, given the vessel's current commitments, within the required loading window.

● Conclusion

It is hoped that a pro forma voyage charter dedicated to carriage of LNG will assist the LNG industry in maximising opportunities for the sale of spot cargos and the carriage of LNG on simple, predictable terms. No doubt many logistical questions will arise and trading conditions may evolve which may necessitate modifications of an industry standard for voyage charter terms. Any feedback on these issues would be gratefully received by the GIIGNL Central Office (central-office@giignl.org), and will be taken into account in subsequent revisions.

As a reminder, in 2011 GIIGNL also published on the public domain of its website standard forms for LNG Master Sale and Purchase agreements (MSPAs) for ex-ship and FOB transactions. Like the VCP, the MSPAs are structured as a two-part document: the annexure contains the key commercial terms that are negotiated on a cargo by cargo basis whilst the main body of the MSPA generally remains unchanged. The VCP and MSPAs may therefore be used in conjunction to facilitate the efficient and balanced contracting of short-term trades of LNG from both a shipping and a cargo perspective.

Jean Vermeire is the President of GIIGNL. The Voyage Charter Party has been prepared by the Commercial Study Group of GIIGNL, chaired by Anita Odedra (BG Group), with the assistance of Christine Abela (GDF SUEZ) and Nicolas Zanen (Cheniere). The legal issues have been addressed by Stuart Beadnall (Stephenson Harwood) who also contributed to this article.

A dynamic gas market – what does it mean for forecasting and investments?

The last few years have been interesting and challenging in several ways. The recession and climate policies have impacted gas demand and future outlooks. From a relatively predictable base load industry, we are now entering a new era of volatility and risk mitigation.

This will first require new ways of forecasting markets, taking in prices, costs, load factors and alternatives in a much more interactive and dynamic way. Clearly then, the operations will change, adapting to a more flexible and price-dynamic demand. Some production will not be base load, more options for exports will be valuable with less predictable markets, and infrastructure needs to take all this into account. The winners will not be found along the traditional supply cost curve, but will demonstrate a positive and dynamic attitude.

This could also make the industry more attractive to young people, which is a bonus in itself! As we work closely with both gas and electricity companies, we have

noticed differences in mindset, forecasting and operations, which indicate room for improvement in profitability and forecasting. Planning for uncertainty and the ability to adapt will be key skills going forward, and we are already helping many players and governments to take in and embrace these as positive developments.

We also notice that there is a strong bias and belief in energy self-sufficiency, whether it is wind, clean coal, solar or gas. Perceptions among consumers and politicians are changing, and gas is clearly becoming more popular when it is domestic and cheaper than when it was looking like increasingly expensive imports. Gas in transportation and balancing power are both interesting growth areas that fit the sustainable agenda of both the environment and economy.

Karen Sund and Dragos Talvescu,
Partners, Sund Energy.



Natural gas in a full picture perspective

Robust strategies

Partner selection

Scenarios

Infrastructure in uncertainty

Gas as the balancing fuel

Unconventional gas

Biogas

Carbon capture and storage

LNG for ships

Sund Energy will be presenting at the World Gas Conference: New ways of forecasting markets at the Expert Forum 8A. Wednesday 6 June (16:30-18:30). *Hope to see you there!*

Out now: Scenarios for EU gas 2020: Prices and flows.

www.sundenergy.com

Successful Pearl Start-up Re-ignites GTL Interest

By Alex Forbes

Even in Qatar, where energy project celebrations have become almost routine, the inauguration of Shell's Pearl GTL project in November 2011 was special. The successful start-up of the largest energy project in Qatar – and one of the largest in the world – was significant on several levels. For Qatar it was confirmation that the world's largest LNG producer is also now unquestionably the "GTL capital of the world". For Shell it was a convincing demonstration of the company's tech-

nological lead in the Fischer-Tropsch process and timely completion of a major contributor to future cash flow. Most importantly of all, it marked the dawning of a new era for an industry which has seen more than its share of disappointments, but which now looks forward to a promising future.

For the still-nascent gas to-liquids (GTL) industry the 2000s was a decade of two halves. The first was an exuberant time, marked by the start of construction of the Oryx project in Qatar and an ever-growing list of proposed new projects, most of them also in Qatar. After decades of work on a technology first developed in the 1920s, it seemed that GTL's time had arrived. Then came two events that cast a cloud over the future of the industry.



HH Sheikh Hamad bin Khalifa Al-Thani, Emir of Qatar (second right) inaugurated Pearl GTL in a ceremony on November 22, 2011, accompanied by HE Abdullah bin Hamad Al-Attiyah, Chairman of the Administrative Control and Transparency Authority (left), Peter Voser, CEO of Shell (second left) and HE Mohammed bin Saleh Al-Sada, Minister of Industry & Energy (far right).

In 2005, the Qatari government imposed a moratorium on further gas production from Qatar's prodigious but over-committed North Field. That decision, still in place today, left most of the proposed new Qatari projects without a supply of feedstock. Project after project was postponed indefinitely, or cancelled.

In June 2006, the Emir of Qatar, Sheikh Hamad bin Khalifa Al-Thani, inaugurated Oryx – which had become a symbol of the industry's optimism. That celebration proved to be premature. Oryx had a difficult birth and it took engineers several years to get the technology to work as intended. Even the final investment decision on Pearl GTL, reached by the board of Shell a few weeks later in July, could not dispel the disappointment felt throughout the industry. Meanwhile, the other big GTL project that had begun construction during the first half of the decade – Escravos GTL in Nigeria – was facing problems of its own, leading to long delays and massive cost over-runs.

The second half of the decade was thus a period of consolidation for the industry, as Oryx worked to ramp up production and as Shell set out to prove that it could construct Qatar's biggest energy project, on time and within budget, during a period of massive overheating in the energy construction industry, especially in Qatar.

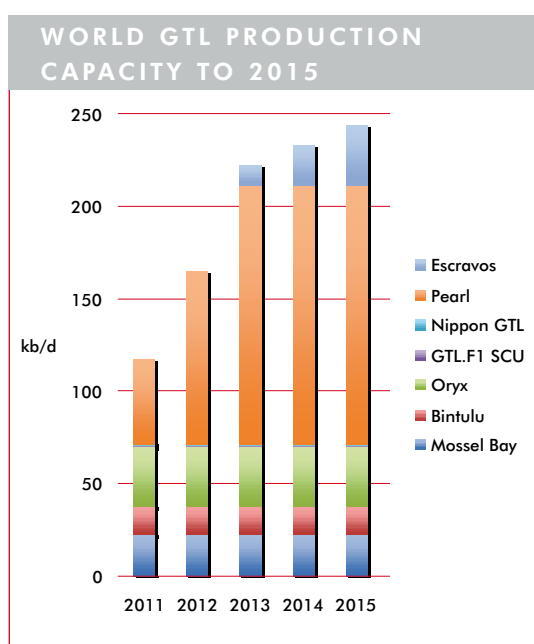
● Production ramps up

Today, the long hiatus is over. In June 2011, Shell announced that it had loaded the first cargo of product from Pearl and that production was ramping up successfully. On November 22, at a glittering ceremony at Ras Laffan Industrial City, more than 1,000 guests gathered to watch the Emir inaugurate the project, which by then had ramped up its first train to full output and had just started production from the second train. In February, at Shell's annual financial results announcement in London, CEO Peter Voser confirmed that the project was on track to reach full output from both trains by the middle of this year.



Oryx GTL is expanding capacity through debottlenecking.

Meanwhile, Oryx, having solved its teething troubles, has been working on expanding the plant's capacity through debottlenecking, and the project company – a joint venture of Qatar Petroleum and the South African fuels and chemicals company Sasol – is looking at options for further expansion. Escravos too is making good progress, with start-up now expected in 2013. As Figure 1 shows, the GTL industry is on a trajectory



LEFT
Figure 1.



that should see global GTL capacity reach close to 250,000 b/d by 2015. (This excludes capacity at Sasol's Secunda facility in South Africa, which is mainly a coal-to-liquids plant but also uses gas from Mozambique as a feedstock.)

Moreover, there are several companies that have been working on developing new proprietary GTL technologies – at large and small scale – which are on or approaching the threshold of commercialisation. For example, at the start of this year, UK-based CompactGTL was celebrating a successful year-long trial of its technology by the Brazilian oil and gas company Petrobras.

However, the optimism felt by the GTL industry today goes well beyond the successes it has achieved in technology implementation, important though these are. Over the past five years the world has changed in ways that make GTL projects look very attractive economically. Two trends in particular will drive the future economics of GTL.

The first significant development is that we have entered an era of structurally high oil prices. In early 2012, Saudi Arabia's influential oil minister, Ali Al-Naimi, was saying that in his view \$100 per barrel was a reasonable long-term price for oil, a big shift from his earlier stance of around \$75/b. Other members of OPEC are of a similar view, and several major oil-producing nations are predicating their national budgets on oil prices at around this level. Moreover, despite continual improvements in technology, oil is becoming more expensive to produce – and to refine.

In short, supplies of crude oil are looking stretched, leading to short-term concerns over how high prices may affect the global economy and long-term concerns over how future demand will be met.

The second significant development – a massive boom in unconventional gas production in North America – took everyone by surprise. During the first half of the 2000s, the conventional wisdom had been that natural gas production in the United States was on a gradual long-term decline from which it would not recover. Much of

the LNG production capacity that was sanctioned during those years was targeted at the large new market perceived to be opening up in North America. It was not until 2008 that it started to become clear that production of unconventional gas – especially from shale – had taken off in such a big way that total US gas production was growing rapidly. Canada too is enjoying an unconventional gas production boom.

By October 2009, when the 24th World Gas Conference was held in Buenos Aires, unconventional gas was the talk of the event. Interestingly, it had been barely mentioned at the 23rd WGC in Amsterdam in 2006. The boom in unconventional gas production in North America has led to much greater resource abundance and much softer prices than even a handful of years ago. And there are hopes that this “shale gale” may be replicated in other regions across the world.

In June 2011, the IEA published a report posing the question “Are we entering a golden age of gas?” It concluded that we almost certainly are, largely on the basis that global unconventional gas resources are presumed to be so vast that gas will remain abundant and therefore relatively cheap for the foreseeable future – and that policy-makers will legislate accordingly.

● **Attractive economics**

Clearly, a combination of cheap abundant gas and tight supply of costly oil works in favour of GTL, a technology that uses natural gas as its main input and produces products with prices mainly linked to oil prices as its main outputs. In this scenario of maturing technology and supportive market fundamentals, GTL economics start to look very attractive indeed.

Take Pearl GTL, for example. *Table 1* (over) shows the inputs and outputs of an economic model of the project. In particular it shows the project's internal rate of return (IRR) and net present value (NPV) – two indicators commonly used to appraise large capital projects – in three oil-price scenarios.



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ECONOMICS OF PEARL IN THREE OIL-PRICE SCENARIOS

	Low-case scenario	Base-case scenario	High-case scenario
Assumed oil price (\$/barrel)	74.0	86.0	98.0
Assumed gas price*	0.00	0.00	0.00
Upstream opex per boe of upstream production (\$/boe)	-2.00	-2.00	-2.00
Downstream opex per boe of upstream production (\$/boe)	-4.0	-4.0	-4.0
Daily upstream wet gas production (boe/day)	320,000	320,000	320,000
Assumed plant availability	95%	95%	95%
<i>* Gas price is nominally zero for integrated projects. Its cost is covered by capex and upstream opex</i>			
US\$ billion			
Capital cost of entire project	-19	-19	-19
Net annual income	6.190	7.307	8.425
Internal rate of return (%)	32.6%	38.4%	44.3%
Net present value @ 5%	68.2	84.0	99.7
Net present value @ 7.5%	50.0	62.5	74.9
Net present value @ 10%	37.2	47.3	57.5

ABOVE
Table 1.

Most of the inputs are data in the public domain: capital expenditure of \$19 billion; operating expenditure of \$6/boe of upstream production; and upstream wet gas production of 320,000 boe/d. The model assumes plant availability of 95%. This is less than the availability of Shell's Bintulu GTL plant in Malaysia, where the technology employed at Pearl was proved. In 2010, Bintulu achieved availability of over 99%.

From these inputs, the model calculates the revenues that can be expected from the 140,000

b/d of GTL products from the two Fischer-Tropsch (FT) trains – which include gasoil, kerosene, naphtha, normal paraffins and lubricant base oils – as well as the revenues from 120,000 b/d of upstream products, consisting of condensate, LPG and ethane.

The model's outputs are impressive. Annual revenue from the project ranges from \$6.2 billion at an assumed oil price of \$74/b to \$8.4 billion at \$98/b oil. This implies a payback period of between 2.3 and 3.1 years, and an IRR of

between 33% and 44%. NPV, at a discount rate of 10%, ranges from \$37 billion to \$58 billion over 25 years. At an oil price of \$115/b, the numbers become breath-taking. Annual revenues rise to over \$10 billion a year – giving a payback period of less than two years. IRR shoots up to 53% and NPV at 10% is \$122 billion.

These numbers do not take into account the production split between Shell and Qatar or any tax that Shell would have to pay. What they show is that, in any conceivable oil-price scenario, Shell



Shell's middle distillate synthesis (SMDS) process was proved at the Bintulu GTL plant in Malaysia.

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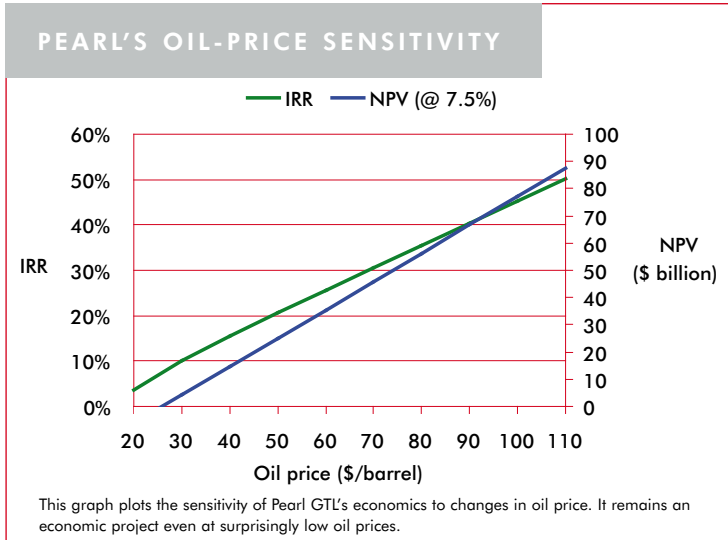
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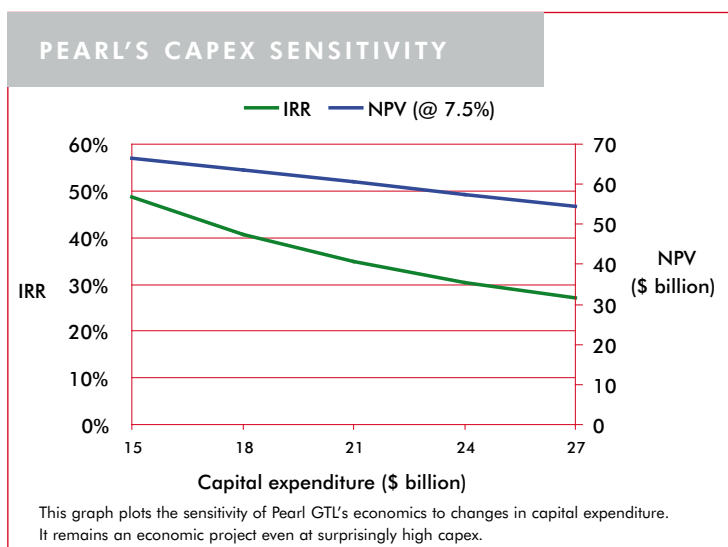


ABOVE
Figure 2.

easily recovers the cost of its investment and plenty of cash is left over for Shell and Qatar to share, according to the formulae in the Development and Production Sharing Agreement (DPSA) that governs the project.

Using the model to investigate the behaviour of the project's economics leads to some surprising conclusions. *Figure 2* shows how IRR and NPV vary as oil price changes. Pearl remains economically attractive at surprisingly low oil prices. Even more surprising is the project's lack of sensitivity to

BELOW
Figure 2.



changes in capital expenditure. As *Figure 3* shows, Shell could have spent a lot more than \$19 billion and Pearl would still have looked a good investment in terms of IRR and NPV. No wonder that Shell appears to be so pleased with its investment.

A key factor driving the economics of Pearl is that it is integrated into the upstream. In other words, upstream gas production from the North Field is part of the project's scope. This has important consequences. Firstly, the project benefits from substantial revenues from the sale of upstream liquids and ethane. Secondly, there is no transfer price for the gas; its cost is covered by upstream capital and operating expenditures. Thirdly, the lack of a transfer price means that gas costs are locked in from the start – so the project has no sensitivity to future gas price movements. In short, Shell makes a profit in both the upstream and downstream phases of the plant, and there is no gas price risk.

Table 2 looks at the economics of two projects that are not integrated into the upstream and therefore have to buy their gas from external suppliers: Oryx in Qatar and Escravos in Nigeria.

Their economics are driven by four main factors: the cost of the feedstock gas; the capital expenditure for plant construction; the cost of operating the plant, which includes labour, overheads and consumables such as catalyst; and the price that can be realised for the products. Other factors that play a role include costs arising from construction delays, and the government take of profits, through royalties, taxes and the terms of production-sharing agreements. However, important as these can be, they vary from project to project. The analysis that follows therefore focuses on the four main factors.

Oryx and Escravos use the same basic technology and have the same design output capacity. Yet Oryx cost around \$1.1 billion to build and finance, while the latest estimate for Escravos, a joint venture of Chevron and Nigerian National Petroleum Corporation (NNPC) is \$8.4 billion. Both plants have a production capacity of around

ECONOMICS OF ORYX AND ESCRAVOS IN THREE OIL-PRICE SCENARIOS

	Oryx GTL			Escravos GTL		
	Low-case scenario	Base-case scenario	High-case scenario	Low-case scenario	Base-case scenario	High-case scenario
Assumed oil price (\$/barrel)	74.0	86.0	98.0	74.0	86.0	98.0
Capital cost of entire project (\$ million)	-1,400	-1,400	-1,400	-8,400	-8,400	-8,400
Net annual income (\$ million)	487	630	773	546	690	834
Internal rate of return (%)	34.8%	45.0%	55.2%	4.2%	6.5%	8.7%
Net present value (\$ billion) @ 5%	5.5	7.5	9.5	-0.7	1.3	3.4
Net present value (\$ billion) @ 7.5%	4.0	5.6	7.2	-2.3	-0.7	0.9
Net present value (\$ billion) @ 10%	3.0	4.3	5.6	-3.4	-2.1	-0.8

Assumptions were made about the gas price, operating costs, plant availability and plant efficiency as the actual data are confidential.

LEFT
Table 2.

32,400 b/d. So the specific capital cost for Oryx was \$34,000 per barrel per day (\$/b/d) of capacity. Specific capital cost for Escravos works out to a staggering \$260,000/b/d.

The economics of the two projects are compared in Table 2. The results are intended to be illustrative.

So, for example, the present value of the \$1.1 billion that Oryx cost has been calculated by assuming the capital was invested in 2006 at a 5% rate of interest, giving \$1.4 billion today. (This is not what it would cost today to construct a similar plant in the same location.) The model



Escravos GTL is due to open in 2013.

assumes that both projects start operating this year for the purposes of comparison.

The results show just how different the economics of two projects that use the same technology and have the same capacity can be. Oryx is highly profitable in any conceivable oil-price scenario, while the economics of Escravos require oil prices of well above \$100/b for the project to be profitable.

The difference is down to two main factors: timing and location. Oryx was built in the project-friendly environment of Qatar's Ras Laffan Industrial City. And the engineering, procurement and construction (EPC) contract was awarded before construction costs began the steep rise that occurred between 2004 and 2008. EPC contractor Technip shouldered much of the burden of construction-cost escalation.

Escravos, by contrast, is being built in a swamp in Nigeria and did not get under way until well into the cost-escalation period already mentioned. Human factors have also played a role, with local politics, militancy and piracy all having their effects. Were it not for the fact that much of the plant has been built and the costs therefore sunk, the future of Escravos would be in doubt. The stakeholders are completing the project because at current and expected oil prices the project will generate large cash flows when completed. Indeed, at long-term oil prices above \$100/barrel, the project starts to look economic despite its massive capital expenditure.

● **New projects**

As it looks to the future, the GTL industry can congratulate itself for having solved the technology challenges involved in getting projects to work – and take heart from the helpful trends in market fundamentals that make its economics now look so attractive. However, growing the industry's capacity beyond the 250,000 b/d in *Figure 1* will require the launching of new projects.

Not surprisingly, the main focus for new projects is in North America. Shell and Sasol, the

current GTL technology leaders, are looking closely at potential opportunities there. Sasol has two feasibility studies under way, one in Canada in association with Talisman and another in Louisiana in the United States. Both projects would use unconventional gas as feedstock.

Sasol is also pursuing a project in Uzbekistan, in partnership with Uzbekneftegaz, the national oil company, and Malaysia's Petronas. The seriousness of that proposal was confirmed in December 2011 when Sasol announced that the project had entered front-end engineering and design, following successful completion of a feasibility study. Estimated cost of the 38,000 b/d project is \$4.2 billion. Depending on the timing of the final investment decision, the plant is expected to come into operation in the second half of the decade.

Shell is considering its gas monetisation options in North America as it seeks to reduce its exposure to low gas prices and increase its exposure to high oil prices. Clearly, GTL is one of those options – and a project in the Gulf of Mexico is a distinct possibility. Again, such a project would probably use unconventional gas as feedstock. Shell would also be interested in constructing a third train at Pearl, where there is room on the site – but that will have to wait until Qatar lifts its North Field moratorium.

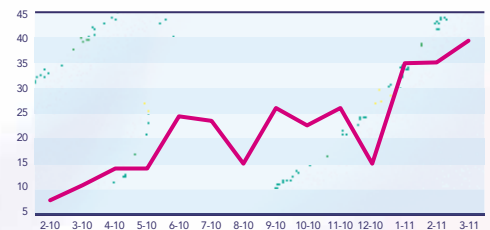
Other companies considering GTL projects in North America include GTL.F1, a joint venture of South Africa's PetroSA and Germany's Lurgi, and US-based GTLpetrol.

Clearly, in the current and projected oil/gas price environment well-executed GTL projects will make substantial profits for their owners and other stakeholders. As the industry looks to the coming decade, the fundamentals are lining up in favour of GTL as never before.

Alex Forbes is an independent journalist and consultant who has been reporting on energy developments and analysing trends for three decades. GTL is one of his specialities.

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Natural Gas: Human, Open and Shaping the Future

By Dimitri Schildmeijer

Reputation matters! It can make or break a company and affect the success of an entire industry. But a strong reputation for natural gas will not come naturally. The sector can do much more to build its image and gain support from policymakers, communities, governments and other stakeholders around the world.

“It’s not rocket science, but we need to get smarter and more concise about what we say, how we say it, and with whom we engage”, says Hansch van der Velden, leader of the IGU Study Group on the image of natural gas, one of three study groups set up by Programme Committee E – Marketing. Here he takes part in a question and answer session.

Why worry about the image of gas?

A strong reputation is a key asset. Yet today, reputation surveys still put us at the bottom of the list with the worst reputation of any sector. We can do better. That is our case for action.

Is that really a concern when profits are healthy?

Yes it is. If there is a mismatch between what society wants, and what society believes we can deliver, eventually the sector will pay the price. Let me give you an example: my company launched a PR campaign at the end of 2011 to showcase natural gas as a partner for renewables. It may not be an eye-opener for us, but a lot of people outside of our sector don’t see a role for gas in a sustainable energy mix. We have a great story to tell and we must put more efforts into the way we tell our story.

That’s one company, what about a whole sector?

It is basically the same thing, only much more complex. A strong image of natural gas will not



Hansch van der Velden, Director Corporate Communications at Gasunie, leads the IGU Study Group on the image of natural gas.

come naturally. It needs a building plan, just like a drilling platform needs one. As an industry that considers reputation as an asset, we need to get smarter about what we say, how we say it and with whom we engage.

Where do you start?

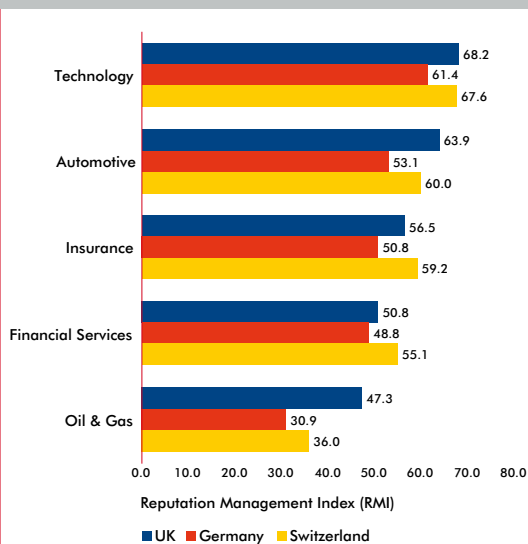
You start by appreciating the context of communication: no country is the same. The starting point is to understand the role of natural gas in the energy mix. How high is gas demand? Are there domestic resources, or is the country importing? Are there alternatives to gas? How modern is the industry?

Then what?

Map your stakeholders. We interviewed 50 specialists in 11 countries (Brazil, Denmark, France, Germany, Iran, Italy, Japan, The Netherlands, Norway, Malaysia and Russia) and found four distinct groups:

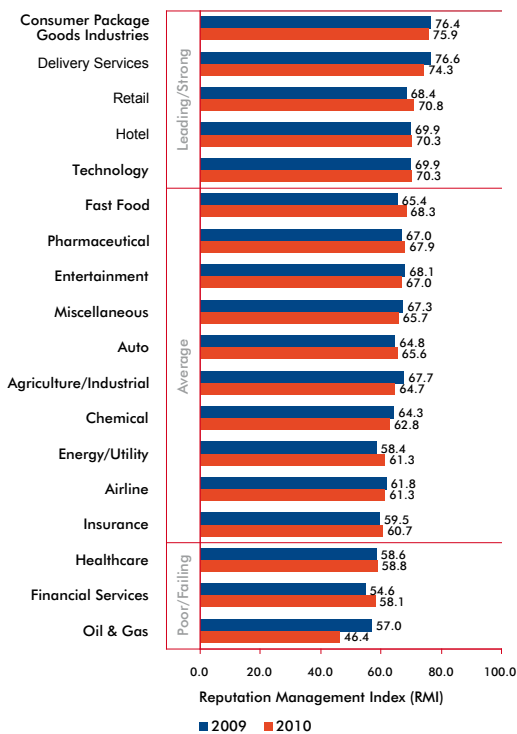
- “We don’t really like gas”: Scandinavian welfare states may have natural gas, but are focusing on sustainability, renewables and CO₂ reduction.
- “We need gas”: emerging markets, like Brazil and Malaysia, which are looking at natural gas as an enabler of economic growth.

INDUSTRY RANKINGS IN THREE EUROPEAN COUNTRIES



Source: Prophet European Corporate Reputation Survey, 2011.

INDUSTRY RANKINGS IN THE USA



Source: Prophet Corporate Reputation Survey, 2011.

FAR LEFT AND LEFT
The oil and gas industry has the worst reputation of any sector, both in Europe and the United States.

AN IMAGE PROPOSITION

An image proposition describes how the industry would like to be seen by stakeholders. Being human, open and shaping the future, will make our reputation stronger and keep our industry successful.



Human

Touches people's lives every day;
Personal and emotional;
People around the world working to provide energy;
Be relevant;
Local contribution;
Part of the community

Open

Part of society;
Responsible and accountable;
Open and transparent;
Listens to criticism;
Acknowledges concerns, feelings, issues and hesitations;
Approachable and ready to engage

Shaping the future

Part of the solution;
Alliances, not enemies;
Inclusive;
Pro-active;
Confident;
New opportunities;
Part of a sustainable (low-carbon) energy mix;
Innovative

- “We use gas”: in countries like France, Germany, Italy, Japan and The Netherlands, natural gas is widely used by households and industry. It’s a convenient but rather anonymous source of energy.
- “We love gas”: in Iran and Russia, where the economy relies on natural gas, gas is very positively viewed, and seen as a fuel of the future.

Your communication strategy has to take into account where you are on this. Each country will have different priorities.

Then one-size communications will fit nobody?

Not true. We are working on a lot of the same issues: CO₂ and greenhouse gases; the impact of on- and offshore production; supply security and geopolitical issues; energy prices; safety of operations. And the issues cross borders: social media makes a local crisis into a global issue at the speed of light. Our communications should cross borders too.

What do you recommend?

Our Study Group’s report is called “Winning Communications Strategies for Natural Gas” and gives recommendations on what we say, how we say it and with whom we engage.

What we say is about content. First, we can talk more about innovation which is a missed opportunity. In every country the gas industry has opportunities to showcase innovation such as: LNG; biogas; natural gas vehicles; using gas efficiently at home; and gas and renewable energy working together. A second area to talk about is the softer values of the industry: corporate social responsibility, employment in our sector and how we engage with communities.

How we say it is about our tone, style of communications. A great phrase is “No-one will care about what we know, until they know that we care.” We need to realise that communications is an emotional process, not just a rational process.

There is more to convincing communications than presenting numbers and charts, which we are used to doing a lot of. Facts are important to underline the story but they can never be the story. We also need to give a face to the industry. Industry leaders should be more visible and recognisable and represent the industry in a broader social debate.

With whom we engage. Industry representatives will admit that a lot of their external engagement is industry speaking to industry. Our advice is two-fold: “Stop preaching, and stop preaching to the converted”. We are not engaging sufficiently with other stakeholder groups that are of great importance to us: NGOs, think tanks, academia, universities, media and online communities. We need to participate in new forums and engage these new audiences in two-way communications.

You want to start talking about the industry as “Human, open and shaping the future”.

Another slogan?

There’s more to it: “Natural Gas: Human, open and shaping the future” is an expression of what the sector wants to be for the outside world – an image proposition. Suppose you speak at a conference you would not say: “we are human, open and shaping the future”. However, if I asked the audience on their way out how they now feel about us, I hope these attributes would be at the forefront of their minds.

Any final words?

Yes, please come and participate in our session “Energising the Image of Gas” at WGC2012. We want to hear your views on this important debate (Wednesday, June 6, 09.45 – 11.45.)

Dimitri Schildmeijer is the Managing Director of AudienceOne (www.audience-one.eu) and a member of PGC E’s Study Group E.3 on the image of natural gas.

GAS CAMPAIGNS

It is important to understand the image of gas, but also to know what the industry is doing about it. Here are some great examples of how gas companies and the industry are communicating the benefits of natural gas.



The Erdgas campaign in Germany is a very visible “pro” natural gas campaign. The green leaf helps Germans recognise that natural gas is economic and environmentally friendly. A new App has been launched to promote different natural gas applications.



A Gazprom TV ad in Russia talks about the company and the role of natural gas for Russia and beyond.



GDF SUEZ launched a new communications campaign in 2011 with its brand “Dolce Vita”. The campaign tells consumers they can reduce their energy consumption by 20% while remaining 100% comfortable with natural gas.



Gasunie in The Netherlands has a campaign that makes the explicit link between natural gas and renewable development.



Increasing Sustainable Gas Production to 2020

By Flavia Di Cino

In order to meet global gas demand by 2020, new sources of gas production in the range of 1.3 to 2.1 tcm/year will need to be developed. The variables are the rate of growth in demand and the success of efforts to arrest declining production from mature fields, and the challenge has grown compared to the 2001-2010 period (see Figure 1).

The world's resource endowment is massive, easily adequate to sustain such a supply increase up to 2020 and well beyond. However, the future of gas production will be far more complex than in the past due to the challenges of exploiting new resources and the diversification of alternatives.

Complexity and diversification will call for best practices and best management along the entire chain of the project cycle, while the commercial

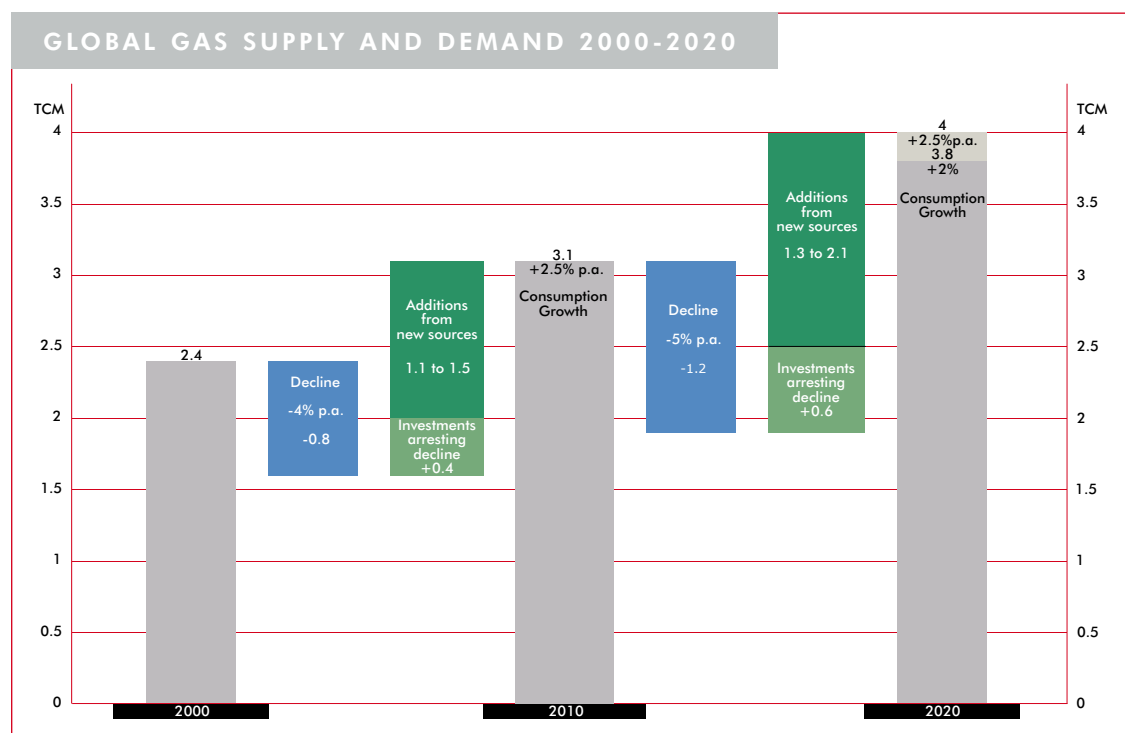
viability of individual projects will remain subject to risk and uncertainty.

Since the turn of this century, unconventional developments have been gaining momentum. Consequently, E&P players have been choosing their projects from a wide range of alternatives, both geographically diversified and with a variety of technical challenges and different degrees of geological risks. Moreover, combining unconventional and conventional undertakings into one portfolio entails the integration of two very different profiles of geological risks. Correctly balanced portfolios will be a key management tool.

Partnerships among E&P players will continue to play an important role in mitigating risks and diversifying portfolios. NOCs and non-traditional players – such as large consumers – are also expected to play a relevant role.

The supply dynamics are deeply intertwined with demand factors – volumes and prices – and with policy. Buoyant demand and the expected adaptation of policies to cover the particular

RIGHT
Figure 1.



characteristics of both conventional and unconventional production have been driving supply response, and are expected to continue doing so. Price mechanisms are currently under review; in particular, the linking of gas prices to oil prices. The impact that the newly adopted mechanisms will have on the absolute level of prices will be a fundamental variable for future developments.

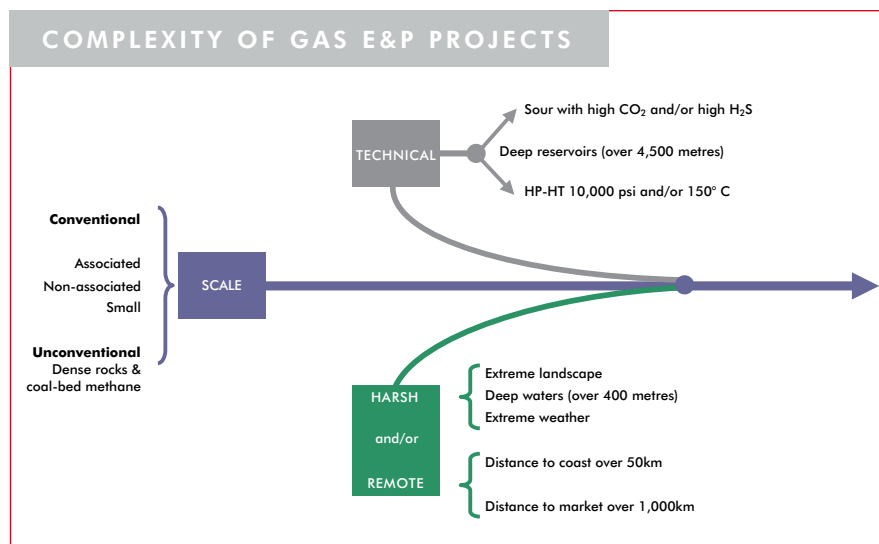
A particular area of complexity for E&P relates to the challenges posed by geological, environmental and technical factors.

On the one hand are conventional and complex projects. These are geologically conventional targets in harsh environments or remote areas, those that face new technical challenges, or those on a scale requiring ad-hoc solutions.

Then there are unconventional developments, which usually call for specific exploration techniques and extensive appraisal of economic feasibility. Indeed, assessing unconventional plays generally involves large amounts of statistical data, due to the heterogeneous geological characteristics of the different plays and within each play. This is a fundamental issue when estimating economic value and production potential of the plays as production performance shows wide variations from well to well, even for wells close to each other in the same play.

Even when there are no precise parameters to define each category of technical complexity, they can be conceptualised by the specific hurdles to be overcome as shown in *Figure 2*.

Technical complexity is not only due to the increasing challenges of each hurdle (e.g. drilling deeper), but also to the fact that complex projects typically involve a combination of more than one challenge (e.g. drilling deeper HP/HT sour gas wells), which increases the overall risk associated with the project.



When addressing these challenges, issues related to health and safety are of the utmost concern. It is a fundamental pre-requisite of all E&P developments that they be conducted in a sustainable way with zero unacceptable risk to people and the environment.

● Flagship developments

During the 2009-2012 Triennium, WOC 1 has been evaluating trends in complexity by reviewing flagship developments. According to the research, all categories of complexity will be represented in the sources of new gas production expected to be developed around the world up to 2020. Some examples are given below.

Australia is home to several flagship projects with massive additions of production capacity, both offshore and onshore, conventional and unconventional. Offshore, they include the Gorgon project which will add 20 bcm/year and includes a large CO₂ sequestration project, and the Prelude project of 5 bcm/year which will use floating LNG technology. Onshore, additions from unconventional CBM to LNG projects already sanctioned are expected to add 30 bcm/year.

In North America, the trend towards shale gas developments is expected to continue. In the

ABOVE
Figure 2.

United States, the production of gas from the Marcellus shale – which is the flagship case for the decade – is estimated to be around 100 bcm/year by 2020, with a potential high case of 180 bcm/year. In Canada, the emergent plays Horn River (shale) and Montney (shale and tight gas) are estimated to have a combined production potential of around 80 bcm/year. However, both sources should be considered “stranded” due to the fact that they are farther in the north-west of the country compared to conventional sources and due to the current development of several plays in the US, which make the North American market self-sufficient for the next decade. For this reason, together with sustained gas price differentials in favour of Asian and European markets versus North America, several LNG export projects are under consideration in the US and Canada.

The Russian sector of the Barents Sea is expected to become an entirely new gas and oil production province, with the Shtokman field set to be developed in three phases of 24 bcm/year each. Shtokman was discovered in 1988 and is located 600km offshore. After more than two

decades, and despite the challenges, the absence of transit countries on the way to markets was the key factor in deciding to prioritise this project. A final investment decision is awaited with start-up expected by 2017.

In the Gulf, the Permian gas reservoir is commonly known as the Khuff Formation and contains sour gas. Production from the Karan field, which is the first non-associated offshore development in Saudi Arabia, started in July 2011 and is expected to reach full capacity of 18 bcm/year by 2013; while Abu Dhabi’s Shah field is expected to add 10 bcm/year.

In China, the Sulige tight gas field is ramping up production to reach 23 bcm/year by 2015. Sulige is a low permeability, low pressure gas field with a reservoir depth of 3,200 to 3,500 metres.

In India, the Krishna Godavari offshore basin is likely to become a world-class area of gas production. The KG-DWN-98/2 block, which sits adjacent to the producing KG-DWN-98/3 block, has a targeted production of 7 bcm/year. However, discoveries are scattered across the basin in both deepwater and shallow-water areas.

In Africa, Angola LNG is about to start operations and is monetising 7 bcm/year of non-associated and associated gas from a series of deepwater and shallow-water blocks.

In Israeli waters of the Mediterranean Sea, several recent discoveries have increased the estimated volumes of resources of the Levant basin to 980 bcm. The Tamar field is expected to start production of 3 bcm/year by 2013.

● WGC2012

These are some of the results of the work of WOC 1’s Study Group 1.2 which has been looking at current and future gas developments. WOC 1’s full report will be presented during WGC2012.

Flavia Di Cino of Tenaris is the leader of Study Group 1.2, Working Committee 1 – Exploration and Production.



Continuing investments will boost production of gas from the Marcellus shale.

Perupetro

PERUPETRO SA, the National Hydrocarbons Agency plans to launch Peru Round 2012 in the second half of this year for exploration and development of areas with hydrocarbons potential.

PERUPETRO is delimiting the area of the blocks that will be part of Peru Round 2012, and expects to surpass the results achieved in the latest processes, given the interest shown by companies in recent months.

At the level of oil basins, Peru has a semi-explored territory which generates

high expectations of new oil discoveries both onshore and offshore.

Peru remains an attractive destination for investors. The country boasts robust economic indicators including 7% GDP growth in 2011, one of the lowest inflation rates worldwide, a sovereign credit ratings of BBB from the major agencies and international reserves above \$50 billion, equivalent to 16 months of imports. All these factors contribute to any funding of oil projects in the country.



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Smart Gas Grids – Transforming Energy Supply

By Jos Dehaeseleer, Daniel Hec and Ilir Kas

Smart grids have an essential role in transforming the functionality of the present energy supply system. The aim is to provide a user-oriented service and support the achievement of the EU’s 20-20-20 targets, while guaranteeing a secure, high quality and efficient energy supply in an open market environment.

The EU’s 20-20-20 targets are to reduce greenhouse gas emissions by 20%, to reduce primary energy consumption by 20% and to obtain 20% of energy from renewable resources, all by 2020.

Smart gas grids will support the ability of gas to play a major ongoing role in the energy mix while meeting the carbon and renewable energy targets, and will enable the active participation of end-users in the energy market.

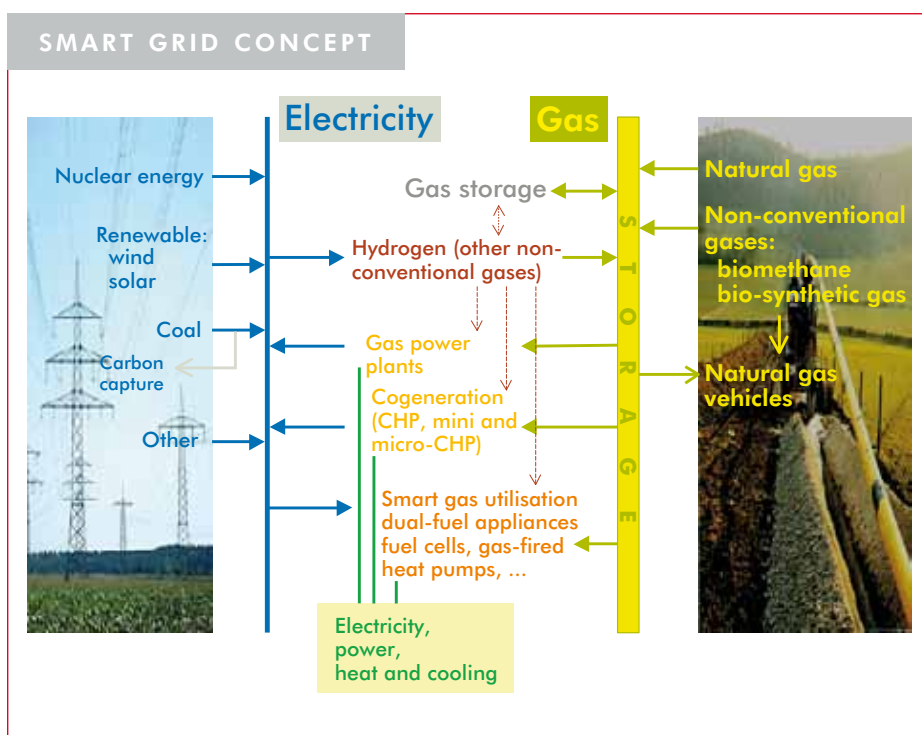
BELOW
Figure 1.

In particular, uncertainties around the future development of efficient and large-scale electricity storage technologies mean that gas is likely to remain a key provider of both heating and electricity balancing services.

The opportunities and benefits for smart grids are different for gas and electricity.

Residential gas appliances are mainly used to provide for basic needs (hot food and space heating). There is limited scope to reduce energy consumption in these areas; any reductions will be dependent on improvements in appliance efficiency and/or increases in the level of home insulation. In contrast, the multiplicity of electrical appliances provides opportunities for consumers to optimise their electricity consumption and manage their peak demand.

Gas networks store large amounts of energy and therefore react relatively slowly over time to changes in demand. However, electricity networks require real-time responses to changes in demand as electricity cannot easily be stored.



● Smart gas grid concept

Smart gas grids cannot be developed in isolation but should be linked to future electricity smart grids and should facilitate smart energy utilisation.

Smart gas grids can be developed independently of a complete roll-out of smart gas meters.

The smart gas grid concept is based on maximising the efficiency of overall energy usage and taking full advantage of all the opportunities that gas and the gas grid can offer.

This may be achieved by means of the additional functionalities, services, opportunities and products described

below. A conceptual diagram (Figure 1) shows the operation of a possible system.

A key existing feature of the gas grid is its ability to store energy. This storage provides flexibility in the use of gas between day and night, and between summer and winter, and flexibility in relation to production of other energy. In addition to the provision of discrete storage on a seasonal basis in dedicated facilities (depleted gas reservoirs, salt cavities and using LNG), gas holders and the gas network itself (by cycling of pressure in the network) may be used on a diurnal basis to store energy when gas is not directly consumed. In the future, flexible grids will enable the integration of electricity, gas, heating and cooling with the result that the overall efficiency of the grid(s) is optimised. The result will be a sustainable, economic and reliable future energy system. Peaks in electricity consumption could be reduced or

removed by the use of dual-fuel applications, or even more by using combined heat and power (CHP) or cogeneration at local or even residential level. A highly promising possibility of storing power from renewable sources is the conversion of wind or solar power into hydrogen or into other non-conventional gases. These gases could be stored or fed into gas networks. When required, power could be generated from gas using gas-fired power plants, cogeneration (CHP, mini and micro-CHP) or fuel cells.

The injection of non-conventional gases reduces the carbon intensity of the gas grid. The technology for manufacturing biomethane is available. Other gases could be injected into the gas networks but there is no experience available at the moment. Manufacturing non-conventional gases for injection into the gas network requires incentives that take account of the greenhouse gas



Breaking ground for a biomethane plant in Klein Wanzleben, Germany – the injection of non-conventional gases reduces the carbon intensity of the gas grid.



emission benefits to make it cost-effective. European legislation/standards concerning the required quality of injected non-conventional gas are not currently available neither are the roles and responsibilities of the involved parties currently defined. For the safe use of the gas by end-users and for correct billing, the quality has to be monitored; and, in case of off-spec gas, necessary timely actions have to be taken to stop it entering the network.

Smart gas utilisation offers solutions to reduce greenhouse gas emissions, improve the efficiency of networks and empower end-users, allowing them to optimise their energy use and participate actively in the energy market. Ways of using gas smartly include dual-fuel appliances (electricity and gas), fuel cells, an increased use of natural gas vehicles (NGVs) for transport and biomethane injection into the gas grid, together with extensive use of cogeneration (CHP). There are already many large CHP units across Europe, while although dual-fuel appliances, fuel-cells, micro- and mini-CHP, gas-fired cooling systems and gas-fired heat pumps are not yet common in the European market, the technology has been developed. The technologies for gas-driven cars are far more advanced than for electric cars and have considerable advantages in relation to efficiency.



Greater use of NGVs can help reduce greenhouse gas emissions.

Increasing the efficiency of energy usage is a fundamental objective of the European energy strategy. Smart gas utilisation will support this objective and should be encouraged.

Secure and robust energy networks are essential for the continuous improvement and effective operation of the European energy markets. Gas systems are located in an increasingly complex environment with increased safety consequences when their integrity is compromised. Smart monitoring and the introduction of new techniques of more “active” control (smart tools) in the field of flow and pressure regulation, traceability, internal pipe inspection, odorisation and cathodic protection could optimise the grid operation and would lead to a more efficient network which allows additional functionalities. This will only be possible if the associated information and communication networks are secure and robust. It is also essential to maintain data and system security and to respect the fundamental rights and freedoms of end-users.

● Conclusions

By promoting the new functionalities, opportunities and products described above, realisation of the concept of smart gas grids will enable the integration of electricity, gas, heating and cooling and the optimisation of both overall energy efficiency and overall grid(s) efficiency.

Further development will be required to ensure that the options are fully exploited. This will require the cooperation of all stakeholders and the development of suitable market mechanisms.

The harmonisation and interoperability of goods, services and communication systems on a European level are essential for the efficient operation, transparency and competitiveness of the energy market.

Jos Dehaeseleer is Head of the Gas Division of ORES, Daniel Hec is Secretary General of Marcogaz (www.marcogaz.org) and Ilir Kas is Technical Advisor at Synergrid.

Congratulations to all in the IGU

The Royal Dutch Gas Association-KVGN will be 140 years old in 2013!

As Founder and Charter Member, the KVGN has a partnership of more than 80 years with IGU. This is a valuable part of our Dutch gas history, and on behalf of the Dutch Gas Industry we congratulate all IGU members on the celebration of IGU's 80th anniversary in 2011, and on holding the 25th World Gas Conference in 2012!

Our joint history and the WGC are a strong foundation for an even brighter future for gas. You can count on the support from the Dutch in making it happen!

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25th WGC



energy in motion



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Brighter outlook for tomorrow

The combined heat and power (CHP) production is vital for Finnish society. In the near future new natural gas based technology is taken use in metropolitan area waste processing which is an important step towards carbon-less energy production. Opting for natural gas instead of coal helps cut down CO₂ emissions and improve local air quality.

Gasum

What Place for Gas Heat Pumps in the Future Energy Market?

By Jean Schweitzer and Daniel Hec

On December 1 and 2, 2011, representatives of IGU's Working Committee 5 participated in a workshop on gas heat pumps (GHP) organised by Marcogaz and GERG. This event, sponsored by GDF SUEZ and GasTerra, was held at the

headquarters of the GDF SUEZ R&D division in Saint-Denis near Paris, France.

About 75 people (representing the gas industry, manufacturers and interested organisations) took part in the workshop. Such a high participation level demonstrated the growing interest for these new technologies. With the declining market for central heating boilers and the emphasis put on renewable energy, the gas industry needs new gas technologies more than ever. Gas heat pumps are one of the technologies that can help us remain competitive in the domestic and commercial heating markets and allow us to offer gas cooling where this is relevant.

The objective of the workshop was to paint a picture of today's situation and discuss the strategy and action needed to accelerate the introduction of GHP to the EU market. Both domestic and commercial sectors were covered.

The contributions on the first day aimed at showing the state-of-the-art technologies currently on the European market. Existing technologies were presented by a range of manufacturers including Aisin, Bosch, Robur, Sanyo, Soprano, Sorption Energy, Vaillant, Viessmann and Yanmar; and a technical visit to the GDF SUEZ research centre was an opportunity to visualise and discuss some of the techniques.

The second day began with a presentation of initiatives in some EU countries for the promotion and integration of gas heat pumps. This was followed by a roundtable which aimed to identify further actions to promote GHP in Europe.

● Main outcomes of the workshop

Most of the participants agreed that the following points were essential to introduce the technology to the market:

- *Sharing knowledge:* The workshop proved that

LEFT

GHP such as these Robur gas absorption heat pumps on a hotel roof in Bergamo, Italy (CENTRE LEFT) were the subject of a workshop organised by GERG and Marcogaz, which was opened by Marc Florette of GDF SUEZ (BOTTOM LEFT).



the industry is eager to obtain and share knowledge about gas heat pumps. A better understanding of the products and their performances, etc. would greatly benefit the development of the market.

- *Speaking with one voice* to authorities at EU and national levels was seen as essential to get a fair treatment of gas heat pumps in current and new regulations.
- *Helping to create the conditions for certification and installation of appliances*: Participation in the definition of the EU regulations such as the implementation of the Ecodesign Directive, standardisation activities, IEA work, harmonisation of efficiency concepts and training of installers were considered as important issues.
- *Communication and visibility*: It is essential to raise awareness and understanding of gas heat pumps as few members of the public or the authorities appreciate that they do exist and are a renewable technology.
- *Developing products to suit the new energy landscape*: Low heat demand, hot water supply and an increasing need for cooling should be taken into account when designing new products.

- *Finding new ways to bring products to the market* such as working with energy service companies (ESCOs) or leasing of appliances etc.

● **Conclusions and action**

It was not possible during the workshop to set up a platform for future discussion and to organise action according to the priorities identified. However, participants unanimously agreed that the workshop was very useful and that similar meetings should be organised in the future.

The gas industry has already decided to work on some aspects and we are including gas heat pumps in the Gas Week (April 23-27) organised by the gas industry through the GasNaturally project in collaboration with the EU Commission. We have no doubt that more initiatives and actions will follow.

Jean Schweitzer of the Danish Gas Technology Centre and Daniel Hec of Marcogaz are members of Working Committee 5 – Utilisation. All workshop presentations can be downloaded from the Marcogaz website, www.marcogaz.org.



The roundtable aimed to identify further actions to promote GHP in Europe.

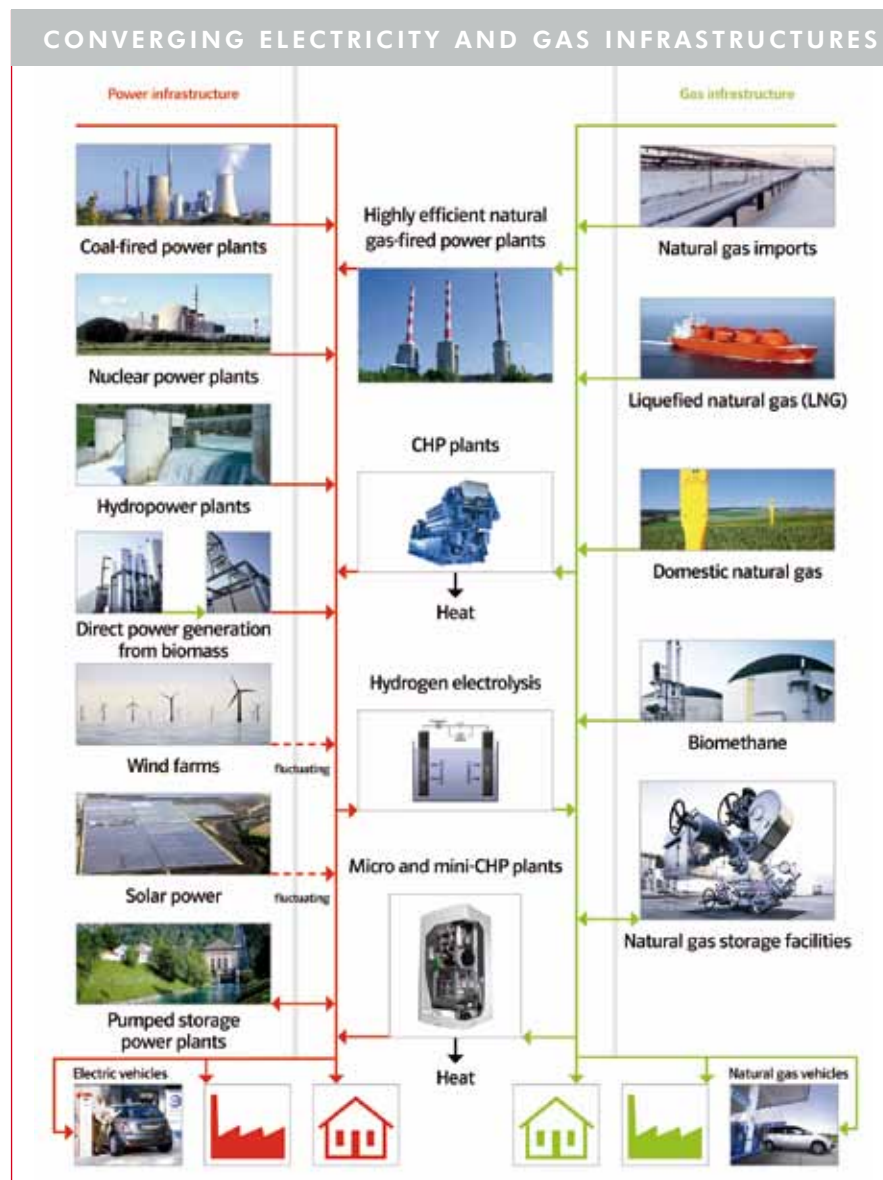
Power to Gas and Gas Quality

By Klaus Altfeld

With the fast pace of renewable energy developments, in particular in the field of wind power, the problem of electricity storage has gained a new dimension. Pumped storage

power stations have been used for decades to store energy, but the number of such power stations and their potential are limited in many countries. The idea is therefore being pursued to use surplus electricity for the generation of hydrogen by electrolysis and to inject the hydrogen generated directly into the natural gas network. This will cause natural gas and electricity networks to become even more interdependent (see Figure 1).

RIGHT
Figure 1.



Injecting hydrogen from surplus renewable electricity into the natural gas network allows the enormous transportation and storage capacity of the existing natural gas infrastructure to be used. In Germany, for example, there are around 500,000 kilometres of pipelines and more than 20 bcm of working gas in storage facilities. This can make an important contribution to solving the problem of surplus or non-transportable renewable electricity and is particularly attractive if it helps to avoid construction of a new electricity line.

GAS QUALITIES OF DIFFERENT NATURAL GASES (PIPELINE), LNG AND BIOMETHANE

Gas Composition	Symbol	Unit	Russian Group H	North Sea Group H	Danish Group H	Libya LNG (rich)	Nigeria LNG (mean)	Egypt LNG (lean)	Biomethane	Biomethane + LPG
Methane	CH ₄	mol%	96.96	88.71	90.07	81.57	91.28	97.70	96.15	90.94
Nitrogen	N ₂	mol%	0.86	0.82	0.28	0.69	0.08	0.08	0.75	0.69
Carbon dioxide	CO ₂	mol%	0.18	1.94	0.60				2.90	2.68
Ethane	C ₂ H ₆	mol%	1.37	6.93	5.68	13.38	4.62	1.80		
Propane	C ₃ H ₈	mol%	0.45	1.25	2.19	3.67	2.62	0.22		5.00
n-butane	n-C ₄ H ₁₀	mol%	0.15	0.28	0.90	0.69	1.40	0.20		0.50
n-pentane	n-C ₅ H ₁₂	mol%	0.02	0.05	0.22					
n-hexane	n-C ₆ H ₁₄	mol%	0.01	0.02	0.06					
Hydrogen	H ₂	mol%								
Oxygen	O ₂	mol%							0.20	0.19
Sum		mol%	100	100	100	100	100	100	100	100
Superior calorific value	H _{sv}	MJ/m ³	40.3	41.9	43.7	46.4	44.0	40.7	38.3	41.9
Superior calorific value	H _{sv}	kWh/m ³	11.2	11.6	12.1	12.9	12.2	11.3	10.6	11.6
Relative density	d	–	0.574	0.629	0.630	0.669	0.624	0.569	0.587	0.641
Wobbe index	W _s	MJ/m ³	53.1	52.9	55.0	56.7	55.7	53.9	50.0	52.3
Wobbe index	W _s	kWh/m ³	14.8	14.7	15.3	15.8	15.5	15.0	13.9	14.5
Methane number	MZ	–	92	79	73	65	71	82	103	77

● Hydrogen and gas quality

The volume of hydrogen that may be added to natural gas is limited. Studies [1] have shown that, with certain restrictions, admixture of approximately 10-15 mol% is not critical in most cases except for three important applications:

- Modern gas turbines with premixed burners (a great number of manufacturers currently specify a limit value of some 5%);
- Steel tanks in NGVs and CNG fuelling stations (the current limit value is 2%, but activities to increase the value are under way);
- Underground porous rock storage (studies have been initiated to determine a reliable limit value).

Of course, hydrogen could also be used to produce methane, the main constituent of natural gas, but the process would involve further capital expenditure and energy losses. This option will therefore only be used to a limited extent for economic reasons.

What does it mean to inject 10% of hydrogen into the natural gas network? The two examples below illustrate the situation:

- In Germany, almost 1,000 TWh of energy in the form of natural gas are transported annually; this is almost twice as much as the electricity consumed. 10% of hydrogen admixed

to natural gas would correspond to an energy quantity of approximately 30 TWh. For comparison: the total capacity of the pumped storage power plants in Germany is 0.04 TWh per cycle (40,000 MWh).

- A medium-sized natural gas transportation pipeline has a capacity of, for example, 1 million m³/h. Injection of 10% (100,000 m³/h) of hydrogen would require an electrical input of more than 400 MW for the electrolysis reaction, which corresponds to the maximum output of several large wind farms taken together.

The examples make it clear that injection of a hydrogen volume into the natural gas network seemingly as low as 10% would significantly contribute to solving the problem of transporting and storing surplus electricity generated from renewable resources.

● Combustion characteristics ranges

The most important combustion characteristics are Wobbe index, relative density, superior calorific value and methane number. *Table 1* lists these characteristics for selected group-H gases as used in Europe today. *Table 2 (over)* shows the combustion characteristics for the gases listed in *Table 1* following admixture of 10% of hydrogen. The data were calculated with the GasCalc program [2],

ABOVE
Table 1.



GAS QUALITIES OF DIFFERENT NATURAL GASES (PIPELINE), LNG AND BIOMETHANE WITH ADMIXTURES OF 10 MOL% OF HYDROGEN

Gas Composition	Symbol	Unit	Russian Group H	North Sea Group H	Danish Group H	Libya LNG (rich)	Nigeria LNG (mean)	Egypt LNG (lean)		Biomethane +LPG
Methane	CH ₄	mol%	87.26	79.84	81.06	73.41	82.15	87.93	86.54	81.85
Nitrogen	N ₂	mol%	0.77	0.74	0.25	0.62	0.07	0.07	0.67	0.62
Carbon dioxide	CO ₂	mol%	0.16	1.75	0.54				2.61	2.41
Ethane	C ₂ H ₆	mol%	1.23	6.24	5.11	12.04	4.16	1.62		
Propane	C ₃ H ₈	mol%	0.41	1.13	1.97	3.30	2.36	0.20		4.50
n-butane	n-C ₄ H ₁₀	mol%	0.14	0.25	0.81	0.62	1.26	0.18		0.45
n-pentane	n-C ₅ H ₁₂	mol%	0.02	0.05	0.20					
n-hexane	n-C ₆ H ₁₄	mol%	0.01	0.02	0.05					
Hydrogen	H ₂	mol%	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Oxygen	O ₂	mol%							0.18	0.17
Sum		mol%	100	100	100	100	100	100	100	100
Superior calorific value	H _{sv}	MJ/m ³	37.5	39.0	40.6	43.0	40.9	37.8	35.7	38.9
Superior calorific value	H _{sv}	kWh/m ³	10.4	10.8	11.3	12.0	11.4	10.5	9.9	10.8
Relative density	d	-	0.523	0.573	0.574	0.609	0.568	0.519	0.535	0.583
Wobbe index	W _s	MJ/m ³	51.8	51.5	53.5	55.1	54.2	52.5	48.8	51.0
Wobbe index	W _s	kWh/m ³	14.4	14.3	14.9	15.3	15.1	14.6	13.6	14.2
Methane number	MZ	-	83	74	68	62	67	76	97	71

ABOVE
Table 2.

the methane numbers in line with [3, 4] (25 °C / 0 °C reference temperatures for calorific value/volume).

Figure 2 shows (in red) superior calorific value as a function of the Wobbe index including the EASEE-gas recommendations [5] for the Wobbe

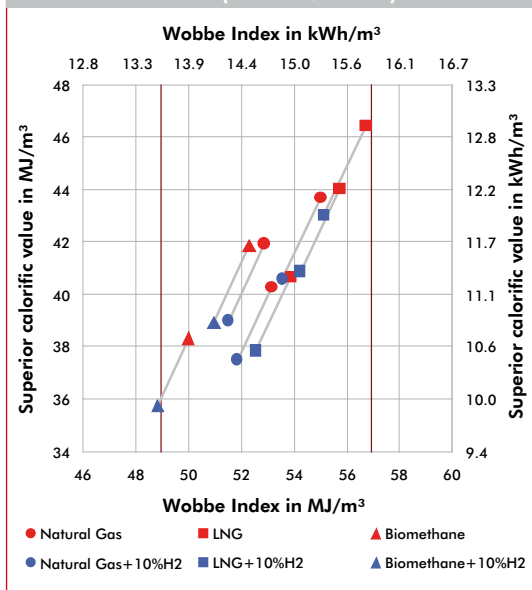
index range (49/57 MJ/m³). The blue symbols represent the gases with hydrogen admixture.

Figure 2 confirms that, prior to hydrogen admixture, all gases listed comply with the EASEE-gas recommendations. But the very high Wobbe indices of rich LNG (just under 57 MJ/m³) are not

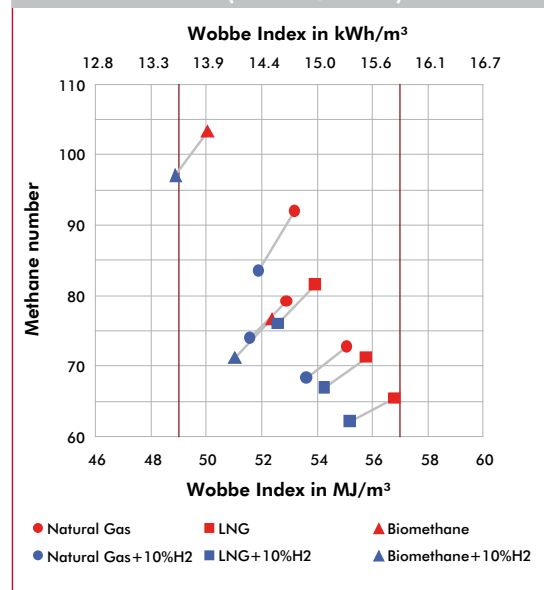
RIGHT
Figure 2.

FAR RIGHT
Figure 3.

SUPERIOR CALORIFIC VALUE AS A FUNCTION OF WOBBE INDEX FOR DIFFERENT GASES WITH OR WITHOUT 10% HYDROGEN ADMIXTURE (25 °C/0 °C)



METHANE NUMBER AS A FUNCTION OF WOBBE INDEX FOR DIFFERENT GASES WITH OR WITHOUT 10% HYDROGEN ADMIXTURE (25 °C/0 °C)



acceptable in most European countries for safety reasons. Biomethane without LPG (approximately 96% methane) is in the lower Wobbe index range. Admixture of 10% of hydrogen reduces the Wobbe index for all gases. In the case of gases with very high methane content relative densities may be slightly lower than the minimum value recommended by EASEE-gas (0.555) (see Table 2). But according to our experience and findings from [1] this is not problematic with respect to combustion behaviour in residential gas appliances.

Figure 3 shows methane number as a function of the Wobbe index calculated on the basis of the AVL method [3] using a DGC program [4]; the accuracy is within approximately ± 2 methane numbers. AVL is short for an institute in Graz, Austria "Anstalt für Verbrennungsmotoren Prof. List", which was responsible for developing, some 40 years ago, a procedure to determine methane number based on gas composition. The wide range, with values from 103 (biomethane without LPG) to 62 (rich LNG with 10% of hydrogen), is remarkable. But even without hydrogen admixture, some LNG qualities and pipeline gases are in the range from 65 to 75. This must be taken into account when designing gas engines for packaged cogeneration plants and vehicles. The design could be based on a methane number of 70 while methane numbers are usually higher in practical operations, but can also be as low as 65 in some cases.

As using gas as a motor fuel has become increasingly important over the past few years, methane number as a fuel property should be included in international gas quality specifications and will also be an important parameter in European gas quality standardisation.

● Conclusion and outlook

The natural gas qualities in Europe will become increasingly diverse involving greater variations in combustion characteristics (Wobbe index, methane number). Except for rich LNG qualities, natural

gases expected to come to the market and biomethane will not pose any utilisation problems in most European countries as their Wobbe indices are in a range from 49 MJ/m³ (13.6 kWh/m³) to just under 56 MJ/m³ (15.5 kWh/m³). With certain restrictions this also applies where up to 10% of hydrogen is admixed except for three important applications (CNG tanks, gas turbines, underground storage facilities). These areas still require R&D input.

Hydrogen produced from surplus renewable energy has a high level of purity and, similarly to biomethane, contributes to further reducing carbon dioxide emissions. This will make natural gas an even more climate-protecting fuel compared with other fossil fuels. Standardisation (harmonisation) of gas quality specifications will help to ensure smooth natural gas trading across borders.

Klaus Altfeld is the Head of Gas Quality/Thermodynamics at E.ON Ruhrgas AG and the Immediate Past President of GERG (www.gerg.eu).

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Unaccounted-for Gas – Something is Missing

By Barbara Jinks

Unaccounted-for gas (UFG) is an aspect of the gas distribution industry often not understood well, despite being experienced by the majority of distribution system operators (DSO).

The accepted definition¹ of UFG is: “the difference between the measured amount of gas entering a distribution system at the point of custody transfer and that which is measured and billed at all delivery points over a defined period of time”.

UFG is important to public safety and can affect business finance and reputation. In a market where safety and reliability are critical, a large volume of UFG may be read as a sign of poor operational practice, affecting company image. UFG can be used as an external benchmark in comparison with other companies or as an internal trend indicator of performance. The majority of companies represented in WOC 4 are wholly or partially private and for funding and regulatory reasons it is particularly important that they understand the significance of UFG to their business.

Through WOC 4’s Study Group 4.3, IGU has created the opportunity to look at key issues around UFG. Collaboration between countries has been tremendous and highlights the fact that UFG is an issue experienced around the globe irrespective of company size and type.

In September 2011, Barbara organised a UFG workshop, hosted by Franc Cimmerman (Geoplin Plinovodi, Slovenia). The aim of the workshop was to review the research at the three-quarter point in the Triennium, present key findings and facilitate discussion among WOC 4 members as a group.

¹ Developed and accepted by WOC 4 members during the 2009-2012 Triennium.

● Research and workshop agenda

The aims of SG 4.3 during the 2009-2012 Triennium are to identify the main components of UFG, look at how it is measured, calculated or estimated and to review approaches for its management. To gather data for the research, a survey was issued to WOC 4 members in 2010. 56 sets of data were received.

● The UFG workshop agenda reflected the issues of most interest to WOC 4 members:

■ “Introduction and overview of SG 4.3 research” by Barbara Jinks (GHD, Australia);

● Mains replacement:

■ “The UK mains replacement methodology and its role in reducing leakage repairs” by Rosemary McAll (GL Noble Denton, UK),

■ “Mains replacement programme in Dublin” by Willie Kearney, Bord Gáis Éireann Ireland;

● Metering accuracy: “How to recalculate volumes of gas when meters do not work properly: a contribution to the determination of UFG” by Paolo del Gaudio (Genova Reti Gas);

● Cost and efficiency:

■ “The impact of meter reading cycles and allocation process on UFG” by Jose Catela Pequeno (Galp Energia, Portugal),

■ “Losses and unaccounted-for gas in GrDF” by Lilian Berterreche de Menditte (GrDF, France),

■ “Theft mitigation at CNG stations” by José Carlos Oliver (Comgás, Brazil),

■ “Correct allocation of calorific power for billing” by Jorge Eduardo Doumanian (Gas Natural Argentina);

● Emissions:

■ “Fugitive emissions – the Canadian perspective” by Lloyd Chiotti (Enbridge, Canada),

■ “Corporate emission management – Gazprom’s experience” by Natalya Kruglova (Vniigaz, Russia).

● UFG causes

UFG comprises 17 factors categorised under the headings leakage, network operations,

theft, metering, billing and calorific value measurements.

UFG can occur at all stages in the gas distribution chain, not all equally under the control of the DSO. Causes can comprise:

- Physical – gas is lost to the atmosphere or stolen;
- Accuracy – no gas is in fact lost but the DSO is not able to measure it; and
- Estimation – due to the need to allocate gas quantities without definitive information on a consumption point.

Physical gas loss can be greatly reduced by:

- Replacing leaking mains with PE or PVC piping;
- Using modern hot-tapping techniques;
- Lowering pipe pressure during decommissioning;
- Consuming the gas instead of venting or combustion; and
- Identifying leakage from leakage survey and carrying out repairs or replacement.

Theft is a physical loss of gas which varies between countries, depending on their economic and social environment. For example, in South America it is known to be a problem. One way to alleviate theft is to be able to detect it faster. This is dependent on the length of the reading cycle adopted; more frequent readings enable more frequent supervision of the meter condition and allow the company to detect the theft and deal with it quicker.

Accuracy of consumption determination entails not only the intrinsic accuracy of measuring devices, but also methods, equipment and management practices put in place to obtain meter readings and calculated consumptions.

Estimation errors can be caused by how a company's meter reading and billing cycles are set up. The impact of this on UFG is not widely recognised and often underestimated.

● Key findings

A key finding is that understanding UFG is important to a successful gas distribution business. The process of reducing UFG involves analysing all parts of a DSO's operations to identify where UFG occurs, and looking at how to reduce gas loss or increase efficiency.

Data from the survey shows that the top three drivers to address UFG are leakage reduction, meter accuracy and cost and efficiency. Companies currently spend most of their efforts to address and research UFG in these areas, including reducing third party damage, permanent leaks from older networks (with cast iron mains) and theft.

UFG is not uniform across company models, regulatory regimes or countries, and varies significantly, showing that the sources of UFG are not common to all distribution companies.

The most important UFG drivers, components and topics being researched are ranked in *Table 1 (over)*.

● Mains replacement

Many countries around the world operate significant lengths of older metallic mains such as cast iron, in particular North America and the UK. Ageing of this material increases UFG as well as the risk of leakage arising from fractures potentially leading to explosions.

To cope with this, companies can renew or replace the network or model the pressure and/or condition the gas. The most effective way to reduce gas loss is by replacement, however this involves large capex.

Replacement reduces leakage and the associative risk of explosion from leakage.

The key question for a DSO with a large network is how to determine which part of the network is most at risk and how to best schedule the replacement programme to reduce the risk.

An example of how this can be solved is the experience of National Grid in the UK by adopting



RANKING OF UFG DRIVERS, COMPONENTS AND TOPICS

UFG driver or component	RANK			
	Most common driver to address UFG	Most important driver	Largest UFG component	UFG topic being researched
Meter accuracy	1	2		1
Leakage reduction	2	1	1 (cast iron)	2
Cost and efficiency		3		
3rd party damage	1			
Theft	3		3	3
Accuracy of custody transfer meter			2	

RIGHT
Table 1.

the MRPS (Mains Risk Prioritisation Scheme²) in 2000, otherwise known as the Risk Model.

● Risk Model

The model was built to produce a likelihood of incident arising from each individual mains unit by combining the likelihoods of leakage, gas ingress into property and ignition so that mains with a high likelihood of incident are replaced first. Since its implementation in the UK, the replacement of 25% of ferrous pipe has resulted in a 53% reduction in explosion incidents.

Application of the likelihood of leakage alone, the Condition Model, can also be used to prioritise replacement of mains, but in this case the outcome is to reduce leakage rather than incidents.

A simulation has been carried out to determine the effect of applying this model to a sample of 36,000 ferrous mains. The replacement programme simulated was the removal of 5% of ferrous pipe each year for 20 years. The results of the simulation showed that, if the pipes were selected randomly, a 5% reduction in population

in year 1 would result in approximately 5% of next year's leaks being removed. If the pipes were selected so that those with the greatest number of previous leaks were selected, it was likely to reduce the following year's leak by 20%. If the pipes were selected by the highest Condition Score, 50% of the following year's leaks were likely to be removed.

For all three scenarios, the number of leaks at the start and end of the programme were the same. The application of the Condition Model reduced the level of leaks the quickest, thus saving the cost of lost gas, and potentially expensive emergency leak repair costs. This is shown in *Figure 1*.

The scenario above shows how replacement can also reduce one element of UFG (leakage from mains) to almost zero. A real example of this is the experience of Bord Gais Éireann in Ireland. Prior to its replacement programme it was operating 5,000km of cast iron pipes. The pipes had been installed from 1910 onwards using poor construction methods and subsequently experienced a high frequency of fractures and leakage.

An explosion in 1987 initiated a replacement programme of 4" medium pressure cast iron

² Developed in 1999 by GL Noble Denton, UK.

pipes, with plans to replace the remaining mains over a 30-year period. However, a second explosion in 2003 triggered the need for an accelerated programme to reduce the risk of another explosion. Using the same Risk Model as the UK, a programme was put in place and all metallic mains were replaced by 2009. The effect is that UFG has been reduced to almost zero.

● Meter accuracy

Although meter accuracy applies directly to gas volume measurement, two other factors bring uncertainty to the estimation of gas consumption:

- The ability to take pressure/temperature conditions into consideration at meter locations; and
- The fact that in most countries buying and selling gas and UFG evaluation are measured in energy, not volume. This raises the subject of accuracy of the calorific value of the gas applied at each delivery point.

Two-thirds of WOC 4 members are conducting programmes to improve gas meter accuracy, reflecting the importance of this issue.

● Emissions

The main drivers to reduce methane emissions are compliance with company policy and national/international obligations to reduce airborne contaminants and greenhouse gases (GHG). Carbon trading is ranked high as a driver to address UFG only in countries with a carbon tax or trading scheme, but is of interest to DSOs in other countries due to the implications of future tax/trading schemes.

Inventories of GHG emission sources made in Canada in 2009 found that emissions from gas distribution occurred mostly from flaring, which is largely manageable (compared to stationary combustion, venting and fugitive gas loss). Studies in Russia reveal that vent stacks contribute a large proportion of gas emissions from distribution systems.

● Conclusion

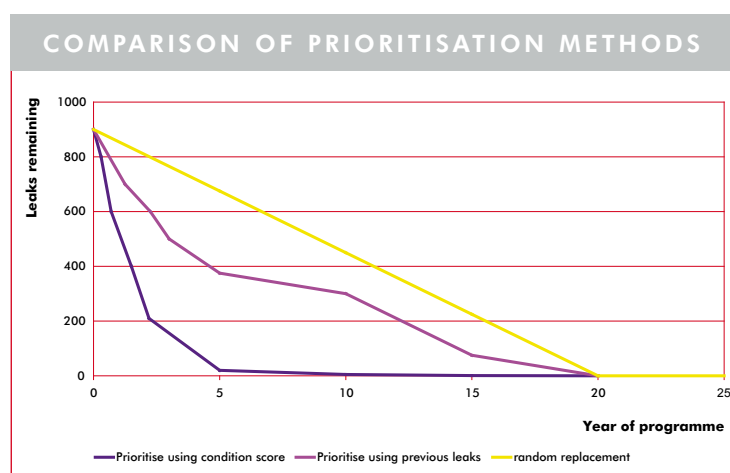
The UFG workshop was a successful event that presented the key findings of SG 4.3's research and facilitated good discussion. The workshop enhanced the understanding of UFG by WOC 4 members in attendance.

Understanding UFG is important to a successful gas distribution business and must be considered at senior management level. UFG can affect public safety, business cost and efficiency, but is not well understood by all DSOs. UFG is not uniform across company models, regulatory regimes or countries. The most important drivers to address are leakage reduction – through reduction of third-party damage and replacement of mains prone to leakage – theft and meter accuracy. It is more beneficial to look for best practice to reduce UFG rather than look for methods to quantify it.

For more information and the latest developments in UFG management come to Committee Session 4.3 or WOC 4's Expert Fora at WGC2012.

Barbara Jinks of GHD is the leader of Study Group 4.3, Working Committee 4 – Distribution. She would like to thank IGU for providing the opportunity to organise the workshop and those WOC 4 members who have contributed to the research and shared knowledge with other members.

BELOW
Figure 1.





Is ACER FERC-lite?

By Susan J. Court

This article compares two “interstate” regulatory agencies with significant oversight of the natural gas industry, one of the study topics of IGU’s Programme Committee B – Strategy. It is extracted from a paper prepared by Susan J. Court, for and with the assistance of members of PGC B’s Study Group B.3.

Until recently, there was no energy regulatory agency in the European Union (EU) with authority comparable to the authority of the Federal Energy Regulatory Commission (FERC or Commission) in the USA to oversee “inter-member-state” or pan-national energy companies and transactions. That partially changed in June 2009, with the passage of the Third Legislative Package for the Liberalisation of the Energy Markets, which created the Agency for the Cooperation of Energy Regulators (ACER or the Agency). Operational since March 2010, ACER is still in the initial stage of its establishment, but has a legal structure and level of activity sufficient to allow a comparison of the two agencies with respect to their regulatory authority and regulatory responsibilities, including their monitoring, advisory, decision-making and enforcement powers.

By way of background, while the USA and the EU are both politically grounded in representative government, US Federalism differs significantly from the legal position of EU Member States, a difference that affects the regulation of natural gas companies and transactions in the two jurisdictions. Specifically, the US Constitution and the laws enacted by the US Congress distinguish between (1) wholesale and interstate transactions and (2) retail and intrastate transactions. They give authority to and responsibility for the first to the Commission and reserve authority to and responsibility for the second to public service com-

missions in the individual 50 states. As a consequence, FERC cannot interfere in state or local matters, and the states are legally preempted from regulating interstate or national energy matters. Also, as a consequence, there is a uniform interstate energy policy at the national level, and a variety of energy policies at the local and state levels. In contrast, the legislation passed by the EU Parliament and Council does not make that distinction and gives authority to and responsibility for wholesale, retail and internal transactions to the regulatory authorities in the individual 27 member countries. Because that authority and responsibility are more or less the same as transposed into national law in those countries, the regulations for wholesale, retail and internal transactions are theoretically harmonised and promote cross-border consistency. For a variety of reasons, however, those laws have not been evenly implemented across the EU, a situation that led to the creation of ACER.

● Comparing the agencies

A comparison between FERC and ACER must begin with the basics. Both are government agencies created by a legislature, charged with a mission and empowered with a mandate. Structurally, the two agencies are comparable in the sense that their policy members are selected by other political bodies that represent a balance of power within their respective jurisdictions. FERC Commissioners are nominated by the US President and confirmed by the US Senate; ACER Administrative Board Members are selected by the Parliament, European Commission and Council. FERC is accountable (through the budget appropriations process) to the US Congress; ACER is accountable to the European Parliament, the Council and the European Commission, as appropriate. Both agencies are also required to operate independently from members of the regulated industries.

FERC and ACER are not similar with respect to the derivation of their authority and review of their

actions. FERC's authority is directly delegated to the agency by the US Congress, which can extensively empower (and has empowered) the Commission to take action in regard to wholesale and interstate natural gas business. The legislative mandate is only limited by the US Constitution. ACER's authority, on the other hand, is indirectly delegated to the agency by the Parliament and Council, and directly delegated by the European Commission, which under the "Meroni" doctrine cannot give the agency more authority than it has itself. Also, FERC's decisions are unquestionably reviewable by a court of law, whereas the extent to

which stakeholders will be able to challenge ACER decisions beyond the Board of Appeal is unclear at this time.

FERC and ACER are not comparable in their size. FERC has five policy members and approximately 1,500 professional staff, while ACER has 32 policy members and approximately 50 professional staff. ACER's budget is a fraction of FERC's budget. Also, the decision makers' required commitment of time is different. FERC commissioners are by law foreclosed from working elsewhere, even for another government agency, whereas ACER Board Members are not full-time employees



ABOVE AND LEFT FERC's authority is directly delegated to the agency by the US Congress.



ACER's Director Alberto Potoschnig (second left) is pictured with Slovenia's Prime Minister, Borut Pahor (centre) at the opening of ACER's headquarters in Ljubljana in March 2011.

of the Agency and the members of the Board of Regulators by definition work at other agencies. (During ACER's start-up period, the Regulators appeared to have played a significant role in the work of the agency by their participation in Working Groups.) In addition, while FERC has an executive director, the FERC Chairman is the chief administrative officer of the Commission. The executive director only handles administrative (e.g., personnel, procurement, IT) matters and does not become involved in substantive or policy issues. By contrast, ACER's Director appears to have a significant role in directing the substantive activities of the Agency's staff, and is its legal representative and public face.

FERC's and ACER's missions are similar – well functioning energy markets achieved through a balance between competition and regulation. Both agencies are governed by laws, directives and rules that promote access to monopoly facilities

and allow competition to work where possible. The scope of their mandates, however, differs significantly. To start with, FERC is tasked with ensuring a uniform national natural gas programme for wholesale sales and interstate transportation, but it has no authority to coordinate or otherwise direct the activities of the 50 state commissions responsible for retail sales and local distribution. ACER, on the other hand, is explicitly charged with providing a framework within which the 27 National Regulatory Authorities (NRAs), which are responsible for wholesale and retail operations, can cooperate. Also, FERC plays a lesser advisory role than ACER, although that is counterbalanced by its ability to take action, i.e., it does not need to advise when it can act on its own accord. Still, ACER's advice to the European Commission, e.g., with respect to network codes, may become tantamount to a decision. Put another way, ACER may ultimately "regulate by advice". The route that ACER will be required to take, however, will be more complicated and circuitous than the road FERC follows to ensure consistent and consistently applied rules for the wholesale sale and interstate transportation of natural gas.

Both agencies perform similar monitoring tasks, inasmuch as they monitor compliance with existing rules, although they employ different remedies for non-compliance. FERC has explicit enforcement authority that significantly exceeds ACER's authority, which is confined to advising the European Commission on appropriate action to consider. Moreover, FERC has taken on the responsibility, without explicit legislative direction, to monitor energy markets to discern any anomalies that require further investigation, and created a Market Monitoring Center for that purpose. Also, in this regard, FERC currently has more authority to obtain data from the companies it regulates to facilitate transparency in those markets to police against market manipulation and market abuse, and also has a Memorandum of Understanding with the Commodity Futures Trading Commission

for sharing information. That difference may fade, however, depending on the implementation of the Regulation on Energy Market Integrity and Transparency (REMIT), adopted in September 2011, by the European Parliament and the Council. This legislation aims to create a framework protecting energy trading from market manipulation and insider trading. A key element of the REMIT is that it grants ACER a coordination role (as well as extra staff and financial resources) for data collection, monitoring, and investigating market abuse at a cross-border level, and it grants additional investigative and enforcement powers to the NRAs. ACER anticipates that during 2012, the agency will start the process of implementing REMIT by getting ready to take on its monitoring functions.

FERC's and ACER's approaches to establishing network codes are also similar, although not identical. In the USA, the natural gas industry develops standards through an iterative, consultative process developed by the American National Standards Institute (ANSI) and overseen by the North American Energy Standards Board (NAESB), which then submits proposed business standards, e.g., regarding uniform gas sales contracts or communication protocols between gas pipeline companies and electric generators, to FERC for review and approval. FERC in turn seeks comments from the public before adoption of any standards that will then become mandatory across the country and enforceable by FERC. Comparably, ACER develops guidelines for the development of EU-wide principles for network codes on specific topics such as capacity allocation and gas balancing. Unlike FERC, ACER then comments on the draft of the codes prepared by the European Network for Transmission System Operators for Gas (ENTSOG) on the basis of these guidelines and submits them to the European Commission, which has final approval authority to make them binding through a procedure called "comitology", i.e., using a committee of national government officials to approve new EU rules. Seemingly, too,

the NRAs, not ACER, are then responsible for the Transmission System Operators' compliance with those network codes. For its part, FERC unquestionably oversees compliance by the interstate natural gas pipelines with its rules, codes and standards.

● Differences

The major difference between the two agencies involves the scope of their decision-making authority and especially their power to enforce the law.

FERC is a licensing agency, whereas ACER is not. Accordingly, FERC certifies and sets the rates and terms and conditions of service for new pipeline facilities that move natural gas across state lines. If it finds the construction to be "required by the public convenience and necessity", and is environmentally acceptable, FERC disposes of local opposition and provides the company with the right to condemn the property along the route, if needed. While ACER does not have licensing authority comparable to FERC's, it can nevertheless influence the operation of TSOs that cross national boundaries and, where the infrastructure concerned is located in the territory of more than one Member State, resolve conflicts on terms and



FERC's and ACER's missions are similar – well functioning energy markets achieved through a balance between competition and regulation.



conditions for access to and operational security of cross-border infrastructure and decide on exemptions. It does not, however, have the authority in the first instance that FERC has to set uniform, pan-national commodity or transmission rates or terms and conditions of service.

Both agencies are required by law to seek the opinion and views of the public on actions they propose to take. Participation in FERC proceedings, however, is governed by a defined set of requirements and appears to provide greater assurance than does ACER's practice for appealing or other challenging agency actions.

The starkest contrast between FERC and ACER is the power of the respective agencies to enforce the laws. In 2005, FERC received impressive authority, including \$1 million per day/per violation penalty authority, to enforce violations of its statutes, orders, rules and regulations, and to police against market manipulation. The Commission can pursue such violations on its own, in administrative proceedings held at the agency or in a court of law, without involving other agencies, such as the US Department of Justice (the USA's primary enforcer of anti-trust violations). (FERC cannot pursue any criminal prosecutions, however; such matters must be referred to the US Department of Justice. This has rarely happened.) ACER, on the other hand, does not have comparable authority, although few if any of the NRAs have that authority either. Rather, as a general matter, they must turn their prosecutions over to competition authorities. What is unknown at this time, however, is the impact of the implementation of REMIT on ACER's and the NRAs' enforcement authority.

● Conclusion

In conclusion, American Federalism has bifurcated regulation of natural gas companies. Because the US Congress may not direct state regulators to act, the USA has a uniform national policy resulting from a single, powerful Federal agency with jurisdiction over wholesale and interstate trans-

actions and an uneven pattern resulting from 50 individual states' jurisdiction over intrastate and local transactions. Conversely, the European Union of Member States has produced singular regulatory oversight of natural gas companies operating at the wholesale and retail levels, within a country and across country borders. Because the EU Parliament and Council can issue directives that must be transposed consistently by Member States, it has theoretically laid the basis for a uniform pan-national energy policy – over wholesale and retail, international and local. That uniformity has not yet been realised, however, and its ultimate realisation may be difficult given the different historical backgrounds and regulatory traditions of the Member States. Nevertheless, the European Union has embarked on creating a pan-national organisation to that end, an organisation that has a few of the characteristics of the American Federal agency but, for now, without comparable decisional or enforcement authority. At bottom, FERC's primary role is regulation where ACER's primary role – at present – is coordination. So, one asks, is ACER FERC-lite? Regardless of the answer, natural gas companies affected by the regulatory oversight in both jurisdictions should closely follow the developments at these agencies as well as the agencies at the state (in the USA) and national (in the EU) levels, to understand and be in a position to respond to any cross-pollination of policies between and among them.

Susan J. Court is the Principal of SJC Energy Consultants, LLC (www.courtenenergy.com) and a member of PGC B. Previously, she was a senior executive and attorney at FERC and a partner at Hogan Lovells LLP in Washington, DC. In 2005, on assignment from FERC, she worked for the Irish Commission for Energy Regulation. Her last FERC position, before joining Hogan Lovells, was Director of Enforcement. She also served as Associate General Counsel for Gas and Oil during the restructuring of the USA's natural gas regulations.

Natural Gas: Leading the Way to America's Energy Future

By Lawrence T. Borgard

Never before has the North American natural gas industry had the tremendous opportunities that it has today. These opportunities hold potential for the global gas industry as well.

As the association representing more than 200 local energy companies that deliver clean natural gas throughout the United States, the American Gas Association (AGA) finds itself in a strong position to take advantage of these opportunities as well as successfully meet the energy challenges that face our nation.

Our ability to safely and reliably deliver natural gas to the 70 million customers who rely on it every day is the foundation on which our entire industry rests. Natural gas truly is a global foundational resource, and when abundant supplies are combined with the entire energy portfolio, natural gas makes a clean energy future viable.

We are in a natural gas resource renaissance. Thanks to the abundant natural gas coming to market from the

development of shale gas, our industry – and most importantly our customers – are enjoying natural gas at very competitive and stable prices.

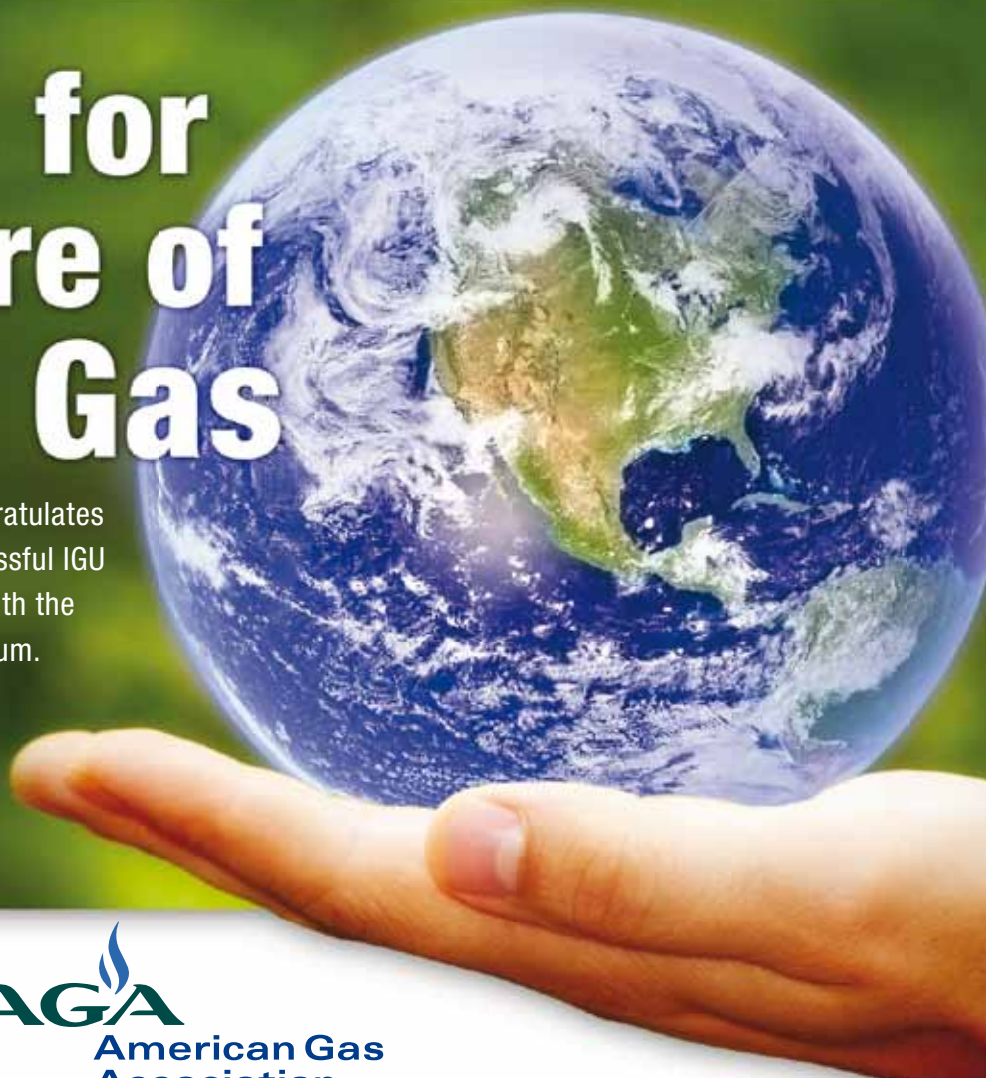
Increasing the use of domestic natural gas will enhance our nation's national security, especially as it continues to displace petroleum in the transportation market. That is why we are pursuing growth opportunities in all gas-consuming sectors.

AGA represents future-ready energy, and by creating a future-ready natural gas industry we are tackling our energy, economic, environmental and security goals. That is good for the North American natural gas industry and for the global natural gas industry.

Lawrence T. Borgard is President and Chief Operating Officer, Utilities, Integrys Energy Group, Inc., and Chairman of the American Gas Association.

Partners for the Future of Natural Gas

The American Gas Association (AGA) congratulates the Malaysian Presidency on a very successful IGU triennium and looks forward to working with the French leadership in the upcoming triennium.



Presenting IGU's New Charter Members

At the Council meeting in Dubrovnik in October 2011, IGU welcomed four new Charter Members from Mongolia (Baganuur), Morocco (Fédération de l'Énergie, CGEM), Mozambique (ENH) and Uzbekistan (Uzbekneftegaz), who have each contributed a short profile to this issue.

● **Mongolia**

Baganuur is a miner and supplier of coal to the thermal power stations in Mongolia's central region. It was originally set up in 1978 as a state corporation and was part-privatised in 1995, becoming a Joint Stock Company with 25% of the shares in private hands. Baganuur produces 2.9 to 3 million tons of coal a year, some 40% of the country's total production.

Coal is a vital energy source for Mongolia. The country has proved reserves of 12.2 billion tons and potential resources are far greater. However, exploiting them has major environmental implications and government policy is to introduce clean coal technology in order to improve access to energy and generate employment. Baganuur is working on a number of coal

gasification research projects with the aim of developing coal-to-liquids (CTL) and DME plants.

As a first step on the CTL front, a laboratory-scale, high-pressure fluidised bed reactor for coal gasification is proposed to investigate the reactivity and other characteristics of candidate coals. There will also be research into DME synthesis, and into the design of catalysts for the CTL and DME processes.

Baganuur seeks to cooperate with international partners and is keen to get involved in IGU activities.

For more information, visit www.baganuurmine.mn.

● **Morocco**

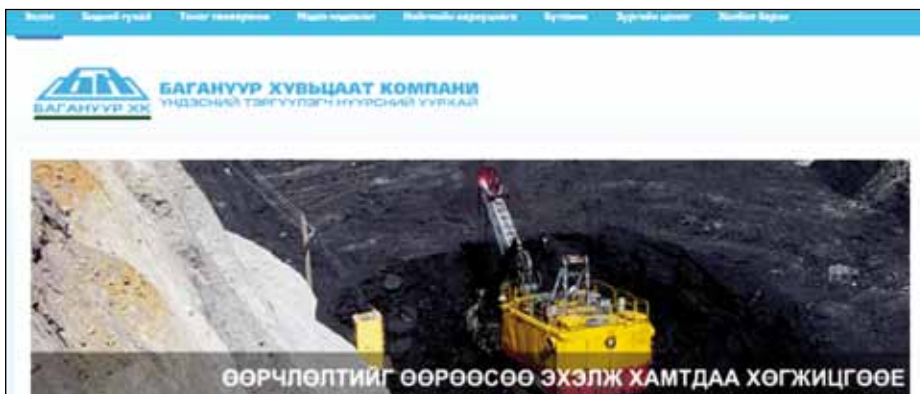
The Fédération de l'Énergie (Energy Federation) of the Confédération Générale des Entreprises du Maroc (Confederation of Moroccan Enterprises – CGEM) was set up in September 2001 as a think-tank for the energy industry and to promote communication in the field of energy. It aims to:

- Build on the benefits of liberalised markets and work to put in place appropriate regulation;
- Keep all energy options open including natural gas;
- Reduce political risk in large energy projects;
- Promote greater energy efficiency;
- Balance prices and costs;
- Create financial partnerships that contribute to

environmental protection;

- Make energy affordable for low-income groups;
- Finance R&D;
- Promote education and information campaigns for the general public;
- Make ethics a key issue in the management of energy systems.

The Moroccan government wants to diversify the country's sources of energy and one way



Baganuur is researching clean coal technology.

is to increase gas use. Morocco currently imports 500 mcm of gas a year via the MEG pipeline from Algeria which is used for power generation. There are plans to build an LNG import terminal on the Atlantic coast with an initial capacity of 5 bcm in 2016, rising to 10 bcm by the end of the decade.

The Energy Federation works closely with the government, playing an important role in strategies developed by the Ministry of Energy and being consulted on draft legislation relating to reforms in the sector. In addition, the Energy Federation has a seat on the Moroccan Economic and Social Council.

For more information, visit www.cgem.ma.

● Mozambique

By Nelson Ocuane

Empresa Nacional de Hidrocarbonetos EP (ENH) was set up in 1981 as a state corporation to develop Mozambique's petroleum resources. A programme of seismic surveying began to establish the extent of the country's reserves, the Búzi, Pande and Temane gas fields having originally been discovered in the 1960s.

Búzi, Pande and Temane are onshore fields in the Mozambique Basin which also has other onshore and offshore prospects. Six concessions have been let and in each ENH has a share ranging from 10% to 30% in partnership with one or two foreign companies. The foreign partners are Sasol, Petronas and PT Kalila.

Domestic use of gas began in 1992, when ENH developed a distribution network to serve residential and industrial consumers, including a power station, in the north of the province of Inhambane, where the Pande and Temane fields are located.



Morocco's CGEM has 31 federations covering different sectors of the economy. The Energy Federation has joined IGU.

ENH became an autonomous public enterprise in 1997 and agreed a partnership with Sasol of South Africa to set up companies to produce gas from Pande/Temane (Companhia Moçambicana de Hidrocarbonetos) and export it by pipeline (Companhia Moçambicana do Gasoducto) to Secunda in South Africa. ENH has a 25% stake in each of these companies. Gas exports began in 2004 and amount to around 3 bcm/year. The Pande/Temane reserves are estimated at 100 bcm (3.59 tcf).

ENH is working on a project to build a branch off the pipeline at Matola to serve Mozambique's capital, Maputo.



Major gas discoveries have been made in Mozambique and ENH aims to make the country a net exporter of hydrocarbons by 2021.



The Rovuma Basin is now a focus of interest with five concessions let. ENH has a share of 10% to 15% in each and the foreign partners are Anadarko, Artumas, BPRL, Cove Energy, Eni, Galp Energia, Kogas, Maurel & Prom, Mitsui, Petronas, Statoil and Videocon.

To date, there have been six gas discoveries in the Rovuma Basin totalling 910 bcm (32.5 tcf) which could supply new domestic and export markets. This represents an enormous boost to Mozambique's gas industry and ENH sees IGU membership as a way of helping it derive the maximum benefit from these discoveries for the people of Mozambique. A number of projects are being evaluated including an LNG plant with between three and five trains, additional gas-fired power plants and fertiliser, petrochemical, methanol and DME plants.

ENH's target is to make Mozambique a net exporter of hydrocarbons by 2021.

Nelson Ocuane is the Chairman of ENH (www.enh.co.mz).

● **Uzbekistan**

Uzbekneftegaz was set up in 1992 as Uzbekistan's national holding company for the oil and gas industry. It has six main joint stock subsidiaries

and 120,000 employees. Gas was originally discovered in Uzbekistan in 1953; and today the country is producing 60 bcm a year with a network of 13,000km of gas pipelines, 250 compressors, underground storage facilities and gas processing plants.

Uzbekneftegaz works with a range of foreign partners upstream and downstream and has a major investment programme. Projects totalling \$19.3 billion have been approved and a further \$7.1 billion-worth are in the pipeline. The focus is on increasing reserves, producing value-added products, improving energy efficiency and supporting projects under the Clean Development Mechanism (CDM).

Two major investment projects are a petrochemical plant in partnership with Kogas, Honam Petrochemical Corporation and STX Energy and a gas-to-liquids (GTL) plant in partnership with Petronas and Sasol. An engineering, procurement and construction (EPC) contract has been signed for the petrochemical plant in Surgil, which will produce up to 400,000 tons of polyethylene and 100,000 tons of polypropylene a year using 4.5 bcm of feedstock gas. The GTL plant in Shurtan is currently at the front end engineering and design (FEED) stage with a planned capacity of 1.4 million tonnes a year of diesel, kerosene and naphtha using 3.4 bcm of feedstock gas.

Uzbekneftegaz aims to provide an efficient, balanced and secure long-term gas supply to internal consumers and foreign partners. To this end, it seeks to develop long-term relationships with IGU members to share their knowledge and experience.

For more information, visit www.ung.uz.



Uzbekneftegaz is Uzbekistan's national holding company for the oil and gas industry.

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Publications and Documents Available from IGU

As a non-commercial organisation promoting technical and economic progress in the gas industry worldwide, IGU offers its publications free of charge.

You are invited to download the publications currently available from the IGU website www.igu.org or order hard copies from the Secretariat.

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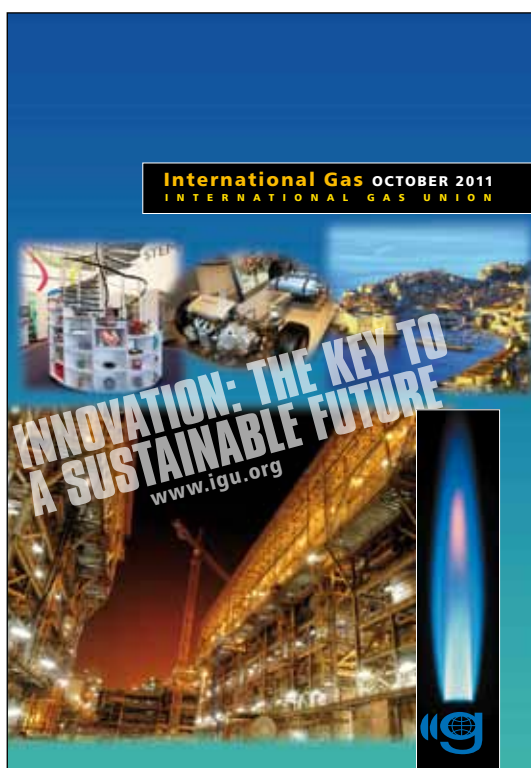
- IGU Articles of Association
- IGU Annual Report
- IGU Strategic Statement
- IGU General Brochure
- IGU Organisation Chart
- Triennial Work Programme 2012-2015
- Preliminary programme for the 25th World Gas Conference



- IGU Gas Efficiency Award 2008/2009 & IGU Social Gas Award
- IGU Guiding Principles for Sustainable Development
- Natural Gas – Part of the Solution to Global Climate Change
- Natural Gas as a Transportation Fuel
- Natural Gas Unlocking the Low-Carbon Future
- World LNG Report 2010
- Wholesale Gas Price Formation – A Global Review of Drivers and Regional Trends

Publications from WGC2009

- Natural Gas Industry Study to 2030
- IGU Energy Efficiency Indicators
- IGU Proposed Guidelines for Gas Market Integration
- Best Practices Initiative
- Proceedings of the 24th World Gas Conference, Buenos Aires 2009



Joint publications with other organisations

- The Role of Natural Gas in a Sustainable Energy Market (with Eurogas)
- Guidebook to Gas Interchangeability and Gas Quality 2010 (with BP)

Scientific and technical papers and documentation

- Proceedings of the 23rd World Gas Conference, Amsterdam 2006, (CD-ROM)
 - Sustainable Development and the Role of Gas (2006)
 - Gas to Power Global Outlook, (2006)
 - The Art of Regulation, (2006)
 - Proceedings of the 22nd World Gas Conference, Tokyo 2003
 - Proceedings of the 17th, 18th 19th, 20th and 21st World Gas Conferences, (CD-ROM)
 - International Gas, ISC, all issues of the bi-annual IGU Magazine from 2004-2011
- Please check the IGU website for other (older) publications which are still available from the IGU Secretariat.



IGU Events and IGU-related Events 2012-2013

2012

June 4
IGU Council Meeting
Kuala Lumpur, Malaysia

June 4-8
25th World Gas Conference
Kuala Lumpur, Malaysia

September 17-21
World Shale Gas Conference & Exhibition
Houston, USA

October 8-11
Gastech 2012 Conference & Exhibition
London, UK

October 9-11
13th Biennial NGV Global Conference & Exhibition (NGV2012)
Chuncheon, Korea

October 9-11
GASEX 2012 Conference & Exhibition
Bali, Indonesia

October 16-19
IGU Council Meeting
Ottawa, Canada

Date to be confirmed
3rd IEF-IGU Ministerial Gas Forum
Paris, France

November 26-December 7
18th Session of the Conference of the Parties to the UNFCCC (COP 18)
Doha, Qatar

December 2
IGU Gas Symposium
Doha, Qatar

2013

April 9-11
IGU Executive Committee
Seville, Spain

April 16-19
LNG 17
Houston, USA

October 13-17
22nd World Energy Congress
Daegu, Korea

October 22-25
IGU Council Meeting
Beijing, China

You can find links to many of the above events by visiting www.igu.org.

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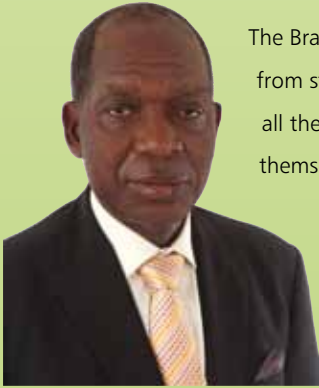
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A Message from the Chairman of Brass LNG



Dr Jackson E Gaius-Obaseki

The Brass LNG project continues to go from strength to strength, addressing all the challenges that present themselves, and I am pleased to have this opportunity to highlight some significant recent events as we move toward the signing of the Final Investment Decision (FID).

Gas supply issues, which have been a challenge for the last 15 months, have been resolved and the projected volumes of LNG to be produced have been allocated to prospective buyers. The Brass LNG sales portfolio has been revised, ensuring improved value and project viability and with the integration of the Nigerian National Petroleum Corporation (NNPC) as a potential stand-alone gas supplier and LNG buyer the nation stands to receive increased benefit from the project. We have also begun the process of admitting strategic investors to join the company.

We have issued invitation to tender packages for Brass LNG's four major EPC contracts and, on the shipping side, invitations have been issued for contracts relating to shipyards and ship owner-operators. In relation to these contracts we have organised workshops which have informed approximately 500 local businesses of the opportunities that are available to them through the Brass LNG project.

We have engaged our host communities through a number of sustainable development initiatives including the renovation of the Okpoama cottage hospital, the initiation of a micro-credit scheme for 120 local women (with an over 90% repayment rate) and have provided development training for 412 local contractors and suppliers to enable them to maximise the business opportunities that Brass LNG will bring to the area. The Brass Island information centre is also nearing completion.

Additionally, upon conclusion of the due diligence process, the proposed integration of the NNPC joint venture (Nikorma) into the Brass LNG shipping acquisition is being addressed. This will expand LNG shipping capability in-country as well as attract additional value from this niche sector.

In advance of the FID the Board has approved engineering works to be commenced by Bechtel covering early engineering, geophysical and geotechnical investigations relating to the gas trains and these will streamline the scheduling of the various EPC contracts mentioned above. Seven critical support contracts are also being finalised relating to areas such as security, air operations environmental monitoring and so forth.

A major industry milestone was passed with the enactment of the Nigerian Oil and Gas Industry Content Development Act, 2010. Our company's commitment to Nigerian content preceded the passage of this Act and has seen 125 technicians trained at PTI Warri since 2005. All stakeholders in Brass LNG are very focused on the early delivery of the project FID in order to accelerate the realisation of the Federal Government's developmental and value creation objectives for the project. FID may now be well within our reach by the end of 2012.

I would like to take this opportunity to commend the management and staff of the company for their faith in the success of the project as displayed in their hard work and dedication. I also continue to express my heartfelt gratitude to the Federal Government of Nigeria as well as to the Bayelsa State Government for their long-standing commitment to the Brass LNG project. The President of Federal Republic of Nigeria and the Honourable Minister of Petroleum have also continued to display their support and commitment to the project's success. We also have massive support and goodwill from our host communities as evidenced by the peaceful and secure atmosphere at the project site and complete lack of any security concerns for the life of the project so far.

I share in the conviction of the management, board, staff and shareholders that the Brass LNG project will soon be delivered both profitably and sustainably.

Dr Jackson E Gaius-Obaseki, CON. JP,
Chairman of the Board of Directors,
Brass LNG.



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