# International Gas

April – September 2014

# RESEARCH AND INNOVATION

## Driving gas market development

IGU

INTERNATIONAL GAS UNION

UNION INTERNATIONALE DU GAZ

www.igu.org

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# BEIJING GAS

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BEIJING GAS GROUP CO.,LTD.

# International Gas

## APRIL – SEPTEMBER 2014

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# Vision, Mission and Objectives

The International Gas Union (IGU) is a world-wide, 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.

## Vision

IGU shall be the most influential, effective and independent non-profit organisation serving as the spokesperson for the gas industry worldwide.

## Mission

- IGU will advocate for natural gas as an integral part of a sustainable global energy system.
- IGU will promote the political, technical and economic progress of the global gas industry, directly and through its members and in collaboration with other multilateral organisations.
- IGU will work to improve the competitiveness of gas in the world energy markets by promoting the development and application of new technologies and best practices, while emphasising sound environmental performance, safety and efficiency across the entire value chain.
- IGU will support and facilitate the global transfer of technology and know-how.
- IGU will maximise the value of its services to members and other stakeholders.

## 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;

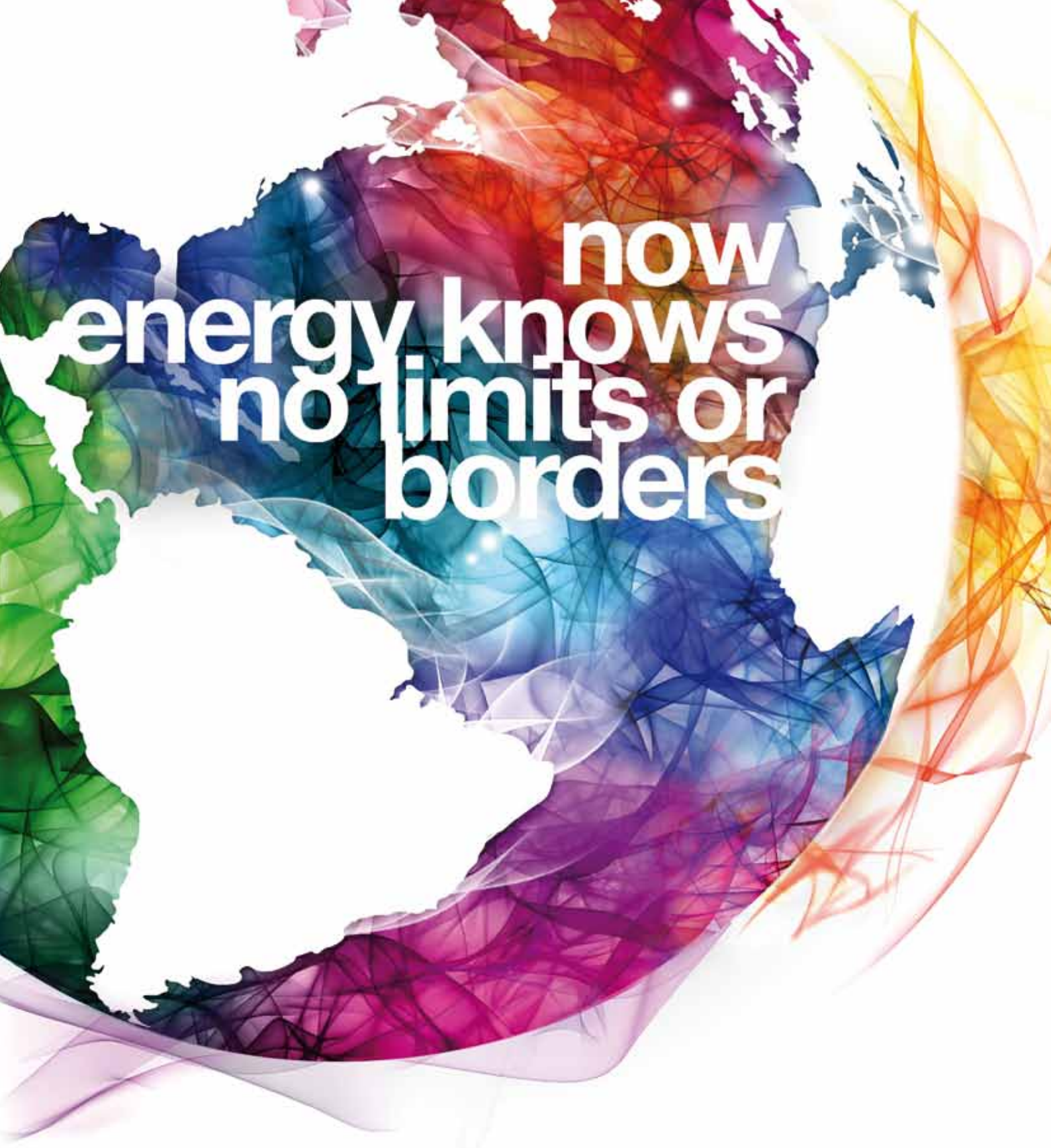
**ENVIRONMENT** Encourage and promote development of clean technology, renewable energy applications and other activities, which will add to the environmental benefits of gas;

**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, policymakers 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.




Two of the gas and electricity industry experts have joined forces to create the first seamlessly integrated energy company in Spain and Latin America. Now energy can adapt to your needs and to those of over twenty million clients in twenty three countries around the world. We have gone a long way together and we'll continue to work with all the energy in the world to stay by your side. Like to join us?

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# Energy and economic growth for the world.

Global energy demand is expected to be about 35 percent higher in the year 2040 than it was in 2010. Natural gas will play an increasingly important role in meeting this growing demand, while at the same time helping power economic growth and improving living standards.

A rising share of global natural gas demand will likely be met by unconventional gas supplies, such as those produced from shale and other rock formations.

So whether it's exploring for or producing new energy supplies, delivering innovative petroleum products or investing in communities, ExxonMobil is developing more than oil and gas—we are helping to support the future.

Learn more about our work at **exxonmobil.com**

ExxonMobil

Taking on the world's toughest energy challenges.™

# Contents

## April – September 2014

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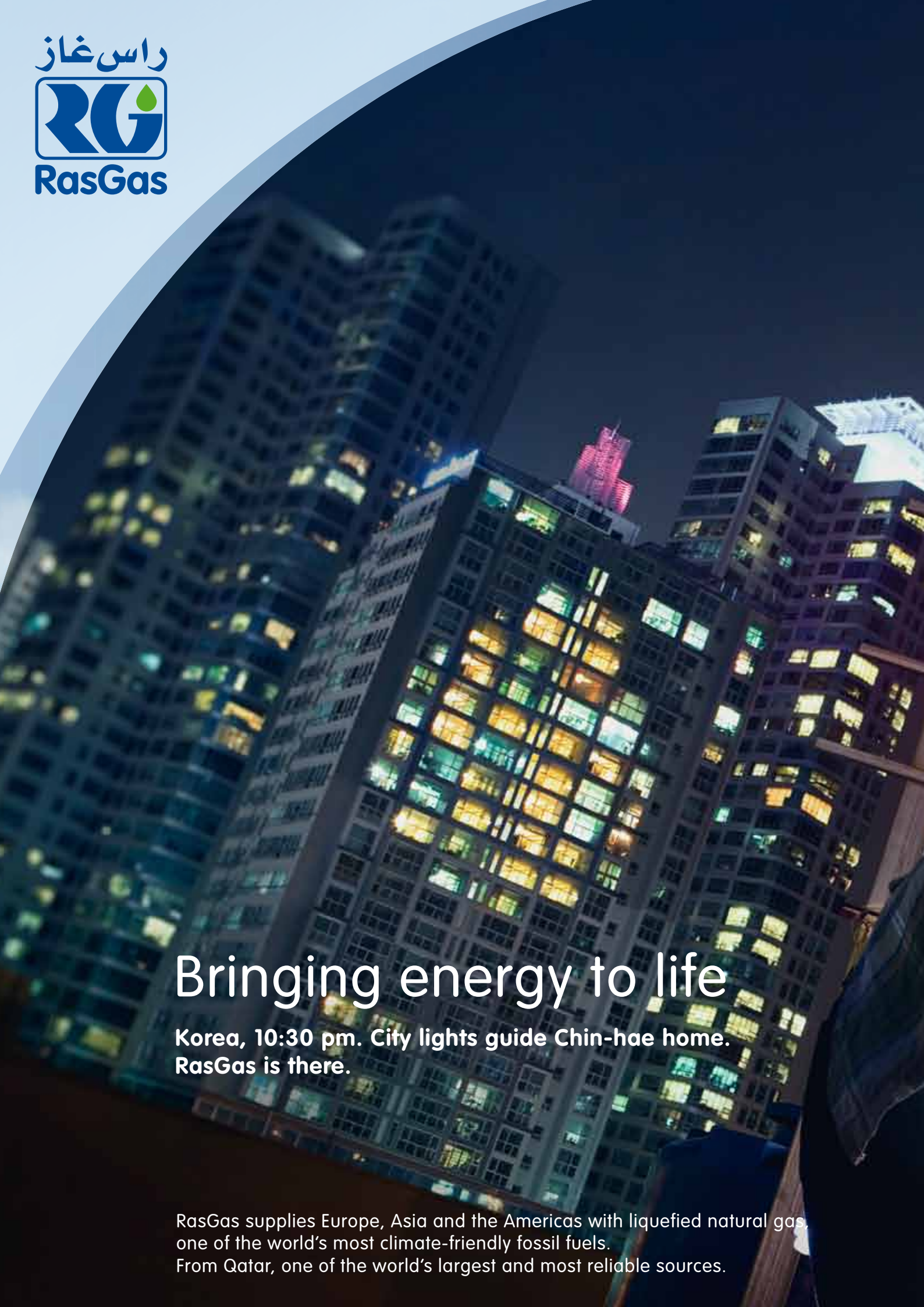
RasGas



# Bringing energy to life

**Korea, 10:30 pm. City lights guide Chin-hae home.**
**RasGas is there.**

RasGas supplies Europe, Asia and the Americas with liquefied natural gas, one of the world's most climate-friendly fossil fuels.
From Qatar, one of the world's largest and most reliable sources.


the power of the drop
THE ENERGY TO TRANSFORM

# Message from the President

*Dear Colleagues*

The energy outlook published by the International Energy Agency (IEA) in November 2013 predicts that gas will be the fastest growing fossil fuel over the next 20 years.

This is an exciting prospect for gas producers. It puts even greater pressure on us to ensure that experts – be they engineers, researchers or specialists – alleviate concerns over sustainable development and greenhouse gas emissions by limiting the impact of methane leakages and improving unconventional gas exploration and production technologies.

One of the major challenges that we will face over the next few years is to limit the ecological impact of natural gas extraction from shale rock formations using hydraulic fracturing to position gas as the cleanest fossil fuel and ideal partner for renewables.

The work of IGU's Programme Committee F on R&D and innovation, supported by other IGU members, will help to defend this position and strengthen convictions that natural gas is part of the solution to combat the greenhouse effect and its consequences for climate change.

Jérôme Ferrier, President.

## IGU initiatives

The French Presidency is currently implementing the objectives we defined when we applied for this role and were elected by the Council in 2008.

To begin with, six new countries have joined IGU as Charter Members since June 2012 – mainly from African and Middle Eastern countries – bringing total membership to 83 countries. We have also welcomed new Associate Members and currently have 43.

IGU has strengthened its relations with international organisations and in particular with certain UN bodies (the UN Industrial Development Organisation, UN Educational, Scientific and Cultural Organisation and UN Framework Convention on Climate Change), as well as with the World Bank and the G20. We have used our presence at major seminars, conferences and forums to present the advantages of natural gas over other energies.

We've also used our presence at the preparatory meetings for the G20 summit in St Petersburg in September 2013, the UNIDO Energy Forum in Vienna in May 2013, the World Energy Congress in Daegu in November 2013 and the workshop organised jointly by IGU and UNESCO in December 2013 on "Women in Engineering in Africa and in the Arab States" as a sounding board for the initiatives introduced by our Task Forces on Human Capital, Gas Advocacy and Geopolitics.


▲ IEA's Executive Director, Maria van der Hoeven (*first left*) and India's Minister of Petroleum and Natural Gas, M. Veerappa Moily (*fifth left*) were special guests at the 8th Asia Gas Partnership Summit in December 2013 which was supported by IGU.

This year will see IGU's involvement in more events and initiatives and we look forward to your continuing support.

In 2015, the French Presidency culminates with the 26th World Gas Conference in Paris in June. The call for papers was launched in February and the National Organising Committee is working hard to make WGC 2015 a memorable event. This will be an opportunity to showcase the natural gas industry's efforts to promote planet-friendly initiatives, six months before Paris hosts COP 21.

The 21st UN Climate Change Conference aims to get all countries, including the biggest emitters of greenhouse gases, to reach a binding agreement that will enter force in 2020; and natural gas has an important role to play in the future energy mix.

Jérôme Ferrier

◀ IGU co-sponsored the 16th Gulf of Guinea Gas Conference in Abidjan in November 2013, where Jérôme Ferrier met Côte d'Ivoire's Prime Minister Daniel Kablan Duncan (*centre*).

# Conviction to share

## Imagine if a long-term energy future also depended on the discovery of new oil and gas resources

Although oil and gas resources are still plentiful, to satisfy growing demand both now and in the future Total continues to make significant discoveries. Relentlessly seeking to increase the productivity of oil and gas field reserves, we innovate to exploit new sources of fossil fuel. But because oil and gas are precious, it will be vital to focus their usage in those areas where it is hardest to replace: in transportation and petrochemicals.

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TOTAL

# Message from the Secretary General

*Dear Reader*

## A dynamic and diverse global market

In my message to you last autumn, I said that we are back on track for global growth. Indeed a long-term perspective shows that the natural gas market has resumed its upward trend after taking a knock during the economic downturn five years ago.

Whilst the economic and environmental virtues of natural gas are universal, the situation for the gas industry varies immensely in different parts of the world.

North America, particularly the USA, continues to be buoyed by an unprecedented and sustained surge in unconventional production from shale and tight gas. The gas resources in Russia are still vast with huge capacity for new exports to Asian markets; the potential to develop new conventional gas production in the Caspian region, the Middle East, East Africa and last, but not least, Australia, provides us with exciting prospects.

▼ Torstein Indrebø, Secretary General.

It is uncertain whether gas demand will grow in the short and medium term in Europe, as policies that promote renewable energy combined with favourable economics for coal-fired plant are starting to squeeze out gas. Policies should support gas in a stronger role in the power sector and as a flexible partner for renewable energy, to enhance the use of gas in on-land and seaborne transportation, to implement innovative distributed energy systems and greater integration of bio-gas technologies.

In Asia and other rapidly developing regions of the world there is a greater emphasis on using established natural gas technologies to implement efficient environmental controls and improve local air quality, leading to a slowing down in the growth of coal-fired plant with more substitution by conventional low emission natural gas plant.

More international pipeline projects and LNG facilities link the producing and consuming areas of the world physically and commercially. We are a dynamic industry and our diversity gives us the flexibility to adjust to the different economic and political realities across the world, and to transfer new technology and skills to enable the market to continue to grow.

Will the shale revolution spread to other regions of the world? China, Argentina and a few countries in Europe are actively pursuing shale gas prospects. Successes outside North America will have far more implications for the global energy markets than we have experienced up to now.

New gas transportation projects are expanding the links between producing and consuming countries.

## IGU in 2014

The IGU Research Conference 2014 will take place in Copenhagen, Denmark, September 17-19. Technological innovation will provide many of the breakthroughs that will keep our industry competitive. I am therefore looking forward with great interest to Copenhagen, where we will map out the technological future for our industry. I hope to meet many of you there. IGU is providing 35 sponsorships to facilitate the participation of young researchers in this flagship IGU conference. You can find more information in this issue of the magazine.

This year IGU Charter Members will have to make some important decisions at the Council meeting in October in Berlin. Firstly, there is the election of the IGU Vice President for 2015-2018 who will become IGU President for 2018-2021, and of the host country for the 28th World Gas Conference in 2021. Secondly, there need to be a new Secretary General and host for the IGU Secretariat after Norway starting from November 1, 2016. The candidate will be elected Deputy Secretary General from December 1, 2014.

One lesson that we have learnt during the last decade is that the gas industry needs to engage in wider energy and climate change fora, in particular reaching out beyond our comfort zone and discussing the different dimensions of the energy challenge with people outside the gas industry. An important tool for our outreach efforts will be the IGU Global Gas Portal to be launched later in 2014.

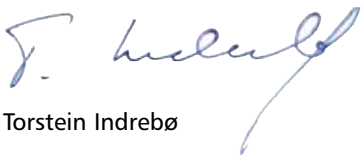
We will continue the cooperation with the United Nations and World Bank on the Sustainable Energy for All initiative, and with UNESCO about bringing more women into the gas industry.

Furthermore, we will seek increased presence in arenas where global energy politics are on the agenda. I am sure you can see the importance of IGU being more active in communicating industry perspectives to a wider audience around the world in parallel with companies and associations.

I wish to welcome the seven new IGU members that joined us last year, with our geographic coverage expanding to Iraq and Lebanon, and the companies: Petronet LNG of India, INPEX Corporation of Japan, Transportadora de Gas del Perú, RasGas of Qatar and ADNOC Distribution of the United Arab Emirates.

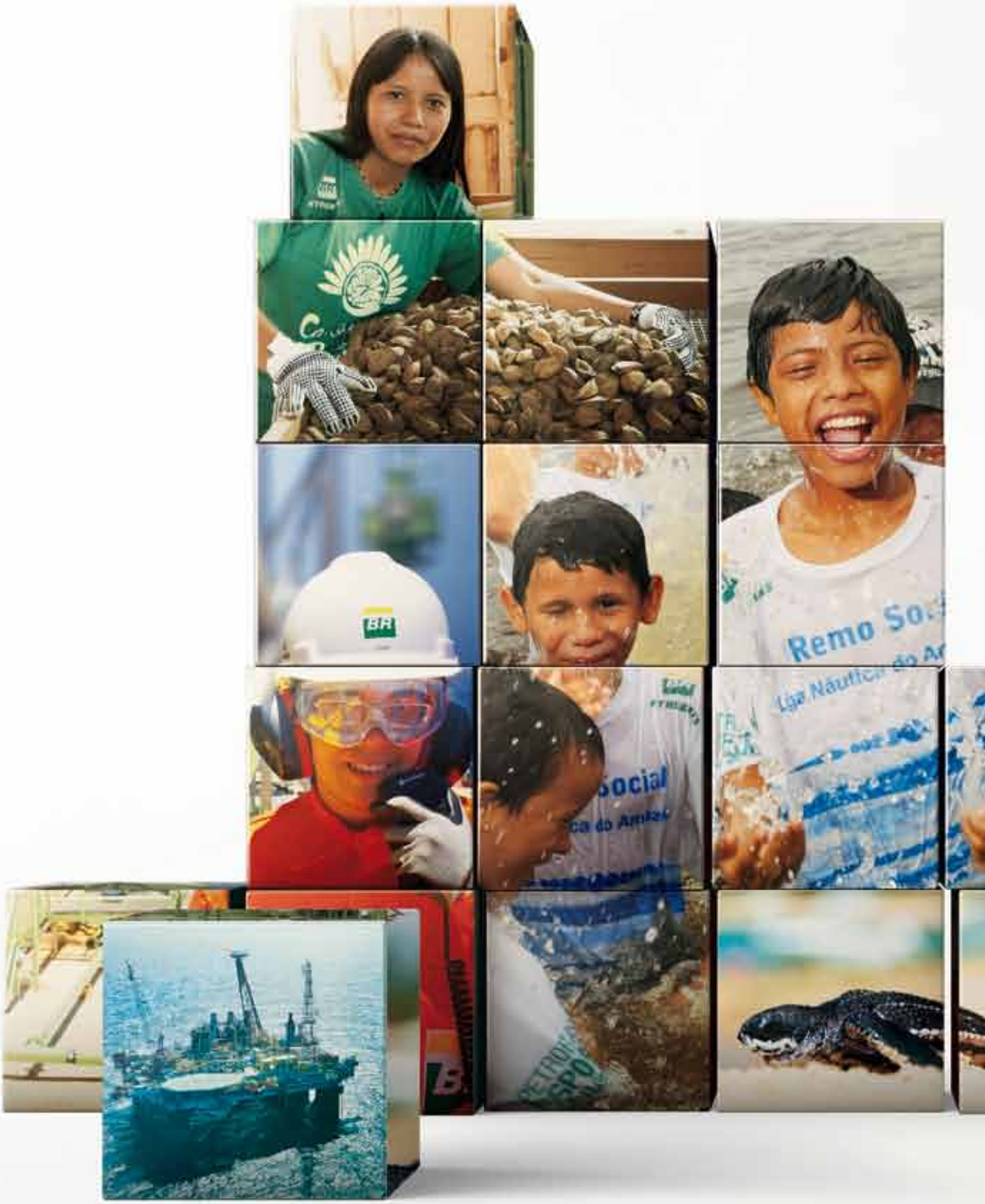
I hope you will find the content of this issue stimulating, and do of course visit www.igu.org for publications and more information on a wide range of topics.

Enjoy your reading!



Torstein Indrebø

F/NAZCA S&S



# AT A DEPTH OF SEVEN THOUSAND METERS, WE FOUND OIL, INSPIRATION AND RESPECT.

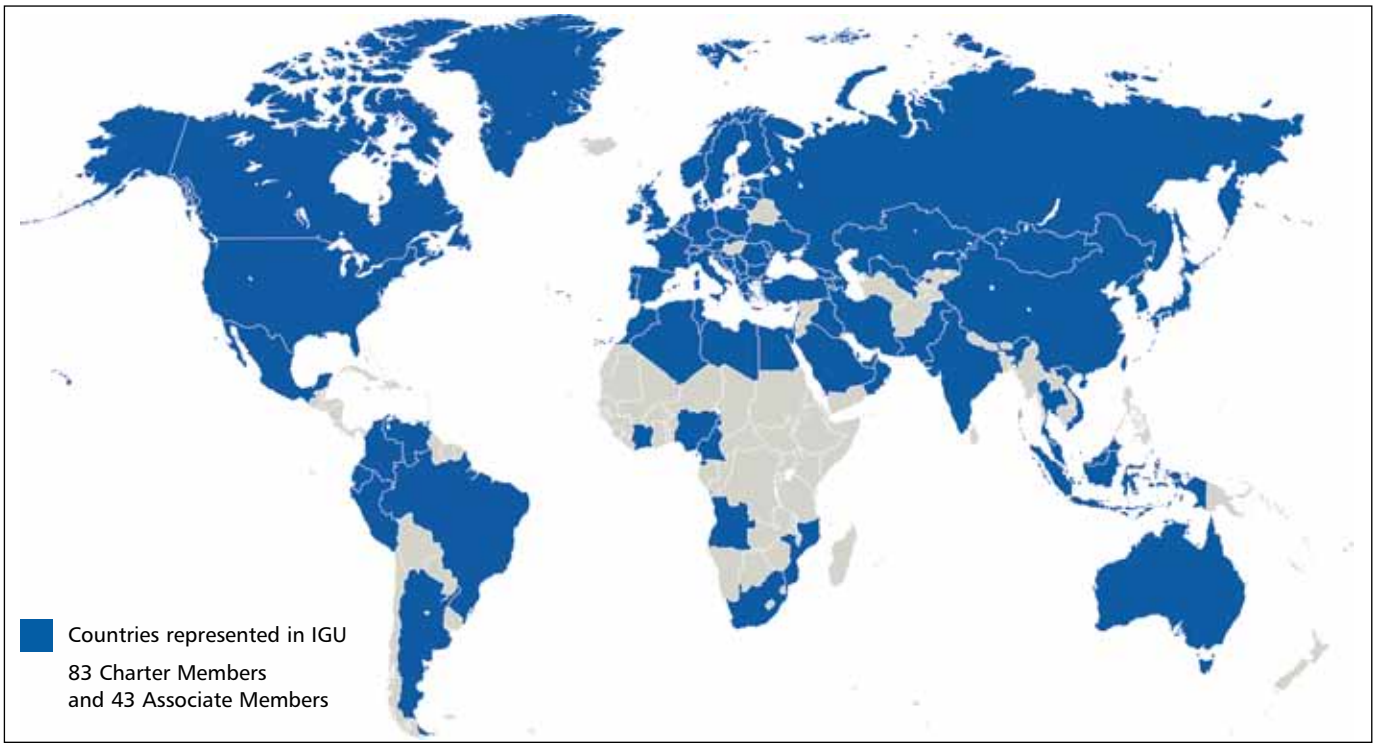
We're world leaders in the exploration and production of deepwater and ultra deepwater oil, and our operations in Brazil's pre-salt layer have earned us a strategic position in the task of meeting the world's ever-increasing energy demand. We invest in the diversification of the energy mix through the use of renewable sources. In addition, we comply with the principles of the United Nations Global Compact and we've been listed on the Dow Jones Sustainability Index for eight consecutive years. Petrobras. Promoting social and environmental responsibility is just as important as growing.

PETROBRAS

*challenge is our energy*

# Countries Represented in IGU

Albania
Algeria
Angola
Argentina
Australia
Austria
Azerbaijan
Belgium
Bosnia and Herzegovina
Brazil
Brunei
Bulgaria
Cameroon
Canada
China,
People's Republic of
Colombia
Côte d'Ivoire
Croatia
Cyprus
Czech Republic
Denmark
Egypt
Equatorial Guinea
Estonia
Finland
France
Germany
Greece
Hong Kong, China
India
Indonesia
Iran
Iraq
Ireland
Israel
Italy
Japan
Kazakhstan
Korea, Republic of
Latvia
Lebanon
Libya
Lithuania
Macedonia
Malaysia
Mexico
Monaco
Mongolia
Morocco
Mozambique
Netherlands, The
Nigeria
Norway
Oman, Sultanate of
Pakistan
Peru
Poland
Portugal
Qatar
Romania
Russian Federation
Saudi Arabia
Serbia
Singapore
Slovak Republic
Slovenia
South Africa
Spain
Sweden
Switzerland
Taiwan, China
Thailand
Timor-Leste
Trinidad and Tobago
Tunisia
Turkey
Ukraine
United Arab Emirates
United Kingdom
United States of America
Uzbekistan
Venezuela
Vietnam





BP is one of the world's leading international Oil & Gas companies. Working with our partners and key stakeholders we produce around 7bcfd of natural gas, and are developing new gas supplies in the Middle East, Africa, the Americas and Asia Pacific.

As we invest in and expand our global LNG business, we bring our expertise across the gas value chain to manage complex projects. We can deliver flexible solutions that meet your energy needs.

We are an active marketer and trader in the world's most liquid markets – North America and the UK, and are increasingly active in the European and Asian markets.

Mutual advantage, experience and commercial innovation make BP a natural gas partner.

bp

## Charter Members

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Albanian Energy Regulator (ERE)

*Algeria*
Association Algérienne de l'Industrie du Gaz – AIG

*Angola*
Sonangol Gás Natural

*Argentina*
Instituto Argentino del Petróleo y del Gas

*Australia*
Australian Gas Industry Trust

*Austria*
Österreichische Vereinigung für das Gas- und Wasserfach (ÖVGW)

*Azerbaijan*
State Oil Company of the Azerbaijan Republic (SOCAR)

*Belgium*
Association Royale des Gaziers Belges

*Bosnia and Herzegovina*
Gas Association of Bosnia and Herzegovina

*Brazil*
Associação Brasileira das Empresas Distribuidoras de Gás Canalizado (ABEGÁS)

*Brunei*
Brunei Energy Association

*Bulgaria*
Overgas Inc.

*Cameroon*
Société Nationale des Hydrocarbures

*Canada*
Canadian Gas Association

*China, People's Republic of*
China Gas Society

*Colombia*
Asociación Colombiana de Gas Natural – Naturgas

*Côte d'Ivoire*
PETROCI Holding – Société Nationale d'Opérations Pétrolières de la Côte d'Ivoire

*Croatia*
Croatian Gas Association

*Cyprus*
Ministry of Commerce, Industry & Tourism

*Czech Republic*
Czech Gas Association

*Denmark*
Dansk Gas Forening – Danish Gas Association

*Egypt*
Egyptian Gas Association

*Equatorial Guinea*
Sociedad Nacional de Gas G.E.

*Estonia*
Estonian Gas Association

*Finland*
Finnish Gas Association

*France*
Association Française du Gaz (AFG)

*Germany*
Deutsche Vereinigung des Gas- und Wasserfaches e.V. (DVGW)

*Greece*
Public Gas Corporation of Greece (DEPA) S.A.

*Hong Kong, China*
The Hong Kong & China Gas Co. Ltd

*India*
Gas Authority of India Ltd (GAIL)

*Indonesia*
Indonesian Gas Association (IGA)

*Iran*
National Iranian Gas Company (NIGC)

*Iraq*
Oil Marketing Company (SOMO)

*Ireland*
Irish Gas Association – Bord Gais Eireann

*Israel*
The Israeli Institute of Energy & Environment

*Italy*
Comitato Italiano Gas (CIG)

*Japan*
The Japan Gas Association

*Kazakhstan*
KazTransGas JSC

*Korea, Republic of*
Korea Gas Union

*Latvia*
JSC Latvijas Gāze

*Lebanon*
Ministry of Energy and Water

*Libya*
National Oil Corporation

*Lithuania*
Lithuanian Gas Association

*Macedonia*
Macedonian Gas Association

*Malaysia*
Malaysian Gas Association (MGA)

*Mexico*
Asociación Mexicana de Gas Natural, A.C.

*Monaco*
Société Monégasque de l'Électricité et du Gaz (SMEG)

*Mongolia*
Baganuur Joint Stock Company

*Morocco*
Fédération de l'Énergie de la Confédération Générale des Entreprises du Maroc (CGEM)

*Mozambique*
Empresa Nacional de Hidrocarbonetos, E.P. (ENH)

*Netherlands, The*
Royal Dutch Gas Association – Koninklijke Vereniging van Gasfabrikanten in Nederland (KVGN)

*Nigeria*
Nigerian Gas Association c/o Nigeria LNG Ltd

*Norway*
Norwegian Petroleum Society (NPF) – Norwegian Gas Association

*Oman, Sultanate of*
Oman LNG L.L.C.

*Pakistan*
Petroleum Institute of Pakistan

*Peru*
Perúpetro S.A.

*Poland*
Polskie Zrzeszenie Inżynierów i Techników Sanitarnych (PZITS) – Polish Gas Association

*Portugal*
Associação Portuguesa das Empresas de Gás Natural

*Qatar*
Qatar Liquefied Gas Company Ltd (Qatargas)

*Romania*
S.N.G.N. Romgaz S.A.

*Russian Federation*
OAO Gazprom

*Saudi Arabia*
Saudi Aramco

*Serbia*
Gas Association of Serbia

*Singapore*
Power Gas Ltd

*Slovak Republic*
Slovak Gas and Oil Association

*Slovenia*
Geoplin d.o.o. Ljubljana

*South Africa*
CEF (Pty) Ltd

*Spain*
Spanish Gas Association – Asociación Española del Gas (SEDIGAS)

*Sweden*
Swedish Gas Association – Energigas Sverige

*Switzerland*
Schweizerische Aktiengesellschaft für Erdgas (SWISSGAS)

*Taiwan, China*
The Gas Association of the Republic of China, Taipei

*Thailand*
PTT Public Company Ltd

*Timor-Leste*
Timor Gás e Petróleo, E.P.

*Trinidad and Tobago*
The National Gas Company of Trinidad and Tobago Ltd

*Tunisia*
Association Tunisienne du Pétrole et du Gaz (ATPG) c/o ETAP

*Turkey*
BOTAŞ

*Ukraine*
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*United Arab Emirates*
Abu Dhabi Liquefaction Company Ltd (ADGAS)

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# 2014 International Bidding Rounds in Peru

## 26 ONSHORE Exploration Blocks

## Block 1-AB for Exploitation

*an attractive country to invest in oil and gas activities*

Perú

## Charter Members (*continued*)

*United Kingdom*
The Institution of Gas Engineers and Managers

*United States of America*
American Gas Association

*Uzbekistan*
Uzbekneftegaz (UNG)

*Venezuela*
Petróleos de Venezuela S.A. (PDVSA)

*Vietnam*
Vietnam Oil and Gas Group (PetroVietnam)

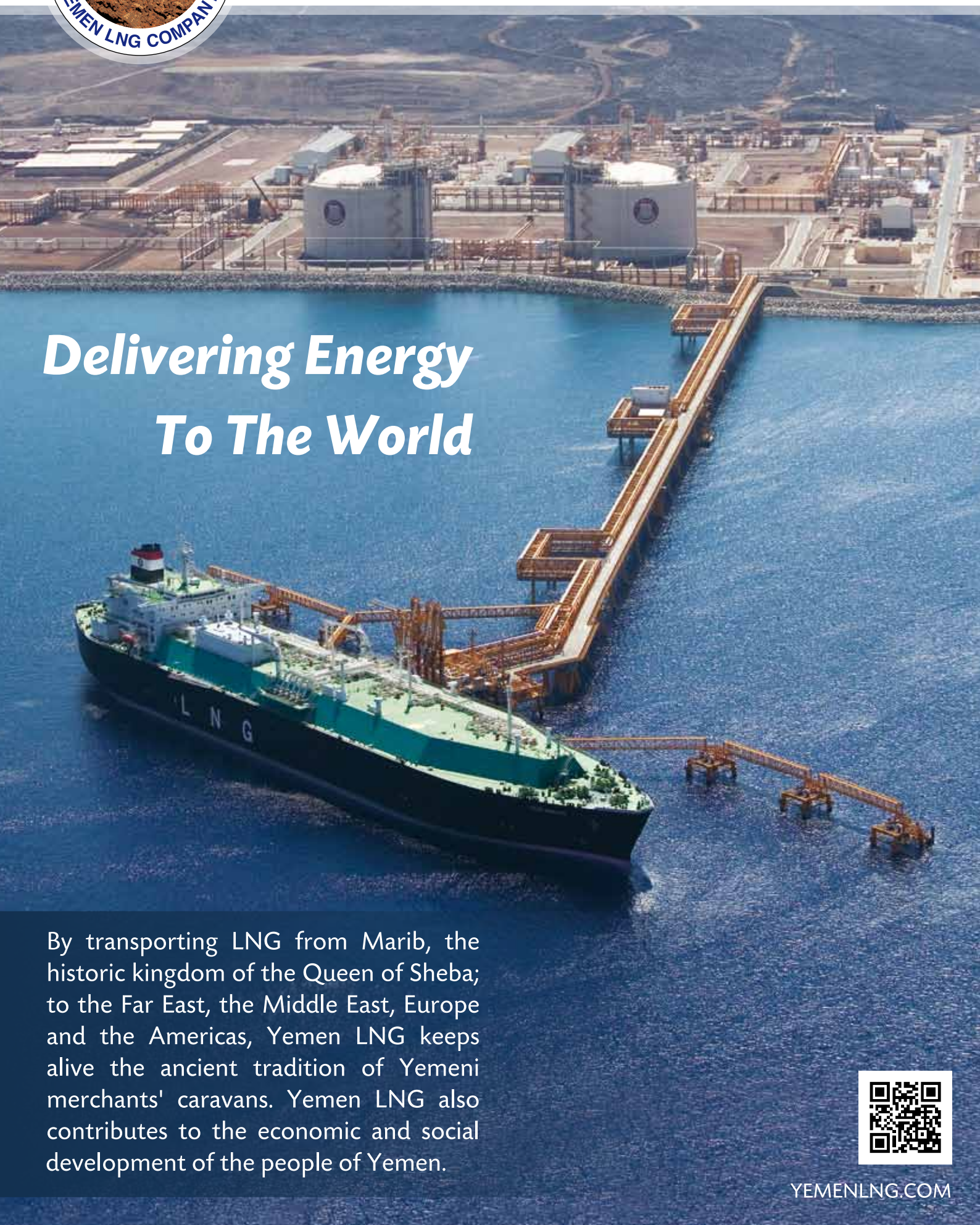
## Associate Members

Abu Dhabi National Oil Company (ADNOC) Distribution (UAE)
Australian Petroleum Production & Exploration Association – APPEA (Australia)
BG Group plc (United Kingdom)
BP Gas, Power & Renewables (United Kingdom)
Bursagaz (Turkey)
Cheniere Energy Inc. (USA)
Chevron Corp. (USA)
China National Petroleum Corporation (China)
ConocoPhillips Company (USA)
Det Norske Veritas (Norway)
DNV KEMA (The Netherlands)
E.ON SE (Germany)
Eurogas
ExxonMobil Gas & Power Marketing (USA)
Gaslink – Gas System Operator Ltd (Ireland)
GasTerra (The Netherlands)
GAZBIR – Association of Natural Gas Distributors of Turkey
GDF SUEZ (France)
IGDAŞ – Istanbul Gas Distribution Co. (Turkey)
Indian Oil Corporation Ltd (India)
INPEX Corporation (Japan)
Instituto Brasileiro de Petróleo, Gás e Biocombustíveis – IBP (Brazil)
Liander (The Netherlands)
N.V. Nederlandse Gasunie (The Netherlands)
OMV Gas & Power (Austria)
Origin Energy Limited (Australia)
Petróleo Brasileiro S.A. – Petrobras (Brazil)
Petronet LNG Limited (India)
RasGas Company Limited (Qatar)
Repsol (Spain)
Russian Gas Society (Russia)
RWE Deutschland AG (Germany)
Shell Gas & Power International B.V. (The Netherlands)
Société Suisse de l'Industrie du Gaz et des Eaux – SSIGE/SVGW (Switzerland)
Sonorgás (Portugal)
Spetsneftegaz NPO JSC (Russia)
TAQA Arabia (Egypt)
TBG – Transportadora Brasileira Gasoduto Bolívia-Brasil S/A (Brazil)
TgP – Transportadora de Gas del Perú (Peru)
TOTAL S.A. (France)
Vopak LNG Holding B.V. (The Netherlands)
Wintershall (Germany)
Woodside (Australia)

## Organisations Affiliated to IGU

Energy Delta Institute (EDI)
Gas Infrastructure Europe (GIE)
Gas Technology Institute (GTI)
GERG – Groupe Européen de Recherches Gazières/European Gas Research Group
GIIGNL – Groupe International des Importateurs de Gaz Naturel Liquéfié/International Group of LNG Importers
NGV Global
NGVA Europe – European Association for Bio/Natural Gas Vehicles
International Pipe Line & Offshore Contractors Association (IPLOCA)
MARCOGAZ – Technical Association of the European Natural Gas Industry
Pipeline Research Council International, Inc. (PRCI)
Russian National Gas Vehicle Association (NGVRUS)

# YEMEN LNG COMPANY




## *Delivering Energy To The World*

By transporting LNG from Marib, the historic kingdom of the Queen of Sheba; to the Far East, the Middle East, Europe and the Americas, Yemen LNG keeps alive the ancient tradition of Yemeni merchants' caravans. Yemen LNG also contributes to the economic and social development of the people of Yemen.

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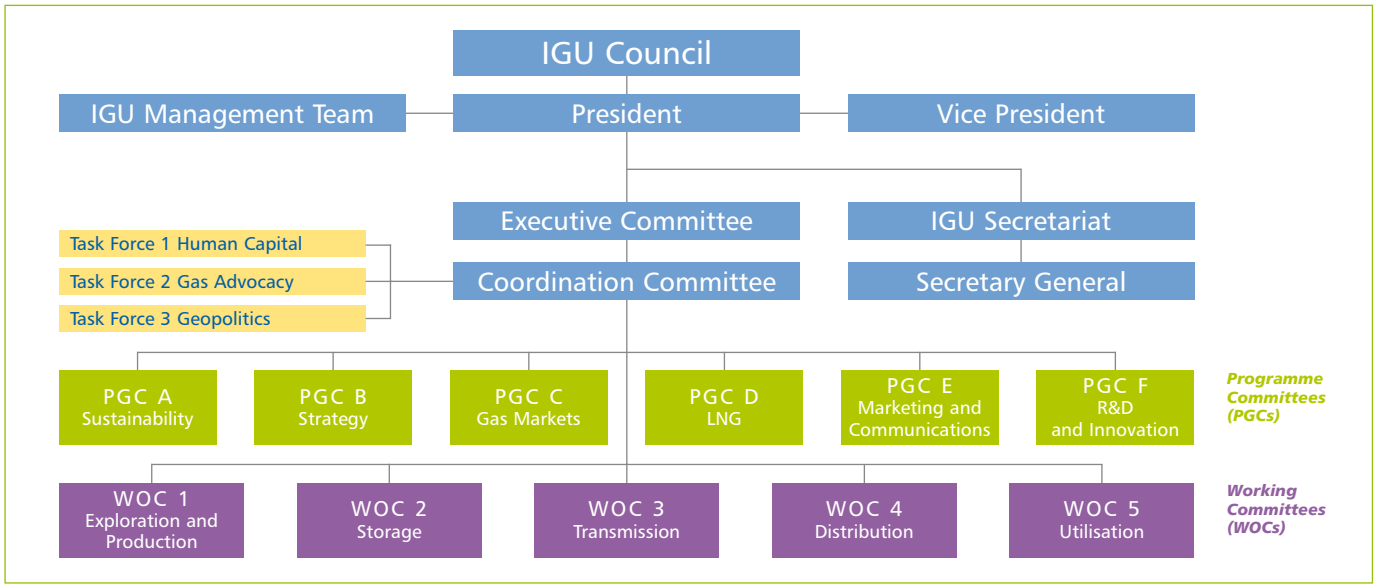
# IGU Organisation 2012–2015





This photograph was taken at the Executive Committee (EXC) meeting which was held in Beijing, China, in October 2013.

*From left to right in the front row are:* Jupiter Ramirez, Fethi Arabi (who was substituting for Abdelhamid Zerguine), Mel Ydreos, Georges Liens, Torstein Indrebø (IGU Secretary General, not a member of the EXC), Datuk (Dr) Abdul Rahim Hj Hashim, Jérôme Ferrier, David Carroll, Pavol Janoč̌ko, Evgueni Riazantsev, Valérie Ruiz-Domingo, Jean Schweitzer, Li-xin Che and Cheryl Cartwright.

*From left to right in the back row are:* David McCurdy, Xia Yongjiang, Runar Tjersland, Denis Krambeck Dinelli (who was substituting for Cynthia Silveira), Jorge Paulo Delmonte (of Associate Member IBP, not a member of the EXC), Hiroyuki Wada, Jae-Seob Kim, Kang Soo Choo, Chris Gunner, Walter Thielen, Marcel Kramer, Khaled Abubakr, Timothy M. Egan, Gertjan Lankhorst, Antoni Peris Mingot, Javier Gremes Cordero and Luis Domenech.

## IGU Management Team

Mr Jérôme Ferrier, President (France)

Mr David Carroll, Vice President (USA)

Datuk (Dr) Abdul Rahim Hj Hashim, Immediate Past President (Malaysia)

Mr Georges Liens, Chair of the Coordination Commitee (France)

Mr Mel Ydreos, Vice Chair of the Coordination Committee (Canada)

Mr Torstein Indrebø, Secretary General

## IGU Executive Committee

Mr Abdelhamid Zerguine, Algeria

Mr Javier Gremes Cordero, Argentina

Ms Cheryl Cartwright, Australia

Mr Luis Domenech, Brazil

Ms Lixin Che, China

Mr Timothy M. Egan, Canada

Mr Mel Ydreos, Canada

Mr Jean Schweitzer, Denmark

Mr Jérôme Ferrier, France

Mr Georges Liens, France

Mr Walter Thielen, Germany

Mr Hiroyuki Wada, Japan

Mr Jae-Seob Kim, Republic of Korea

Datuk (Dr) Abdul Rahim Hj Hashim, Malaysia

Mr Gertjan Lankhorst, The Netherlands

Mr Runar Tjersland, Norway

Mr Jupiter Ramirez, Qatar

Mr Evgueni Riazantsev, Russia

Mr Pavol Janočko, Slovak Republic

Mr Antoni Peris Mingot, Spain

Mr David Carroll, United States of America

Hon. David McCurdy, United States of America

Mr Xia Yongjiang, China National Petroleum Corporation, Associate Member

Ms Valérie Ruiz-Domingo, GDF SUEZ, Associate Member

Mr Chris Gunner, Shell, Associate Member

Mr Khaled Abubakr, TAQA Arabia, Associate Member

Ms Cynthia Silveira, Total, Associate Member

Kang Soo Choo IGU Regional Coordinator for Asia and Asia-Pacific

Marcel Kramer IGU Regional Coordinator for the Russia-Black Sea-Caspian area

# News from the Secretariat and Presidency

The main activities of the IGU Secretariat and Presidency since the last edition of the IGU Magazine (October 2013-March 2014) are detailed below in news items and general information.

## Secretariat staff changes

### *Deputy Secretary General*

During its meeting in Beijing in October 2013, the Council elected Pål Rasmussen as IGU's Deputy Secretary General for the period November 1, 2013 to November 30, 2014. He is working alongside Torstein Indrebø and will stand for election as Secretary General to take over when Torstein retires from IGU on December 1. A graduate of the University of Bergen and the Norwegian School of Management, Pål has extensive experience of working in the gas industry, latterly with Statoil and Gassco. He currently chairs the Norwegian Gas Association, the Norwegian Charter Member of IGU.

### *Administration Consultant*

Since November 29, 2013, our Administration Consultant Silje Storsul has been on maternity leave. To take her place the Secretariat has engaged Anette Sørum Nordal. Anette is fresh out of university where she achieved a Master's degree in Spanish. She has also studied in South America.

## New members

During its meeting in Beijing in October 2013, the Council approved the applications of Iraq and Lebanon to become Charter Members and

Pål Rasmussen.

Anette Sørum Nordal.

The staff of the IGU Secretariat: (*from left to right in the front row*) Hans Riddervold, Special Projects; Torstein Indrebø, Secretary General; Sjur Bøyum, Communication Manager & Webmaster; (*from left to right in the back row*) Ksenia Gladkova, Senior Advisor to the Secretary General; Carolin Oebel, Director; Silje Storsul, Administration Consultant; Mats Fredriksson, Senior Advisor to the Secretary General. Khadija Al-Siyabi was not present for the photo but can be seen on page 36.

of ADNOC Distribution, INPEX Corporation, Petronet LNG, RasGas and Transportadora de Gas del Perú to become Associate Members. IGU now has 83 Charter and 43 Associate Members. See pages 182-187 for short profiles of the new members.

### IGU Global Gas Award

Entries for the IGU Global Gas Award open in May with a closing date for submissions of 31 October. The topic is "Sustainable development and innovative promotion of natural gas". The winner will receive a prize of $5,000 plus an invitation to WGC 2015 in Paris. For more information see the article on pages 46-47.

### IGU in G20 Energy Committee meeting

IGU was invited by the Australian G20 Presidency to participate in the Energy Sustainability Working Group (ESWG) meetings that took place in Melbourne, February 10-13. Secretary General Torstein Indrebø and Director Carolin Oebel represented IGU at the meetings which included a workshop on energy governance and how to strengthen global gas markets. The Secretary General gave a presentation on the role of gas in global energy security and participated in a panel discussing gas market developments with special relevance to Asian markets.

The G20 agenda in 2014 is related to "growth and resilience" where energy plays an important role. The ESWG meeting will provide input to the G20 Leaders Summit taking place in Brisbane in November this year. The G20 group consists of the 20 largest economies of the world, all members of IGU.

### IGU elections

At the 2014 Council meeting in Berlin in October, IGU Charter Members will elect the Vice President for 2015-2018, who will become President for 2018-2021, and the host country for the 28th World Gas Conference in 2021. A new Secretary General and host country for the IGU Secretariat after Norway (from November 1, 2016) will also be elected.

### Election of Committee Chairs/Vice Chairs

According to the IGU Articles of Association, Charter Members are eligible to nominate candidates for the Chair and Vice Chair of the Programme and Working Committees for each Triennium. The Vice Chairs serving during a Triennium are eligible to become Chairs in the following Triennium.

Holding the Chair of a Committee gives the Charter Member the automatic right to a seat on the Executive Committee during the same Triennium.

Charter Members were invited to declare their interest in the Chair and Vice Chair positions of the 11 Programme and Working Committees in December 2013, with the deadline for responses set for March. The Council has to approve the candidates at its meeting in Berlin in October.

### Sponsorship for young professionals to attend IGRC2014

Denmark, represented by the Danish Technology Centre will host the IGU Research Conference 2014 in Copenhagen, September 17-19.


▼ Torstein Indrebø addresses the ESWG meeting in Melbourne. With him on the panel are Dr Aldo Flores Quiroga, IEF Secretary General (*far right*) and representatives of IEA and GECF.

IGRC2014 intends to facilitate a dialogue between technology and business leaders across all areas essential to the future gas system.

The scope of IGRC2014 includes technology developments as well as innovations in products, services and business models across the entire gas value chain, which can provide solutions to meet the challenges facing the gas industry.

Apart from being of great interest to energy and gas professionals from all continents, IGRC2014 is also an outstanding opportunity for students and young researchers in the gas/energy domain to learn about the latest technology developments. This is why IGU has decided to sponsor 35 students and young professionals under 35 years of age to participate in the event. The sponsorship package includes free registration to the conference, complimentary meals on site and a lump sum to pay for accommodation in Copenhagen.

The call for applications was issued in December 2013, with academia, research centres and energy companies being the targeted groups to nominate candidates. Members of IGU's Programme Committee F – R&D and Innovation are now evaluating the applications and the final selection will be performed in cooperation with IGU's Regional Coordinators.

The 35 selected individuals will receive confirmation of their participation by mid-April and will have to arrange their transportation to Copenhagen. They will be required to give feedback on the event by writing an article or making a presentation to their university or company.

### 4th IEF-IGU Ministerial Gas Forum, Mexico

Successful events held in Vienna in 2008, Doha in 2010 and Paris in 2012 have established the IEF-IGU Ministerial Gas Forum as a regular platform for ministers and senior decision makers to discuss key developments in the gas industry. Preparations are now underway for the 4th IEF-IGU Ministerial Gas Forum which will be held in Mexico City in November. Strong support from the Mexican government is confirmed and the country's new energy policy will be high on the agenda. The Forum will take place under the Chatham House Rule and is by invitation only. There were more than 120 participants in the last event in Paris.

### GasNaturally in 2014

IGU is one of the gas associations working together under the GasNaturally umbrella (www.gasnaturally.eu) and the initiative will continue in 2014. The programme for this year will mainly target the EU Parliament and Commission in order to maintain a continuous information campaign on the benefits of gas and its role in the European energy portfolio. The combination of gas and renewable energy sources will continue to be a focus topic of GasNaturally.

### IGU Baltic, Nordic and Polish Charter Member meeting

On August 22, 2013, IGU and the Swedish Charter Member, Energigas Sweden hosted a meeting of Baltic, Nordic and Polish Charter Members in Stockholm. Members from Denmark, Estonia, Finland, Lithuania, Norway, Poland and Sweden participated, with each presenting the latest developments and challenges in the gas industry in their country. In the afternoon, they discussed issues affecting the development of the EU gas market. IGU will follow up the issues through the GasNaturally initiative. After the meeting, Energigas Sweden arranged a visit to a CNG and LNG filling station run by AGA. The day ended with a boat trip on Lake Mälaren.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Representatives of the Baltic, Nordic and Polish Charter Members judged their meeting a success. Mats Fredriksson and Sjur Bøyum from the IGU Secretariat also attended.

Participants found the meeting useful and have decided to make it an annual event. The Polish Charter Member, PGNiG will host the 2014 meeting in Poland.

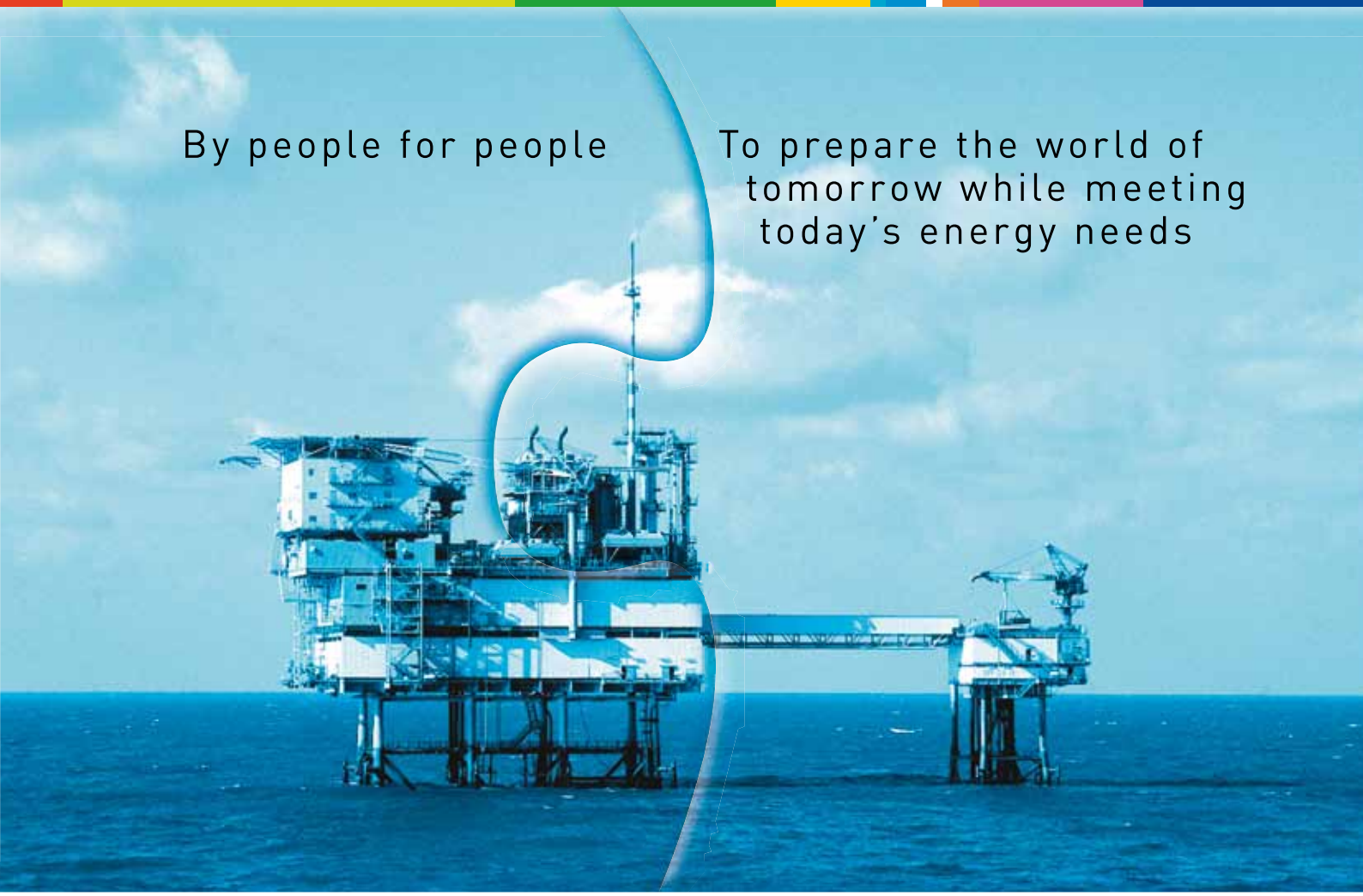
## China International Pipeline Conference

The China International Pipeline Conference was held in Lafang, China, September 12-14, 2013. It was organised by the China Petroleum Pipeline Bureau. Torstein Indrebø represented IGU and gave a presentation on "Trends and perspectives of the global gas industry". China has an ambitious programme to increase the share of gas in the energy mix, and is expanding the national gas transmission network and international pipeline connections.

## IGU Management Team visit to St Petersburg, Russia

Gazprom, the Charter Member for Russia, invited the IGU Management Team to St Petersburg for meetings and technical visits,


Torstein Indrebø addresses the China International Pipeline Conference in Lafang.

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*A barrel of oil equivalent (or "boe") is a unit of measurement used to compare the energy value of (non-liquefied) gas to that of crude oil.
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▲ The IGU Management Team visited Gazprom in St Petersburg in September 2013. *From left to right are:* Torstein Indrebø, Alexander Medvedev, Daniel Paccoud, a Gazprom employee, Jérôme Ferrier, Alexey Miller and David Carroll.

September 16-20, 2013. The IGU delegation was headed by the President, Jérôme Ferrier, who was accompanied by the Vice President, David Carroll, the Chair of the National Organising Committee for WGC 2015, Daniel Paccoud, and the Secretary General, Torstein Indrebø.

The delegation visited the Portovaya compressor station on the Baltic Sea coast near Vyborg, which serves the Nord Stream subsea pipeline running for more than 1,200km to Greifswald in Germany. The first gas deliveries via Nord Stream started in November 2011 and a second line entered service in October 2012. The pipeline gives Russia increased export capacity and enhances security of supply for customers in Europe.

There was also a technical visit to the Gatchina gas storage facility near St Petersburg, which serves the Leningrad region. The storage facility covers seasonal and daily variations in gas demand to ensure reliable gas supplies to customers in the region.

The delegation met with Alexey Miller, Deputy Chairman of Gazprom's Board of Directors and Alexander Medvedev, Deputy Chairman of Gazprom's Management Committee for discussions about key IGU issues and the challenges facing the gas industry. Mr Miller expressed full support for and appreciation of the proactive role of IGU in global gas advocacy activities, and assured the IGU team of Gazprom's continued support. Mr Ferrier used the opportunity to thank Gazprom for its active contribution to the professional work of IGU by sharing competence and experience with the global membership.

## World Energy Congress

The 22nd World Energy Congress, the flagship triennial event of the World Energy Council, was held in Daegu, Korea, October 13-17, 2013. Jérôme Ferrier took part in a session looking at how innovations in transport technology can further global decarbonisation with a presentation entitled "Natural gas and LNG: A part of the solution".

## World Shale Oil & Gas Summit

Co-hosted by CWC and the American Gas Association and co-sponsored by IGU, the 4th

▶ Jérôme Ferrier took part in a session of the 22nd World Energy Congress in Daegu.


◀ David Carroll addresses the World Shale Oil & Gas Summit in Houston.

▲ Carolin Oebel addresses the African training seminar in Abidjan.

edition of the World Shale Oil & Gas Summit was held in Houston, USA, November 4-7, 2013. It attracted more than 300 delegates. David Carroll represented IGU and gave a welcoming address.

### IGU contribution to UN initiative "Sustainable Energy for All"

IGU worked with regional and international organisations to hold its first African training seminar in Abidjan, Côte d'Ivoire, November 4-5, 2013. Entitled "Access to sustainable energy for all with gas", the seminar was organised with the United Nations Industrial Development Organisation (UNIDO), Sustainable Energy for All (SE4ALL) initiative, Economic Community of West African States (ECOWAS) Commission, ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and IGU Charter Member for Côte d'Ivoire, Petroci.

Torstein Indrebø together with the Minister of Mines, Petroleum and Energy of Côte d'Ivoire, HE Adama Toungara, and Dr Kandeh K. Yumkella, Special Representative of the UN Secretary General and CEO of SE4ALL, who is also an IGU Wise Person, opened the seminar. Carolin Oebel moderated proceedings and summarised the key points in the closing session. A more detailed report on the seminar is provided on pages 128-134. Further activities are planned to enhance access to sustainable energy and economic development with gas.

### GoG Gas Conference

The African training seminar was scheduled immediately before the 16th Gulf of Guinea (GoG) Gas Conference, which was held in Abidjan, November 6-8, 2013. Jérôme Ferrier and Dr Kandeh K. Yumkella gave opening remarks in the presence of the Ivorian Prime Minister, Daniel Kablan Duncan. Torstein Indrebø also addressed delegates. The conference was attended by more than 450 delegates from 27 countries. There is a short report on pages 136-137.

### IGU at COP 19

The 2013 UN Climate Change Conference, COP 19 was held in Warsaw, Poland in November 11-22. Building on the success of its participation in previous events, IGU had a stand in the exhibition area and organised a natural gas symposium on November 17 with the Polish Charter Member, PGNiG. The symposium looked at the need for innovation to spur the development of clean energies and was moderated by

Sjur Bøyum and Khadija Al-Siyabi on duty at IGU's COP 19 stand.

Torstein Indrebø. Jérôme Ferrier and the Deputy Environment Minister of Poland, Piotr Woźniak gave opening presentations. The presentations can be downloaded from the IGU website and there is a report on pages 140-144 of this issue.

### GasNaturally Gas Forum

Carolin Oebel participated in the second GasNaturally Gas Forum for EU Member States in Brussels on November 13, 2013. The forum was entitled "Making a clean future real". In the context of the continuing discussions on the EU's 2030 policy framework for climate and energy, the forum looked at the long-term role of natural gas and how energy policy can boost Europe's competitiveness, while meeting climate goals and ensuring security of supply. Beyond the general agreement that natural gas will play a vital role in the future EU energy mix thanks to its flexibility and lower $CO_2$ emissions, participants discussed the outlook for gas demand, its different uses and its role in future energy systems.

### Visit to Turkmenistan

Georges Liens, CC Chair and Ksenia Gladkova, Senior Advisor, participated in the Turkmenistan International Oil and Gas Conference 2013, which was held in Ashgabat, November 19-21. Ksenia Gladkova was one of the keynote speakers alongside the then CEO of Turkmengaz, Kakageldy Abdullayev. She gave a presentation in Russian entitled "Natural gas supporting social and economic development" which

Ksenia Gladkova addresses the Turkmenistan Oil and Gas Conference in Ashgabat.

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Torstein Indrebø and Khadija Al-Siyabi at the UNECE meeting in Geneva.

Jérôme Ferrier addresses the Asia Gas Partnership Summit in New Delhi.

After the Asia Gas Partnership Summit, Torstein Indrebø visited the GAIL training institute in New Delhi.


included extensive information on IGU's recent developments. After the session, a meeting with Yagshigeldy Kakayev, Chairman of the State Agency for Management and Use of Hydrocarbon Resources was organised to follow up discussions on Turkmenistan joining IGU.

### UNECE Committee on Sustainable Energy

The 22nd annual session of UNECE's Committee on Sustainable Energy was held in Geneva, Switzerland, November 21-22, 2013. Torstein Indrebø gave a presentation entitled "A new role for gas in a green economy" and participated in the subsequent panel discussion. Khadija Al-Siyabi, Advisor to the Secretary General, also attended.

### Asia Gas Partnership Summit

The 8th Asia Gas Partnership Summit was held in New Delhi, India, December 3-4, 2013. It was organised by the Federation of Indian Chambers of Commerce and Industry (FICCI), promoted by IGU Charter Member Gas Authority of India Ltd (GAIL), and supported by IGU and the Natural Gas Society. There were about 1,000 delegates and many high-level international speakers.

Jérôme Ferrier gave a keynote address on the long-term perspectives for gas in India and the region in general, while Torstein Indrebø parti-

cipated in a strategic panel looking at Indian energy supply options. The event also offered the opportunity to meet with the management of GAIL and Associate Members Petronet LNG and Indian Oil.

After the summit, Torstein Indrebø was invited to visit the GAIL training institute in New Delhi. The institute offers extensive training courses to GAIL staff and others, including employees of foreign companies.

### LIOG Summit

The 2nd Lebanon International Oil & Gas Summit took place on December 4-5, 2013 in Beirut. The event gathered more than 430 delegates and was held under the patronage of the Ministry of Energy and Water. Jérôme Ferrier gave an opening speech in the presence of the Minister, Gebran Bassil.

### Joint IGU/UNESCO workshop

IGU cooperated with UNESCO to organise a successful workshop on "Women in Engineering in Africa and the Arab States" in Paris on December 10, 2013. For a full report see the article on pages 146-155.


IGU has strengthened its relations with international organisations such as UNESCO, whose Director General, Irina Bokova is pictured with Jérôme Ferrier.

▲ Ksenia Gladkova at the PISM seminar in Warsaw.

### UCG conference and exhibition

A conference and exhibition entitled "Unconventional Gas Resources: Challenges and Opportunities for Sustainable Development" took place in Muscat, Oman, January 20-22. It was held under the patronage of HE Salim Bin Said Al-Aufi, Under Secretary in the Omani Ministry of Oil and Gas. IGU supported the event and Jérôme Ferrier gave a keynote speech. Khadija Al-Siyabi also attended.

### Seminar on energy policies

On February 11 the Polish Institute of International Affairs (PISM), one of the major policy think tanks in Central Europe, organised a seminar in Warsaw entitled "New Factors Determining Changes in Energy Policies in the World". Ksenia Gladkova represented IGU as a panel member during the session on "Game Changers in the Global Gas Market". The topics discussed included the shale gas revolution, perspectives for LNG market development and new developments and their impact on conventional gas markets and politics. Having a presence in policy debates advocating the role of natural gas is high on the IGU agenda.

# IGU Initiatives Launched at the Council Meeting in China

By Mark Blacklock

The IGU Council returned to China for its 2013 meeting last October, where business included the launch of the Global Voice for Gas project, the new Global Gas Award and the accession of seven members. The Council had previously convened in Beijing in 1990 and Tianjin in 2005.

The Council met in the Grand Hyatt Hotel in Beijing on October 24, 2013, following a workshop on unconventional gas developments in the Asia-Pacific region and sessions of the Coordination Committee and Executive Committee on October 22-23. The whole event was hosted by the China Gas Society and Beijing Gas Group. It was attended by 175 delegates and 27 accompanying persons.

IGU's President, Jérôme Ferrier welcomed delegates and asked them to approve the minutes of the October 2012 Council meeting in Ottawa, before giving the floor to the Secretary General, Torstein Indrebø.

Torstein introduced Khadija Al-Siyabi, who had been seconded by Oman LNG to work as Advisor to the Secretary General earlier in the year and was attending her first Council meeting. "The secondment programme is mutually beneficial to IGU and the sponsoring company and we invite applications from members for an opening in 2014," he said.

Brief presentations were then given on three important events that had been held


▼ Flanked by Torstein Indrebø and David Carroll, Jérôme Ferrier welcomes delegates to the 2013 Council meeting.

since the previous Council meeting and one forthcoming event.

Jérôme reviewed the 3rd IEF-IGU Ministerial Gas Forum, which was held in Paris on November 16, 2012, and announced that the next Forum would take place in Mexico City in late 2014.

Carolin Oebel, Director in the Secretariat, reported on IGU's Gas Symposium during COP 18 in Doha on November 30, 2012, and gave details of a similar event to be held during COP 19 in Warsaw shortly after the Council meeting (see pages 140-144).

The world's leading LNG forum is jointly organised by IGU, the Gas Technology Institute (GTI) and the International Institute of Refrigeration (IIR) every three years. Jay Copan, Executive Director of LNG 17, which was held in Houston in April 2013, briefed delegates on the successful outcome of the latest conference and exhibition in the series. LNG 17 broke all records with 3,605 participants from 83 countries, 419 abstracts received, 309 exhibitors and 4,048 trade visitors. "We raised $4.625 million of sponsorship and have left a legacy in the form of a $1 million scholarship fund," he said. At the end of LNG 17 the baton was passed to Australia and LNG 18 will be held in Perth, April 12-15, 2016.


◀ Jay Copan giving the final report on LNG 17.

▼ There was a high turnout of delegates.

The IGU Research Conference is also held triennially and IGRC 2014 will take place in Copenhagen, September 17-19. Conference Director Peter Hinstrup, who is an Honorary Member of IGU, updated delegates on preparations and asked them to help in distributing the call for papers. He also announced that IGU would be sponsoring 35 student researchers to attend the conference using funds donated by the IGRC Foundation. The Regional Coordinators will select five applicants from each of the five regions and 10 applicants will be selected by the IGU Presidency and Secretariat.

Thanking Peter for his presentation, Jérôme stressed the importance of the IGRC and declared that, "Only innovation can bring the industry forward". He also thanked Brazil for offering to host IGRC 2017 which will be held in Rio de Janeiro.

## Global Gas Award

Torstein then briefed delegates on the relaunch of IGU's Awards programme. "We want to enhance the prestige of the programme and rather than having two awards we will now focus on one – the Global Gas Award," he explained. "The topic for this triennium is 'Sustainable development and innovative promotion of natural gas' and the prize will be $5,000 plus an invitation to the 26th World Gas Conference (WGC) in Paris in 2015." A full report on the new Global Gas Award can be found on pages 46-47.

## 2015-2018 Triennium

Torstein went on to invite Charter Members to apply for the vice chairmanships of the committees in the 2015-2018 Triennium. He also asked the current vice chairs to confirm that they will assume the chairmanship in 2015. The leadership of the committees will be decided by the Executive Committee (EXC) during the April meeting in Sydney.

Then Jérôme asked delegates to approve three new members of the EXC: Javier Gremes Cordero representing Charter Member Argentina, who takes over from Carlos Seijo; Jae-Seob Kim of Korea to replace Kap-Young Ryu; and Valérie Ruiz-Domingo of GDF SUEZ to replace Philippe Miquel.

## Elections

Torstein will retire after the 2014 Council meeting and Norway as the current host of the Secretariat has nominated Pål Rasmussen, Chair of the Norwegian Gas Association, to be his successor. To ensure a smooth handover, Pål will work alongside Torstein and he was elected Deputy Secretary General for the period November 1, 2013 to November 30, 2014. "It was an honour to be asked to take on the role of Secretary General and I am looking forward to working with you," he said.

Norway's term as host of the Secretariat ends in October 2016. Elections for the new host and for the 2018-2021 Presidency will be held during the 2014 Council meeting. Torstein announced that Russia had made the first application for the 2018-2021 Presidency and invited Alexander Medvedev of Gazprom to make a short presentation. "Russia intends to upgrade its presence in IGU and we will do our utmost to convince you to support us," he declared.

China applied during the Council meeting and in a last-minute addition to the agenda

▼ Jianxun Li (LEFT) and Alexander Medvedev (RIGHT) announcing China's and Russia's bids for the 2018-2021 IGU Presidency.

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Jianxun Li, Vice President and Secretary General of the China Gas Society, was invited to address delegates in the afternoon session. Korea has since announced that it will be competing with China and Russia.

## New members and finance

The Council was asked to approve seven applications to join IGU. Iraq's Oil Marketing Company and Lebanon's Ministry of Energy and Water applied to become Charter Members, and ADNOC Distribution, INPEX Corporation, Petronet LNG, RasGas and Transportadora de Gas del Perú applied to become Associate Members. Saeed Mubarak Al-Rashedi of ADNOC Distribution and Khalid Sultan R. Al-Kuwari of RasGas addressed delegates, while Khadija gave short presentations on behalf of the applicants who were not able to attend.

The Council was also asked to approve a change in Charter Member for Timor-Leste, with the new National Oil Company Timor Gás e Petróleo taking over from the Secretariat of State for Natural Resources.

Bayerngas and DanaGas have left IGU so the total membership is now 126 – 83 Charter and 43 Associate Members.

When he presented the 2012 accounts and the 2014 budget for approval, Sjur Bøyum, Communication Manager, announced that the membership fee of €5,000 would be frozen for 2014.

## Global Voice for Gas

Gas advocacy has become an important part of IGU's work and a major part of the morning's proceedings was dedicated to discussing the Union's public affairs and government relations strategy to 2020.

"IGU recognises that the case for natural gas must be put more strongly if gas is to realise its full potential," said Jérôme.

"In the past gas supplies were the bottleneck and there was a limited need for political lobbying," said Torstein. "It is clear that IGU must adjust to the changing business environment and we have the momentum and leadership capacity to do this." He identified three areas of focus.

Firstly, in order to put the case for gas, IGU needs to have a greater presence in high-level forums when energy politics are discussed. "IGU first participated in a G20 event in July 2013 under the Russian Presidency and aims to strengthen relations under the current Australian Presidency through the G20 Energy Sustainability Working Group and Business Forum for Industry Leaders," said Torstein. IGU is also developing relations with the Asia-Pacific Economic Cooperation (APEC) forum, European Union and Organisation for Security and Cooperation in Europe (OSCE).

Secondly, the Global Voice for Gas outreach campaign is being launched to create improved awareness and recognition of the role of gas in a sustainable energy future. Torstein asked Hans Riddervold, responsible for special projects in the Secretariat, to brief delegates.

"To achieve a global voice for gas is one of the most important initiatives of IGU," Hans declared, explaining that the campaign is targeted at key influencers, stakeholders, policy- and decision-makers in political institutions around the world. A "pull" marketing strategy will bring the targeted audience to a redeveloped website which will become the global gas portal. The Secretariat has funded initial work from IGU's reserves and is seeking sponsorship and in-kind support for further development.

The third area of focus is on partnerships with other international organisations to provide universal access to sustainable energy. Some countries with insufficient access to energy have gas resources but lack expertise. "We have been asked by the UN and World Bank to transfer competencies to nations wishing to exploit their gas resources," said Torstein, adding that the first training seminar would be held jointly with UNIDO in Abidjan,

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Georges Liens giving his progress report on the Triennial Work Programme.

Côte d'Ivoire shortly after the Council meeting. He asked Carolin to brief delegates while Dr Kandeh Yumkella, CEO of the UN Secretary General's Sustainable Energy for All initiative, who is a member of IGU's Wise Person's Group, sent a video message to the Council. A full report on the training seminar is on pages 128-134.


Moments for reflection and networking in the coffee break.

### TWP 2012-2015 and WGC 2015

Next up was Georges Liens, Chair of the Coordination Committee (CC), who gave a progress report on the Triennial Work Programme (TWP). "The technical committees now have a record 1,010 members from 57 countries," he said. The full progress report of the CC and technical committees is on pages 79-121.

Daniel Paccoud, Chair of the National Organising Committee for the 26th World Gas Conference, then updated delegates on preparations for the event which will be held in Paris, June 1-5, 2015. "We are pleased and honoured that the French President, François Hollande will open WGC 2015," he announced.

### Chinese gas industry

After lunch, there were brief addresses from Jianxun Li, James Kwan of the Hong Kong and China Gas Company on GASEX 2014, which will be held in Hong Kong, November 18-20, and Uwe Klaas of the German Technical and Scientific Association for Gas and Water (DVGW), which will be hosting the 2014 Council meeting in Berlin, October 14-17.

The rest of the afternoon session was dedicated to presentations on the Chinese gas industry. Heming Liu, Deputy Director of the Ministry of Housing and Urban-Rural Development, began by giving an overview of the country's gas market.

There are some 200 million natural gas customers in 31 provinces of China served by 55,000km of transmission and 460,000km of distribution pipelines. Total residential and industrial consumption in 2012 amounted to 147.5 bcm, with domestic production supplying 107.7 bcm and the balance imported.

The average annual growth rate of gas consumption since 2000 has been 16% and government policy is to develop the sector further so that the share of gas in China's energy mix doubles to 10% by 2020 and reaches 15% by 2030. This will make an important contribution to the government's aim of

reducing air pollution. Increasing energy efficiency is also a priority.

Yalan Li, General Manager of Beijing Gas Group, explained that urbanisation is an important factor driving the development of China's gas sector – 14 million people move to the cities each year, she said – and looked at the plans.

On the supply side there is a focus on unconventional gas with production of tight gas and coal-bed methane set to grow and commercial shale gas production expected to start in 2015. There are also coal-to-gas projects such as the Datang coal-to-gas plant in Inner Mongolia in which Beijing Gas is an investor. Total production is expected to reach 137 bcm in 2015.

Apart from increasing domestic production, the country is expanding imports. Three import channels are currently in operation: LNG terminals on the east coast and pipelines from the north-west and south-west; and a fourth channel will be developed from the north-east. Imports are expected to more than double to 93 bcm in 2015.

On the demand side, distributed energy projects and NGV use are being encouraged. By 2015, when annual gas consumption is forecast to reach 230 bcm, distributed energy projects are expected to use 12 bcm (5.2% of consumption) and NGVs 30 bcm (13%).

Lixin Che, President of the Research Institute of Beijing Gas Group, went into detail about the construction of infrastructure and technological developments.

In 2010, she said, there were eight underground storage facilities with 4.35 bcm of capacity. By 2015 there will be 24 with total capacity of 22 bcm. She reviewed the expansion of the pipeline network, LNG import capacity and LNG peak shaving capacity, and also looked at the use of advanced technologies in areas such as pipeline construction, combating corrosion and detecting leaks.

Finally, Ning Ning, Vice President of CNPC's Research Institute of Petroleum Exploration and Development (RIPED) looked at China's gas resource base and the challenges of exploration and production. He said that unconventional gas production was 29.2 bcm in 2012 or 27% of production, and forecast that it would reach 180 bcm (51%) in 2030, while conventional gas production would reach 170 bcm.

As the most senior Honorary President present, Datuk Abdul Rahim Hashim ended the proceedings with a vote of thanks to the Chinese hosts.

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

▼ CLOCKWISE FROM TOP LEFT: **Heming Liu, Yalan Li, Lixin Che and Ning Ning gave presentations on the Chinese gas industry.**

# The IGU Global Gas Award

By Ksenia Gladkova

IGU launched an Awards programme with generous cash prizes in 2008 to complement non-monetary awards for best practices. The IGU Awards programme calls for ideas and projects that promote innovation and sustainability in the gas industry. It also helps to raise IGU's profile and increase awareness of the Union's activities. Now the programme has been refocused on one Award to enhance its prestige and impact with the topic linked to the special projects of each triennium. For the 2012-2015 Triennium the topic is "Sustainable development and innovative promotion of natural gas" and the prize is $5,000.

Focusing resources on one Award allows IGU to promote this as the main competition for the global gas industry. A comprehensive promotional campaign will attract high-quality entries and ensure good media coverage.

The initial selection process will be carried out by an Evaluation Committee with members from the relevant Committees and Task Forces, the IGU Presidency and the Secretariat. The finalists' submissions will then be passed to a Judging Panel which will include representatives of the IGU Wise Persons Group, Regional Coordinators, Executive Committee (EXC) and Secretariat. The judging criteria will vary depending on the topic of the Award. As an example, they may include:

- Relevance of the project to sustainable development;
- To what extent does the project improve energy efficiency?


Kunihiro Nishizaki (*second left*) and Kazuhiro Hirai (*third left*) were the winners of the 2009-2012 IGU Gas Efficiency Award. They are flanked by Datuk Abdul Rahim Hashim, IGU President 2009-2012, and Torstein Indrebø, Secretary General.

- Has there been a similar project in the past?
- To what extent does the project impact the industry?
- How realistic is the implementation and financing?
- Does the project demonstrate in-depth knowledge of the gas industry?
- Is it a part of a long-term strategy?
- Does the project target a large audience or a specific group of players?

The results will be announced in the run-up to the World Gas Conference. All the finalists will receive a diploma and be invited to present their projects during a special WGC session as well as attending the Award Ceremony.

Appropriate press coverage will be organised including a press conference, and the results will be displayed on the dedicated webpage. The press follow-up will include an article in the IGU magazine and a special IGU communiqué which may be published in selected external magazines.

## Competition timeline to 2015

On May 5, 2014, the Secretariat will issue a written invitation to all members to submit projects. The invitation will include the judging criteria, composition of the Evaluation Committee and Judging Panel, the schedule, details of the prize and a description of the related events during WGC 2015 in Paris. Each submission should contain a full description of the project, abstracts and a full CV for each author. The deadline for submission will be October 31, 2014.

The Evaluation Committee will consider the submissions and announce the choice of the finalists on January 31, 2015. All participants will be informed about the decision and the finalists' submissions will be published on the IGU website.

The finalists will then go forward to the Judging Panel which will announce the winner in May 2015. The result will be published on the IGU website and announcements may be arranged in selected media.

Luis Felipe Fernández Pérez was the winner of the 2009-2012 IGU Social Gas Award.

A dedicated Award session with presentations by all the finalists will be held during the 26th WGC in Paris, June 1-5, 2015, and there will be a separate Award Ceremony for the formal presentation to the winner.

Winning an IGU Award is an honour and an achievement. We encourage all of you to take part in this exciting competition.

*Ksenia Gladkova is Senior Advisor to the Secretary General.*

### IGU Award – New for 2012-2015

| |
|---|
| One Award |
| Link to the IGU focus areas |
| Selection process involving more actors including active participation of Executive Committee members |
| Full media coverage |
| A stand-alone WGC session and Award Ceremony |
| Dedicated webpage |

# The future of the gas industry: new opportunities driven by cooperative competition

By Alexander Medvedev

My fellow gas industry colleagues!
I am sure you will all share my joy that, contrary to decades of prejudice in the international energy industry, now is a wonderful time to work in the gas industry. As an industry, we have a wonderful opportunity to work together, in cooperative competition, to continue this successful dynamic. I believe that our continuing success should be built around a number of key themes that dominate our industry:

- Being flexible and understanding the needs of our clients
- Gas as the only viable green option
- Gas as a transportation fuel
- Gas prejudice: subsidies for nuclear and green
- Commitment to partnerships, which will drive growth

I hope this year will be successful to all players in our market and I look forward to continued cooperative competition from you all.

Alexander Medvedev

**Flexibility: committed to meeting the needs of the client**

Whilst we are of course constantly looking to the horizon, running R&D projects into the future applications of natural gas, we should never forget the symbiotic relationship between producer and client, near unique in the modern industrial world. We must understand our clients' needs, and the fluctuating nature of demand. Industrial capacity and weather conditions mean that a client might need more or less gas at the same time each year. We all have to be flexible.

During the last two winters there have been cold snaps that were unforeseen in Europe. With other producers either at capacity, shutting down fields for maintenance, or unable to meet deliveries due to political disturbances, we were able to meet our clients' significantly enhanced demands.

Our finance department would have been delighted for us to sell at the higher prices prevalent in a spot market situation. This, however, would have been a betrayal of the bond of trust that must be at the heart of the gas industry, where often there is a physical linkage between up- and downstream as well as financial. The pipeline as an umbilical cord, if you will. Alternative scenarios are too fixed to the benefit of one side or another, whether financial or operational; we need to maintain a balance between up- and downstream needs.

It is the commitment to our clients that has led the industry to invest billions of dollars in upstream exploration and development activities. Gazprom and our partners have successfully run ultra high tech operations to develop Russia's natural wealth in complex physical, geological and environmental situations – operations mirrored the world over throughout the industry. The investment does not stop here. We are all also investing in the mid- to downstream sector. New and planned export pipelines are specifically designed to ensure that demand will be met, no matter what the circumstances. The same can be said of the growth of LNG. Gas is gas no matter how it is produced or transported. Conventional, tight, CBM or shale. Pipeline or LNG – it is all the same.

While demand is projected to grow during the next few decades – we are delighted to agree with Exxon's view on the gas market – we are also aware that we must invest to ensure security of supply, no matter what. It is this demand that is driving multi-billion dollar investment in some of the world's most ambitious engineering projects, be they located in Russia, Europe, North America or the Pacific.

**Gas – the only currently viable green option?**

Perhaps we should rebrand gas? At Gazprom we often refer to it as the "blue fuel", but it strikes me that "green fuel" should be used. Of course there is a certain amount of pollution derived from the production and combustion of natural gas; however, the reality is that it is by far the cleanest hydrocarbon: 30% cleaner than oil and a massive 45% cleaner than coal. I believe that there is a grand alliance

to be created: the integrated energy industry; governments and regulators around the world; public health organisations and finally environmental campaigners. We are not always the most comfortable of bedfellows, but I believe we have a common enemy and that is coal.

Whilst long-term carbon pollution is doing serious damage, the short-term danger is just as bad. The pollutants present in coal smog are deadly to urban populations. Charles Dickens, famous for his descriptions of "London fog" was actually writing about coal-based smog. Since the removal of coal-fired power stations and the introduction of natural gas, Londoners are living longer lives, with respiratory diseases down significantly. China is following the same path, investing in both local and imported gas solutions for power generation that will lessen their reliance on coal, thereby improving public health, and maintaining industrial output.

Gas is a medium-term force for better public health and a long-term bridge to a non-carbon future, once the technologies are both operational and financially viable. In the long term the world is realising that burning coal is frankly unsustainable for our planet.

Our friends in environmental NGOs should be promoting the use of natural gas. In the current global economic environment, and remembering it's not sunny all the time and the wind doesn't always blow; natural gas is the only green alternative to burning coal and oil; whether for power generation, heating, or as fuel for transportation.

**Gas as a transportation fuel**

We believe that gas will become a viable transportation fuel. From long-distance commuters to municipal transportation, continental HGVs and finally as a marine bunkering fuel, we are successfully investigating the future of gas as a transportation fuel and have created a small scale, but successful and entirely scaleable retail business in Germany.

Such a new part of the energy industry demands that we work in partnership, and we have both enjoyed and profited from working with major international companies such as Volkswagen and E.ON, sharing our technology and experience. We have also been a driving force, in cooperation with the IGU on two versions of the "Blue Corridor Rally". These events, utilising gas-powered vehicles are designed to raise the profile and prove the concept of gas as a transportation fuel to a much wider audience.

As an industry, we need to work together to convince regulators, politicians, motor manufacturers and finally consumers that gas really is an attractive alternative to more mainstream fuels.

**Environmental persecution?**

The simple truth is that gas is persecuted because it is a hydrocarbon. We must work together to demonstrate gas's clean credentials and fight to rebalance the global system of environmental policy/subsidy dynamic. Nuclear enjoys numerous state-backed subsidies around the world because it is "low carbon"; however, we are all aware of the risks of a catastrophic incident. Perhaps more damaging are the environmental and fiscal costs associated with decommissioning and clean up.

In the gas industry, we are of course all aware of our advantages over nuclear. One of the most important is speed. A CCGT system takes a fraction of the cost and time associated with the commissioning, regulatory and operational processes of its nuclear equivalent. There are a number of markets considering what should be done with ageing nuclear infrastructure. They cannot put these decisions off forever. I believe the entire gas industry should put the case for gas as a partial replacement for nuclear. We are clean, we are efficient, we are environmentally friendly, and over the lifetime of the project, we are cost effective.

On the other side of the low carbon equation are the truly green alternatives. Of course we understand that genuinely green technologies need to be encouraged. However, we would suggest that if regulators and governments around the world genuinely want to have a positive effect on the environment, the subsidies given to green power need to be reconsidered into R&D, not power generation. Of course there are perfect places to harvest the power of the wind or sun; however, it is equally true that the currently available technology does not work as efficiently as gas solutions in much of the world. Let gas be the bridge to a greener future, and stop persecuting us because of our dirtier cousins, oil and coal.

**Partnership at the heart of our industry**

Gas has a near unique status in the global industrial economy. Due to the inherent nature of the industry, market and the commodity itself, it demands total commitment to two intertwined concepts: partnership and flexibility.

We have to work together. Success is therefore driven by long term partnership. Of course there will always be tensions between parties, but our positive experience is that we are successful when our partners are successful. It is through this spirit of competitive partnership that I hope the international gas industry will continue to go from strength to strength.

*Alexander Medvedev is the Deputy Chairman of the Management Committee of OAO Gazprom and Director General of Gazprom Export.*

# News from Organisations Affiliated to IGU

*Here we have reports from the European Gas Research Group (GERG), Gas Technology Institute (GTI), International Group of LNG Importers (GIIGNL), International Pipe Line & Offshore Contractors Association (IPLOCA), NGV Global, NGV Europe and Russian National Gas Vehicle Association (NGVRUS).*

## Innovation for Europe's Energy Future

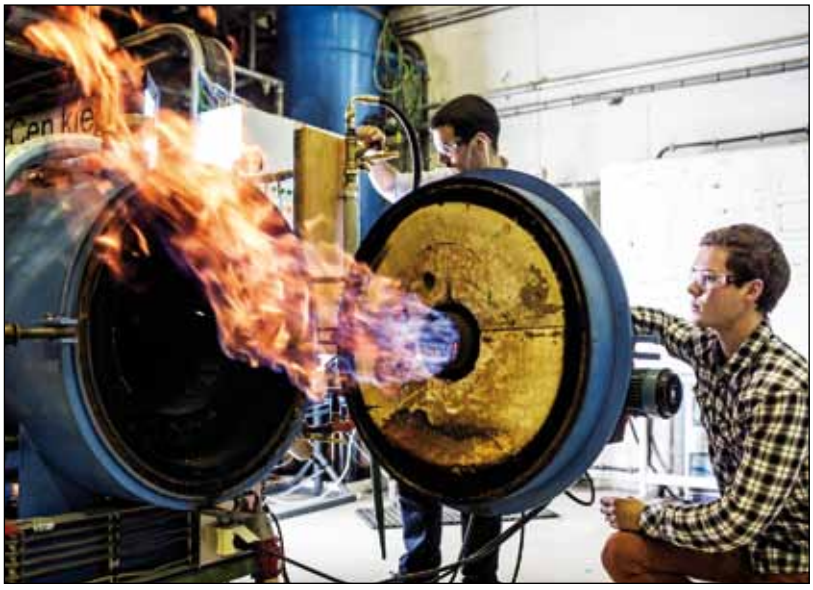
*By Robert Judd*

GERG, the European Gas Research Group has been part of the European gas industry picture for over 50 years now, celebrating its 50th anniversary in 2011.

In that time it has witnessed huge changes in the industry. The last decade in particular has seen a transformation with few if any of the original industry giants standing still, and a slicing of the old vertically integrated gas companies into a much larger pack of leaner more focused companies, each concentrating on a part of the gas chain. Along with these changes, mergers and acquisitions and deregulation have led to many gas companies becoming multi-utility players, energy rather than gas companies.

The world of energy is becoming more complex, and the old rules no longer apply. This is as true for research and innovation as it is for the business models of the industry. The gas industry can no longer be seen as mature – we need to work alongside renewables, address the challenges of decarbonisation and harmonisation, and fit a whole new portfolio of unconventional resources into our strategic planning.

The impact on organisation and funding of research and innovation in the gas industry has been marked. GERG has had to evolve and move with the times in order to say relevant and determine where best to add value to its members.



▼ GERG is developing links with organisations outside the gas industry such as universities through the new membership tier, Friends of GERG.

### *GERG is growing*

The good news is that GERG is growing. From an original membership of five major integrated gas companies, GERG membership now numbers 29, with five of these members having arrived in the last year alone. Additionally, GERG now has a new membership tier, introduced around a year ago, Friends of GERG (FoG). This enables the organisation to bring in interests whether academic or industrial from outside of Europe's gas industry. Indeed, the borders of Europe are no barrier to acceptance for a new Friend of GERG. The FoG initiative is intended to renew and broaden the level of expertise and knowledge within GERG, and recognises that in an increasingly collaborative energy world, innovating means to learn from as many sources as possible. FoGs can attend GERG technical or Programme Committee meetings,

can propose projects, and can join projects. We hope to see many more FoGs in the GERG fold over the next few years.

### *Programme Committees – the heart of GERG*

GERG currently organises its activities around five Programme Committees which meet twice a year and are open to all members. These Committees propose and develop R&D and technology based projects owned and delivered by the members who join the projects. The Programme Committees are: General (fundamental) Studies; Transmission and Storage; Distribution; Utilisation; and the recently added LNG. Programme Committee Leaders now work closely together to develop and communicate the increasing number of cross-cutting issues that are resulting from the shifting priorities of our increasingly connected energy scene.

The collaborative R&D projects which emerge from our Programme Committees are the life force of GERG, and the portfolio has ranged in value from around €10 million to around €40 million, drawing leverage from European initiatives such as the Framework R&D Programmes and in the future from the Horizon 2020 Programme recently launched in Brussels. In the future we also expect to see increasing linkage of our Programmes with those of other energy R&D based initiatives in Europe and beyond.

### *The challenges*

While the gas and energy industries in Europe have undergone big changes, so GERG cannot stand still as it continues to support the interests of its members.

Challenges include:

- How do we continue to provide the collaborative research and innovation needs of an ever broader membership?
- How do we continue to leverage R&D funds at the level required to make a difference when internal R&D budgets are being squeezed?
- How do we address the changing technical priorities of the industry against an increasingly complex backdrop of the European energy transformation?
- How do we demonstrate the value of gas technology innovation in enabling Europe to meet its targets for a future low carbon energy system?

In addressing these challenges, we see big opportunities for GERG. With an increasingly segmented European gas industry, we believe that GERG can provide a glue, pulling together research interests which cut across the different segments of the industry, and at the same time show how the gas industry can play a role in all our energy futures. To this end we are working closely with stakeholders in Brussels and beyond to demonstrate that without gas technology and innovative solutions which link the gas and broader energy infrastructures, the success of the energy transformation is substantially less likely and substantially more expensive.

A notable example of this work is the GasNaturally initiative, in which GERG is working with Marcogaz, Eurogas, OGP, GIIGNL, GIE and of course IGU to illustrate that gas is the ideal partner to renewables, and can indeed

▼ Gas infrastructure has huge energy storage capacity and one of GERG's projects has been a power-to-gas research roadmap.

"make a clean future real". GERG is also working closely with the European Commission on a variety of fronts. It has recently provided gas industry input, along with Marcogaz, to the Commission's forthcoming Integrated Roadmap for Energy Technologies, which will define a new Strategic Energy Technology (SET) Plan for the 2030 Energy Framework.

### *A new Secretariat, a new branding*

In the second half of 2012, GERG saw the retirement of Dave Pinchbeck the Secretary General, after 16 years of excellent service, and my appointment as his successor. I was previously with the GL Group and Advantica. I am now working closely with the President, David Salisbury of National Grid, the Board and with all our friends and stakeholders to continue the good work Dave started, and to try and ensure that GERG stays aligned with the needs of the industry.

The end of 2013 saw the launch of a new GERG website and the start of a rebranding which is illustrating how GERG is moving forward. In the background the GERG Board is developing a new Strategic Roadmap, which will better equip the organisation to meet the challenges of the future, and new ways of driving project lifecycles to improve the relevance and dynamics of the GERG output.

▸ GERG has launched a new logo and website.

In summary, the collaborative approach on which GERG has built its legacy is, if anything, more important now than at any time in the past. The challenge GERG is addressing is how to build even more effective collaboration in innovation across a broader gas industry, and alongside a complex energy community.

*Robert Judd is the Secretary General of GERG (www.gerg.eu.).*

## Gas-to-Liquids Solutions to Monetise Natural Gas Resources

*By Vann Bush*

Global demand for power, hydrogen, liquid fuel and chemical production is rising in parallel with increasing access to low-cost natural gas resources, providing new market opportunities. North America is experiencing growing interest in technologies to use the newfound abundance of unconventional natural gas. Around the globe, managing the logistics and environmental implications of associated gas is critical. Small-scale gas-to-liquids (GTL) plants are being considered to help producers monetise natural gas resources. The technology can take the unwanted associated natural gas that is usually flared and transform it into more valuable liquid products, as well as enable production of stranded gas reserves where distribution infrastructure is lacking.

Gas Technology Institute (GTI) is exploring the potential of innovative technology to make GTL a feasible technical and economic option at scales in the range of 1,000 to 10,000 barrels of liquid per day. Laboratory and pilot projects are evaluating thermochemical and electrochemical conversion pathways. Innovations in reforming methane to make syngas (a mix of CO and $H_2$), processing syngas, converting syngas into liquid fuels, and directly converting methane into liquid hydrocarbons are all being tested by GTI technologists.

For example, GTI is making solid progress on two cutting-edge projects funded by the US Department of Energy (DOE) through Advanced Research Projects Agency-Energy (ARPA-E) grants, which are concentrated exclusively on transformative technologies.

### *On-site power and liquid fuel from stranded or low-value natural gas*

GTI's partial oxidation gas turbine (POGT) technology is being developed as part of a GTL process. GTI is collaborating with Aerojet Rocketdyne, the prime contractor on this pro-

Aerojet Rocketdyne's compact gasifier is a central element in a new GTL application under development.

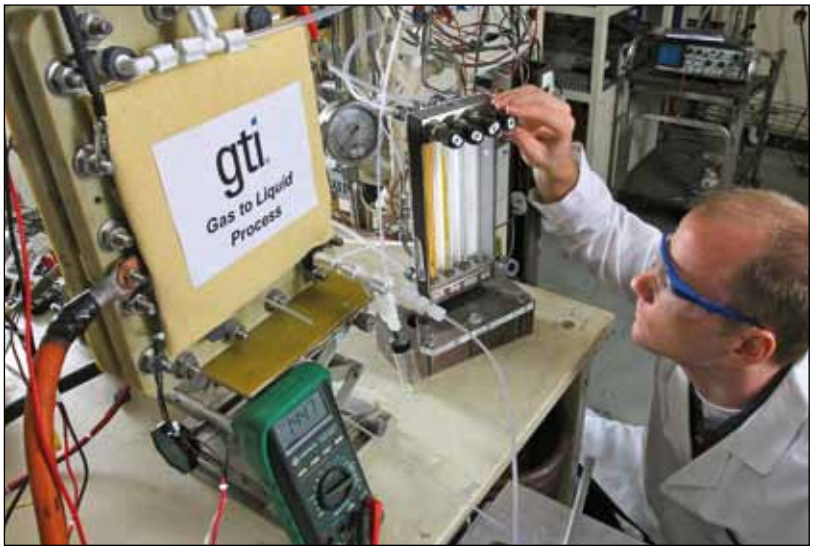
ject, to modify and test their compact gasifier to operate as a high-temperature, high-pressure natural gas partial oxidation reactor that would be combined with an advanced turbo-expander being designed for this application.

GTI has performed systems testing on the partial oxidation reactor system and economic evaluations on the entire GTL system. The test results show efficient, direct production of syngas with the correct 2:1 ratio of hydrogen and carbon monoxide for liquids synthesis, and with lower steam demand than conventional methane reformers. Both results are favourable to process economics.

The turbo-expander is a unique component that leverages Rocketdyne's capabilities from their space programme experience to design rotating equipment that expands the volume of the syngas to lower the temperature for fuels synthesis, while also generating electric power.

Because the method produces both power and liquid fuel, it is an attractive option for associated gas now flared in oil production fields (including offshore platforms). In addition, the economic assessments also suggest that it has promise in other applications where power off-take is available. The amount of co-produced power can be controlled, allowing for flexibility as electricity demands change. Modular equipment will allow the size of the process plant to be tailored to match the amount of natural gas at the on-site location, minimising the plant footprint.

Metal oxide catalysts are being continuously regenerated in a battery-like reactor to convert methane into methanol and hydrogen.




### *Creating methanol at low cost and low energy*

Methanol is one of the 25 top chemicals produced worldwide; it is the main feedstock for the chemical industry, and is a source of dimethyl ether (DME), which can be used for transportation fuel. With the dramatic expansion of unconventional natural gas supplies in recent years, methane is abundant but under-utilised as a precursor for chemicals and liquid fuels because of difficult transportation logistics.

Conventional methanol production is a two-step process: steam reforming methane at high temperatures using a Fischer-Tropsch reaction, followed by a high-pressure reaction of the reformate hydrogen and CO with a catalyst at high temperature. The efficiency is 50-65% depending on waste heat recovery.

Under ARPA-E funding, GTI is developing a new low-temperature process to convert natural gas or methane-containing gas into methanol and hydrogen for liquid fuel or chemicals production. The new process being created by GTI uses metal oxide catalysts that are continuously regenerated in a reactor that is similar to a battery. Using metal oxide catalysts reduces the energy required during the conversion process. The process is more efficient and less capital-intensive than current approaches and has the added benefit of operating at room temperature.

Results to date have been very positive. The combustion efficiency of the whole process is 83% and the carbon efficiency is 90%. Long-term tests for 1,000 hours plus system design and testing are planned, with production levels in a prototype system anticipated at a gallon per day.

### *GTI: Converting abundant resources into high-value products*

Initiatives at GTI are focused on extracting the most value from natural resources, and our extensive background in thermochemical and electrochemical conversion, gas processing, systems development and techno-economic analyses supports our efforts. The combination of key competencies and facilities are being directed at the technical and economic challenges of GTL at less than 100,000 barrels/day, multi-billion-dollar capital scale. Meeting these challenges with technical innovation is feasible and results are already showing real promise. GTI will continue to address the issues and reduce the technical and market risks of tomorrow's GTL solutions.

*Vann Bush is Managing Director of Energy Conversion at GTI. For more information, contact him on +1 847 768 0973, vann.bush@gastechnology.org or visit www.gastechnology.org.*


▲ GTI is developing technology to make small-scale GTL a feasible technical and economic solution.

## Earthquake Lessons for the LNG Community

*By Secil Torun*

The Technical Study Group of the International Group of LNG Importers (GIIGNL) has published a study on the impact of earthquakes on LNG facilities. This aims to complement feedback on the topic from a number of companies.

Available on the GIIGNL website (www.giignl.org), the study highlights some important lessons learned by the LNG community in the form of three key statements that are explained and justified in appendices. The feedback clearly differentiates the effects of earthquakes from the effects of tsunamis.

The study includes the magnitude 9.0 earthquake which occurred on Friday, March 11, 2011 off the Pacific coast of Japan. It was one of the largest earthquakes ever to hit Japan and the fourth most powerful ever recorded worldwide in modern times.

### *Key statement 1*

Earthquakes, even very large ones, have never led to major accidents at LNG facilities.

Lessons learned:

- Even for the largest earthquakes, only minor damage to LNG facilities was observed.
- LNG facilities are able to withstand earth-

quakes as long as an adequate seismic design is in place.

- Current seismic design standards include adequate safety margins.

Possible improvements for the LNG community / further work to be performed:

- The LNG community could benefit from a shared review of seismic design practices.
- A more detailed investigation should be performed on the behaviour of the various types of equipment.
- It is important to review local regulations, standards and fitness for service of the seismic design every time a large earthquake resulting in serious damage occurs.

*Table 1* shows damage to LNG facilities caused by major earthquakes around the world.

### *Key statement 2*

Pile foundation for essential facilities is an effective countermeasure against tsunamis.

Lessons learned:

- Great damage can be caused when a tsunami hits the pedestal foundation of LNG facilities and scrapes away ground just below the pedestal.
- The foundations are generally designed from the viewpoint of seismic rather than tsunami impact. However, it is recognised that pile foundation is an effective countermeasure in terms of tsunami.

### *Key statement 3*

Resistance to tsunami is greatly improved by avoiding submergence of electric/system equipment (including spare facilities) through water tightness and/or adequate foundation level.

Lessons learned:

- Buildings to store electric/system equipment shall have water tightness and/or the foundation level of electric/system equipment shall be raised above the height of tsunami.
- Spare facilities of electric motors etc. should be prepared and stored above the height of tsunami.

Table 1.

**Damage to LNG Facilities Caused by Major Earthquakes**

| *Type* | *Earthquake name* | *Terminal* | *Description* | *Typical damages on facilities* |
|---|---|---|---|---|
| Very large earthquakes | Japan 2011 | Minato LNG | Magnitude: 9.0<br>Peak ground acceleration (PGA): 615gal (0.615G) | Relaxation of tie rod of gas holder. |
| | Japan 1995 | Senboku | Magnitude: 7.3<br>PGA: 818gal (0.818G) | Sinkage of some small basement due to liquefaction. |
| | Chile 2010 | GNL Mejillones | Magnitude: 8.8<br>PGA: 780gal (0.78G) | No damage. |
| | | GNL Quintero | Magnitude: 8.8<br>PGA: 780gal (0.78G) | Slight damage to one cargo unloading arm (re-adjustment of the counterweight plates required). |
| | Alaska, USA 1964 | Kenai | Magnitude: 9.2<br>PGA: N/A | LNG facilities not yet operational. |
| Large earthquakes | Chile 2012 | GNL Quintero | Magnitude: 6.5 | No damage. |
| | Alaska, USA 2011 | Kenai | Magnitude: 6.8<br>PGA: N/A | No damage. |
| | Italy 2009 | GNL Italia La Spezia | Magnitude: 6.3<br>PGA: N/A | No damage. |
| | | GNL Italia Rovigo | Magnitude: 6.3<br>PGA: N/A | No damage. |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**Damage to LNG Facilities Caused by Major Tsunamis**

| *Tsunami/Year* | *Terminals Affected* | *Description* | *Damage to Facilities* |
|---|---|---|---|
| Japan 2011 | Minato LNG | Approximately 4m and over above usual tide level | Facilities supported by pile foundation were not damaged. On the other hand, facilities such as small-diameter piping unsupported by pile foundation were greatly damaged, but the damage did not cause LNG leakage. |
| Sumatra 2004 | Senboku | Approximately 1m above usual tide level | No damage to facilities. |
| Chile 2010 | GNL Mejillones | Approximately 0.5m from usual tide level | No damage to facilities. GNL Mejillones took the decision to disconnect and send the ship far away from the terminal. |

Table 2.

Possible improvements for the LNG community / further work to be performed for key statements 2 and 3:

- The LNG community could benefit from sharing methods to assess the likelihood of a tsunami striking a facility.
- Practical design of relevant foundations for tsunami mitigation should be discussed for facilities in areas where a large tsunami can occur.

*Table 2* shows damage to LNG facilities caused by major tsunami around the world.

## Conclusion

Despite the fact that very large earthquakes have hit areas where LNG facilities are located, no severe damage to such facilities was found, which verifies that the current seismic design standards are adequate (in Japan, Chile, the USA and Italy).

On the other hand, in locations where large tsunamis are likely to occur, specific countermeasures should be considered in the design of LNG facilities in order to avoid gas outages.

*Secil Torun (GDF SUEZ) is the Chair of GIIGNL's Technical Study Group which prepared the study with the assistance of Makoto Yamada (Tokyo Gas).*

## IPLOCA Convention 2013

*By Najib Khoury*

More than 650 delegates attended IPLOCA's 47th Annual Convention which was held in Washington DC, USA, September 23-27, 2013.

During the Convention the Association elected its Board of Directors for 2013 to 2014. The following were named to positions on the Board:

### *Officers*

*President of IPLOCA and Director for Middle East & Africa:* Najib Khoury (CCC)

*1st Vice President and Director for Europe Mediterranean:* Jean-Claude Van de Wiele (Spiecapag)

*2nd Vice President and Director for East & Far East:* Atul Punj (Punj Lloyd Group)

*Treasurer and Director for Europe Central:* Harald Dresp (Max Streicher)

*Immediate Past President:* Doug Evans (Gulf Interstate Engineering)

### *Regional Directors*

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Marco Jannuzzi (Caterpillar)
Wilhelm Maats (Maats Pipeline Equipment)
Bruno Maerten (GEOCEAN)

On the evening of the final banquet Greg Miller of Pipeline Inspection was the lucky winner of a car, courtesy of Volvo Construction Equipment and Renault Trucks. Lottery funds of more than $20,000 were raised for Crossroads School, Houston, Texas, which serves students with learning differences.

Guest speakers provided presentations at the Open General Meetings as follows:

- Richard Norton Smith, Presidential Historian: *Presidents, not Pipelines*
- Willie Watt, General Manager for Pipeline Bundles, Subsea 7: *Pipeline Bundles*
- Alan D. Quilley, President, Safety Results Ltd: *Leading and Lagging Indicators – Evolution of Health & Safety Measurement*
- John Attrill, Project General Manager, BP: *Southern Corridor*
- Stephen Moore, Wall Street Journal: *Is America on the Comeback?*
- Suzanne Minter, Manager Crude and Natural Gas Analysis, Bentek Energy: *The Butterfly Effect of North American Shale Development*
- Loek Vreenegoor, General Manager Pipelines,

▲ Tony Vervest (*left*) and Mark Bumpstead (*third left*) of Nacap Australia were presented with IPLOCA's Health & Safety Award by Mark Rand (*second left*) and Bruno Maerten (*right*).

Flow Assurance & Subsea, Shell: *Are Our Pipelines Smart Enough?*

Three awards were presented during the Open General Meetings, as follows:

### *IPLOCA Health & Safety Award, sponsored by Chevron*

The award was presented by Mark Rand of Chevron and Bruno Maerten, Chairman of the IPLOCA HSE Committee to Nacap Australia, in recognition of their work producing the "Code Safe" video. Also recognised as runners up, were Max Streicher for the "Safety Matters to Everyone" initiative, McConnell Dowell and CCC Australia JV for "Game On" and Spiecapag for "Engaging Everybody".

### *IPLOCA Corporate Social Responsibility Award, sponsored by Total*

This award was presented by 2012-2013 IPLOCA President Doug Evans and Bruno Maerten, Chairman of the IPLOCA HSE Committee to Heerema Port Amboin for their support of REMAR, an organisation to help orphans, homeless and addicted youth in Angola. Two runners up were also recognised: Spiecapag, for "Employment and Site Work Skills Management" and Welspun for their "Global Commitment to Corporate Social Responsibility".

### *IPLOCA New Technologies Award, sponsored by BP*

John Attrill of BP and 2012-2013 IPLOCA President Doug Evans, Chairman of the New Technologies Committee, presented the award to Herrenknecht, in recognition of their "Pipe Express", a new method for environmentally friendly and economic installation of pipe. Two runners up were also named: Applus RTD for "IWEX 3D" ultrasonic testing and Laurini Officine Meccaniche for three innovative machines.

The IPLOCA 2014 Convention – the 48th annual – will take place in Abu Dhabi, UAE, October 13-17.

*Najib Khoury of CCC is the President of IPLOCA (www.iploca.com).*

## Natural Gas Fuels Clean Marine Transportation

*By Diego Goldin*

When Alicia Milner, NGV Global's Chairperson wrote about new demand for natural gas in non-traditional markets in the last issue of *International Gas*, she focused on the upstream sector of the oil and gas industry. Here we look at the marine sector.

The "Age of Gas" has embraced shipping activity, where energy suppliers and shippers are joining efforts to use LNG to meet new emissions limits for marine engines. The news website Bloomberg quoted Mike Hosford, GE's General Manager for Unconventional Resources as saying: "We truly believe the age of gas is here. The industry needs bigger players to step in and start helping to build out the infrastructure". GE is evaluating five locations in the US, and the company considers that the country will need another 50 to 100 small-scale plants for ships, trains, mining and trucks by 2025.

While the US already has about 60 small-scale liquefaction plants, none of them are close enough to water for ships to use, according to California-based Clean Energy, an NGV

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The LNG-fuelled barge Greenstream started operations on the River Rhine in 2013.

Global corporate sponsor. That will change when, together with consortium partners GE and Ferus Natural Gas Fuels, a Calgary-based supplier, Clean Energy builds an LNG fuelling terminal on the St Johns River in Jacksonville, Florida.

The increasing number of LNG-fuelled vessels obviously needs the appropriate infrastructure for bunkering the new fuel. Companies like Clean Energy, Galileo, GE and Shell will supply part of the solution, and complement other facilities being built in ports where LNG is already available.

Shell said in March 2013 that it is planning LNG plants for North America's Great Lakes and Gulf Coast, able to supply fuel for vessels using all five Great Lakes, the Mississippi River and Intra-Coastal Waterway as well as to those operating offshore in the Gulf of Mexico.

In Europe, Norway pioneered LNG-fuelled shipping. The ports of Stockholm and Amsterdam offer LNG bunkering and the Shell-chartered Greenstream was the first vessel to use the latter in December 2013. Rotterdam is set to open its first LNG bunker station in the summer of 2015.

An EU-funded study is underway to analyse the potential introduction of LNG infrastructure in Spain and France, and the ports of Antwerp and Zeebrugge signed a Memorandum of Understanding last November to facilitate the supply of LNG to the shipping trade. Meanwhile, Bomin Linde LNG is planning to construct LNG bunker terminals in Hamburg and Bremerhaven.

In Asia, the Port of Singapore has commenced investigations into establishing LNG bunkering operations.

"It used to be said that LNG was a chicken or egg problem," says Paal Johansen, who leads DNV GL's maritime business in the Americas, "but now it is looking as if we not only have the egg, but the chicken and the henhouse too."

### *A new paradigm*

A new LNG-on-demand modular system developed by another NGV Global corporate sponsor, Argentina-based Galileo, offers an alternative form of infrastructure. Cryobox is an LNG production nano station designed so that private industry and communities can become their own LNG suppliers. South American

operator Buquebus has adopted this system for refuelling its fast ferry, the *Francisco*. Named after Pope Francis, the ferry makes two daily trips between Buenos Aires and Montevideo. It is the world's first passenger roll-on/roll-off ship powered by gas turbines.

According to Galileo, modularity contributes to the feasibility of many projects, since it is possible to avoid unnecessary infrastructure costs in the preliminary stage, minimising financial risk and the cost per unit volume produced. Demand can be matched by the progressive addition of modules: Buquebus ordered seven Cryobox units with a production capacity of 84 tons/day, more than enough to supply the Francisco's current consumption of 66 tons/day.

This project can be considered as a change of paradigm, since it is the first time that a sea transportation company has become a self-supplier of a fuel, which is in turn the environmentally cleanest alternative. According to Anibal Argomedo, Buquebus Technical Manager, the use of LNG reduces combustion emissions by 98%, in marked contrast to traditional fuels.

Buquebus evaluated different technologies for the project, also giving consideration to a mini LNG plant. The differences in capital invstment and operating costs were persuasive: the use of a nano LNG production station allows savings of 50% Capex and 40% Opex per annum.

"The fact that long-haul trucking, rail and marine transport industries can operate on LNG radically changes the cost structure for distribution networks," says Osvaldo del Campo, Galileo's CEO, who envisages a broad uptake of natural gas based on an affordable refuelling infrastructure.

### *Growing number of LNG vessels*

According to DNV GL, in September 2013 there were 42 LNG-fuelled merchant vessels (excluding LNG carriers and inland waterway vessels), most being small ferries and vessels that shuttle supplies to offshore oil platforms. In 2013, seven new LNG-fuelled ships entered service, the latest one being the Francisco for Buquebus. Although some tankers hauling LNG in world trade have long used boil-off gas as a supplementary fuel, the first LNG-fuelled merchant ship was a Norwegian ferry built in 2000 and it is still in service.

Forty new LNG-fuelled ships and two conversions are on order, scheduled for delivery in the next three years. By 2020, DNL GL has forecast that the LNG-fuelled fleet could reach 1,000 vessels.

The biggest vessels ordered so far that are powered primarily by natural gas are two container ships for delivery in 2015 and 2016 for TOTE Inc., which runs services between the continental US and Puerto Rico and Alaska.

"Within the next five to 10 years, LNG will become the main fuel source for all marine transportation," says Anthony Chiarello, TOTE's President and CEO. "It's going to catch on. When those ships are actually plying the seas and people are then able to calculate the emissions impact and the possible cost savings, they can do that entire math and say, 'This is really a good decision.'"

Chiarello's words substantiate those of Han-Jeong Kwak, CEO of Korean shipbuilding company SPP, who told DNV in 2011: "Despite all


▼ Galileo has developed Cryobox, a new LNG-on-demand modular system.

▲ The LNG-fuelled passenger and vehicle ferry *Francisco* has a top speed of 58.1 knots (over 107 km/h).

the cost barriers and problems in establishing LNG bunkering infrastructures, the LNG fuel era is just a matter of time."

Last year, United Arab Shipping Company (UASC) ordered five 18,000 TEU and five 14,000 TEU containerships from Hyundai Heavy Industries with the capability to switch to LNG when infrastructure allows. According to Seatrade Global, UASC is planning an LNG bunkering station in the Middle East for refuelling on outbound and inbound legs of the Asia-Europe trade route.

Two LNG container ships have been ordered by US carrier Crowley Maritime Corporation; they will be built at VT Halter Marine Inc. and are being designed in cooperation with MAN and TGE Gas. They are set for delivery in late 2016. The crucial aspect of the design of these two ships is that the LNG tank, which can hold 2,400m³ – corresponding to two weeks of sailing – is located below deck and that the tank does not take up more than 5% of the ships' total container capacity.

Another ship owner, Matson has decided to move forward with the construction of two new Aloha class 3,600 TEU containerships at Aker Philadelphia Shipyard. Designed for service between Hawaii and the West Coast, the vessels will feature dual-fuel engines and hull forms optimised for energy efficient operations.

Harvey Gulf International Marine, a New Orleans-based operator supporting offshore drilling in the Gulf of Mexico, has ordered six LNG-fuelled platform support vessels and is building a fuelling terminal in Port Fourchon, Louisiana.

LNG could also become the future fuel for Maersk Line which is negotiating with Gazprom as a potential supplier.

A groundswell of momentum is building in the US and elsewhere around the use of LNG as marine fuel as owners, ports and regulators have realised the benefits of this emerging technology.

At the request of our members NGV Global has become increasingly involved in exploring the synergies between marine and land-based natural gas fuelled transportation, particularly in the areas of standardisation and regulatory matters.

*Diego Goldin is the Executive Director of NGV Global (www.ngvglobal.com).*

## 2013 Blue Corridor Rally Showcases Benefits of NGVs

*By Matthias Maedge*

The Blue Corridor NGV Rally 2013, held between October 3 and 19, highlighted the virtues of the transportation fuel of the future: natural gas. Sponsored by Gazprom and E.ON, gas-powered trucks, light-weight vehicles and buses travelled for 16 days through nine European countries, following the old Hansa trade route. The rally made a 4,000km circuit from St Petersburg, Russia with stops in Finland, Sweden (the sector between Turku and Stockholm was by ferry), Denmark, Germany, Poland, Kaliningrad (Russia), Lithuania, Latvia and Estonia.

Beside the motorcade of clean, low-cost vehicles the rally also featured valuable round-table discussions, in which local NGV market players, politicians, experts, business represen-

▲ Some of the participants in the 2013 Blue Corridor Rally are pictured during a stop in Dziwnow, Poland.

tatives, sponsors and other stakeholders discussed the benefits and market prospects for the use of natural gas as a fuel for road and maritime transport. Moreover, the events provided unique opportunities to inspect innovative NGVs on display.

The Blue Corridor Rally kicked off on October 3 with a launch ceremony at a Gazprom Neft multi-fuel filling station in St Petersburg. Surrounded by regional authorities, representatives from Gazprom Export, E.ON and Gazprom Gazomotornoe Toplivo, as well as guests from the energy and automotive sectors, Eugene Pronin, a specialist with Gazprom Export and a director of NGVRUS, told audiences that natural gas in the transportation sector "is a relevant topic for the entire world for the simple reason that transport emissions do not know national borders".

### *Rally stop in Hamburg emphasises benefits of LNG shipping*

As the 15 vehicles of different types on display outside the Hamburg roundtable showed, Germans have recognised the benefits of LNG and CNG in transport, and so auto manufacturers have responded to the resulting demand. Germany is a leader in the NGV market, with more than 920 fuelling stations and more than 100,000 NGVs in use. The rally stop in Hamburg was supported by NGVA Europe which invited Antonio Tricas from the European Commission's Directorate General for Mobility and Transport (DG MOVE), as keynote speaker for the event. Mr Tricas informed the audience about the Clean Power for Transport package, which aims to facilitate the development of a single market for alternative fuels for transport in Europe,

▼ Matthias Maedge (NGVA Europe), Antonio Tricas (DG MOVE) and David Graebe (Gazprom Germania) in front of a VW Scirocco CNG rally car during the stop in Hamburg.

including minimum binding targets for CNG and LNG road filling stations and LNG bunkering for shipping.

Furthermore, Dr Markus Baum with Daimler Trucks, Manfred Kuchlmayr of Iveco, Nadege Leclerq from Westport and Dr Stefan Schmerbeck of Volkswagen told audiences of their companies' plans to increase and improve their NGV offerings. This is because, as Timo Vehrs, Head of Business Development at Gazprom Germania, said, companies and consumers alike are coming to understand that "natural gas in transport is ready for daily use". Vehrs predicted that as personal mobility, "one of the mega trends of the 21st century", expands, so will NGV use, because natural gas is easily available and cars running on it are technically mature and offer a variety of speeds, models and engine classes.

The conversation focused on commercial use of NGVs and a new, innovative use of LNG in transport: shipping. The discussion of LNG in shipping – led by Igor Maynitskiy, Gazprom Export; Jan Tellkamp, DNV GL; Dr Richard Schröder, Bomin Linde; Michael Kraack, Marine Service; and Werner Gliem, Logistik-Initiative Hamburg – was particularly relevant in the port city of Hamburg, where 30% of pollution from shipping is from diesel engines. This is one area of the NGV market where Germany falls behind; Tellkamp noted that Norway, Poland, Sweden, Belgium, The Netherlands and Luxembourg already use LNG bunkering.

### *Considering the results*

Altogether the Blue Corridor NGV Rally 2013 featured 25 new passenger cars, commercial vehicles, municipal trucks, long haul tractors and buses from a broad range of European manufacturers: BMV, Fiat, Ford, Iveco, KAMAZ, LIAZ, MAN, Mercedes-Daimler, Opel, Scania, Volkswagen and Volvo. After the rally came to a close and returned to St Petersburg, the organisers summed up the encouraging results.

"The Blue Corridor experience shows that it is already possible today to drive from the Urals to Paris and from the Baltic to the Adriatic and Black Seas with NGVs," said Andre Schumann, Head of Business Development at E.ON. "We thank all actors in the Blue Corridor Rally 2013: Hansa; everything went perfectly well," applauded Eugene Pronin.

### *Background*

To demonstrate the benefits of the use of natural gas as fuel, Gazprom and E.ON, together with around 20 local gas companies, as well as vehicle manufacturers, organise the Blue Corridor Rally. Held for the first time in 2008 and supported by IGU, the 2013 edition gathered NGVs for a tour around the Baltic Sea. Blue Corridor was developed to encourage the establishment of the natural gas fuelling infrastructure needed to create a natural gas highway across Europe. This infrastructure – especially the construction of a sufficient number of natural gas filling stations and the transport of the fuel to them – will empower more drivers and fleet owners to purchase NGVs by assuring that they can drive them anywhere.

*Matthias Maedge is the Deputy Secretary General and EU Affairs Director of NGVA Europe (www.ngvaeurope.eu).*

## The Russian NGV Revolution

*By Eugene Pronin*

Set up in 1999, NGVRUS is the regional professional union of political, public, scientific and business institutions related to the use of gas as a transportation fuel in Russia and neighbouring countries. NGVRUS brings together over 40 equipment manufacturers, CNG, LNG and LPG suppliers and end users from Belarus, Germany, Poland, Russia, Switzerland and Ukraine. As a regional NGV association, NGVRUS is represented in a number of international organisations, including IGU, the UN Economic Commission for Europe,

Russia is expanding its NGV fuelling infrastructure: a CNG filling station in Gorno-Altaisk.

European Business Congress, NGV Global and NGVA Europe.

In 2013, the Russian NGV market witnessed dramatic changes as the President, Vladimir Putin, and Prime Minister, Dmitry Medvedev, focused on the national NGV strategy. New targets were set specifying that up to 50% of municipal vehicles should switch to natural gas by 2020. The 50% target is for cities with populations of more than 1 million people. The target for cities of between 300,000 and 1 million people is 30% and for those with over 100,000 people it is 10%.

These changes, according to Gazprom Gazomotornoye Toplivo (Gaztop) – a subsidiary of Gazprom responsible for NGV fuel production and sales – will save $2.7 billion in fuel costs per year. Some $1.5 billion of the savings will come from the passenger sector, $1 billion from the service sector and $180 million in agriculture.

### *The scope*

There are 164 cities in Russia with populations exceeding 100,000; in total, these cities are home to some 70 million people – half of the national population. According to NGVRUS, the challenging targets of the Russian government mean that municipal administrations have to acquire a minimum of 16,000 new CNG and/or LNG buses in the 2013-2015 timeframe. Usually a methane-fuelled bus is some 20% to 30% more expensive compared to a diesel one, and these extra costs were not allowed for in the local budgets of 2013 and 2014. So the federal government has voiced its readiness to subsidise the purchase of buses and other municipal vehicles such as garbage trucks and street sweepers.

The natural gas refuelling infrastructure in Russia will be developed mostly by private businesses. NGVRUS estimates that at least 5,000 natural gas filling stations are needed in the immediate future. This figure includes 3,700 CNG and 1,300 LNG stations.

### *The players*

Major players have repeatedly stated their willingness to invest in the development of natural gas filling infrastructure.


KAMAZ is the largest truck manufacturer in Russia and has an extensive NGV range.

Gazprom has allocated $450 million in 2013-2014 to build or renovate 300 filling stations in 31 regions of Russia, while Gaztop intends to build 2,000 filling stations by 2020. In the near future, Gaztop wants to increase sales of natural gas for transport to 1.5 bcm per year.

Meanwhile, Rosneft has declared it will spend $1.8 billion to build 1,000 CNG filling stations.

It is noteworthy that Sberbank – a leading banking institution in Russia – has committed to invest $650 million in the development of Russian natural gas refuelling infrastructure and raising public NGV awareness.

Methane-fuelled vehicles will be supplied by Russian and Belarussian OEMs (KAMAZ, GAZ Group, Volgabus and BELAZ) as well as by foreign companies who have established themselves in Russia: MAN Truck and Bus Rus, IVECO Russia, Volkswagen Group Rus, Volvo Vostok, Scania Rus, Liebherr Rusland and STORK.

A holding company, Concern Tracktor Plants has announced its intention to produce agricultural self-propelled vehicles powered by natural gas.

Russian Railways has tested a prototype and is planning a fleet of 40 LNG-fuelled locomotives.

The Russian Ministry of Industry and Trade will provide $2.5 million of funding for research in the field of unconventional fuels for aircraft. Natural gas will presumably be included in the contract.

The Ministries of Industry, Regional Development, Transport and Energy of Russia have been ordered to provide proposals on the modernisation, development and harmonisation of NGV-related regulations.

NGV market stakeholders have to propose encouraging economic incentives, including exemptions and reduced taxes and import duties on NGV-related equipment and facilities. The government is also investigating CNG retail pricing and intends to set an upper limit to ensure it does not exceed 50% of the cost of diesel.

*Eugene Pronin of Gazprom Export is a member of the Board of Directors of NGVRUS (www.ngvrus.ru) and the Chair of IGU's Working Committee 5 – Utilisation.*

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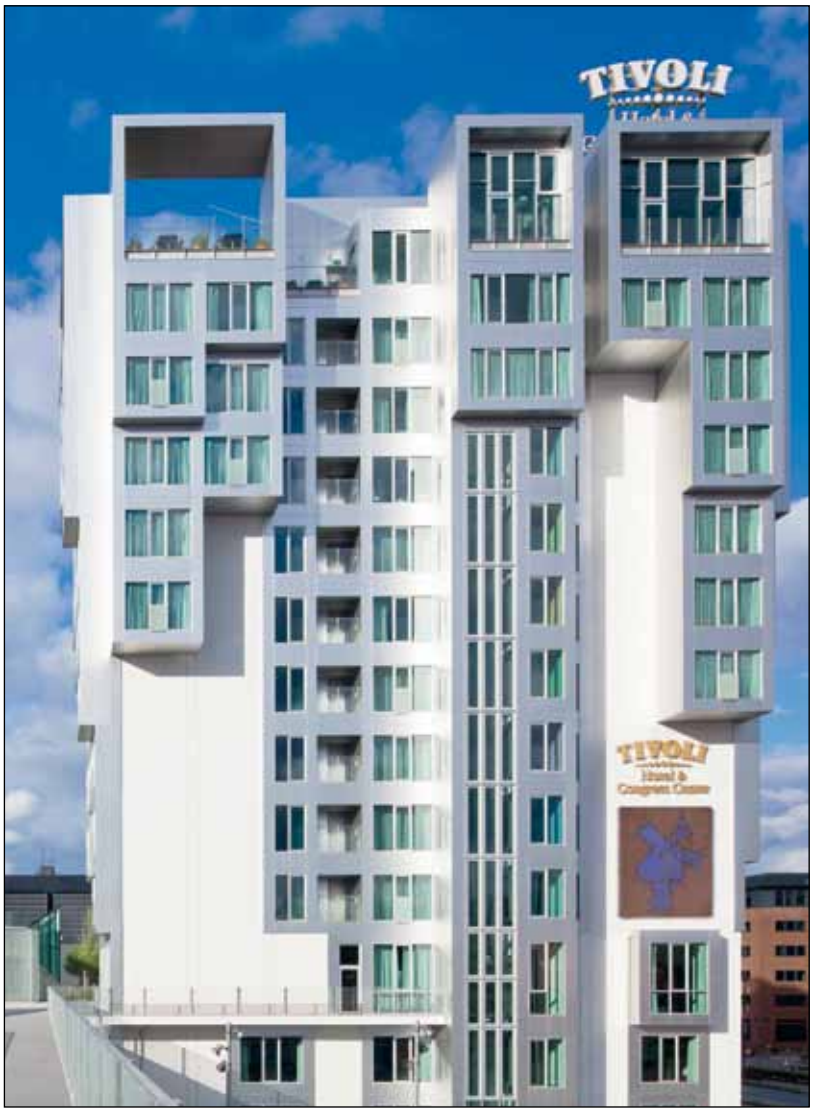
# IGRC2014 in Copenhagen Set to Be Biggest IGRC Ever

By Peter Hinstrup

IGU's next world-leading R&D event – IGRC2014 – takes place in Copenhagen, Denmark, September 17-19. The venue is the state-of-the-art Tivoli Congress Center in central Copenhagen and the conference is hosted by the Danish Gas Technology Centre (DGC).




▼ Copenhagen's centrally-located Tivoli Congress Center is the venue of IGRC2014.

All members of the IGU family and guests are cordially invited to join us for three exciting days focusing on *Gas Innovations Inspiring Clean Energy.*

Judging from the number of abstracts, IGRC2014 in Copenhagen may very well be the biggest IGRC ever.

## Call for papers sets all-time record

We have received a total of 772 abstracts from 44 countries. These are all-time records in the history of IGRC, which goes back to 1980 when the first conference was held.

Such impressive figures reflect the current high interest in gas technology as well as the understanding that gas will play an increasing role in the future energy mix, and that technology will be the key to the future business model for gas growth.

All the abstracts have been reviewed by members of the International Paper Committee established under the auspices of IGU. It has been a tough job for the committee members to score all abstracts and select the 332 papers that will constitute the IGRC2014 programme. Out of these, 92 papers will be presented in oral sessions/workshop sessions and 240 in poster sessions. All authors will be notified about acceptance of their paper by April 1.

You can read more about the conference programme on www.igrc2014.com.

## Opening plenary

The IGRC2014 opening plenary on Wednesday, September 17 will feature key energy figures from the Danish and global energy world:

Jérôme Ferrier, President of IGU, will give the opening speech on "The importance of R&D and innovation";

Martin Lidegaard, Danish Minister for Climate, Energy and Building, will welcome delegates to "Green Denmark";

Peder Ø. Andreasen, CEO of Energinet.dk, will talk about "Gas and power synergies in a clean energy future";

Ulco Vermeulen, Managing Director of Gasunie will chair a panel debate on "How innovations change the gas market".

We are also planning to offer delegates a cultural experience during the opening plenary when Harlequin and Columbine from the Tivoli Pantomime Theatre will perform the pantomime "Gas Innovations Inspiring Clean Energy". The pantomime will be specially created for IGRC2014 and will not be shown again elsewhere.

## Technology is the key to a growing gas market

As well as the opening plenary, IGRC2014 features three exciting plenaries discussing different aspects of the role of technology in the development of the future gas market:

"What is the business case for R&D?" chaired by Gerald Linke, Senior Vice President, E.ON, Germany;

"What could be the important technology game changers?" chaired by Jack Lewnard, Vice President, Chesapeake Utilities, USA;

"Important messages from the world of gas technology" chaired by Marc Florette, CEO, GDF SUEZ Research and Innovation, France and including a presentation by IGU Vice President David Carroll.

You can find more information about these plenaries on www.igrc.2014.com.

## Be an exhibitor at IGRC2014

In addition to the technical conference programme, IGRC2014 will feature an exhibition of advanced gas technology equipment and services from gas companies and manufacturers around the world.

The exhibition will give the delegates a unique opportunity to obtain a quick overview of important global gas technology issues – conveniently located at the Tivoli Congress Center under the same roof as the conference.

Exhibitors will be exposed to a group of highly motivated delegates representing both researchers and managers involved with technology development.

As a new feature IGRC2014 will also encompass an Innovation and Student Forum. This special low-cost exhibition forum is intended for small start-up companies, educational organisations, HR departments, etc. that have a

▼ IGRC2014 delegates will have the opportunity of visiting Avedøre power station.

special interest in communicating with students, venture entrepreneurs and organisations/ individuals dedicated to R&D. If you are interested in being an exhibitor you can find more information on www.igrc2014.com.

## Technical tours and programme for accompanying persons

There will be three technical tours on September 16, with the option of visiting Avedøre power station, Kløvermarken gasworks or a gas-fired heat pump installation, and we are also offering a very attractive programme for accompanying persons. The value-for-money package includes meals, special sessions and tours. For more information see the detailed programme on www.igrc2014.com.

Copenhagen – the capital of Denmark – is safe and pleasant. It is easy to get to from all over the world and easy to move around in. And Copenhagen is the ideal hub for visiting other parts of Scandinavia. Take the opportunity to combine IGRC2014 with a few days off in Wonderful Copenhagen with your accompanying person.

## Sponsors

IGRC2014 is supported by sponsors representing all parts of the gas industry from countries all over the world. We are most grateful for this support without which the conference would not be possible.

I look forward to seeing you in Copenhagen, September 17-19.

*Peter I. Hinstrup is the IGRC2014 Conference Director and an Honorary Member of IGU (pih@igrc2014.com).*

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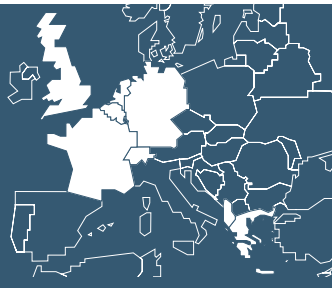

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# Gearing Up for the 26th World Gas Conference

By Daniel Paccoud

*The triennial World Gas Conference together with its exhibition is the most important and prestigious event held under the auspices of IGU. This is the third of a series of updates on preparations for the 26th World Gas Conference (WGCPARIS2015) which will take place in Paris, June 1-5, 2015.*

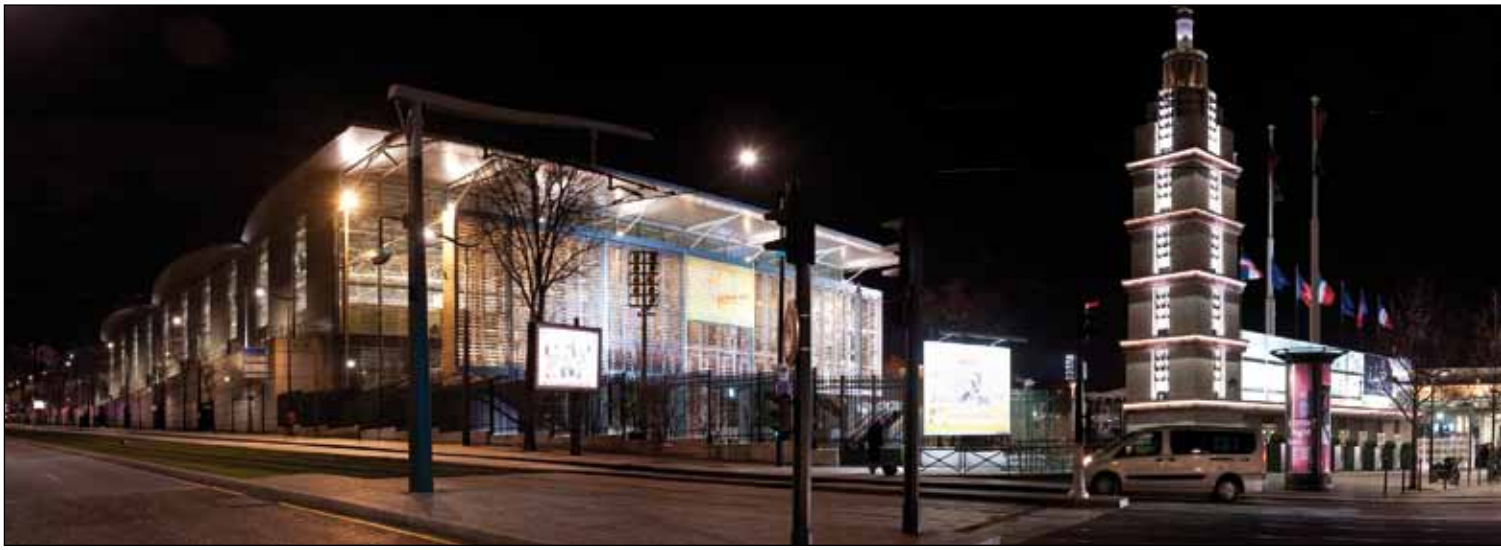
The role of natural gas is increasing in the global energy mix, now presenting a great opportunity for growing economies which are faced with the big challenge of fuelling development in an environmentally sustainable way. WGCPARIS2015 will be showcasing the latest developments in policies, strategies, technologies, challenges and opportunities in the global gas industry.

With the theme "Growing together towards a friendly planet", WGCPARIS2015 will drive discussions on hot topics like sustainability, renewables, the growth of natural gas and human capital, serving as a catalyst to shift the way the industry is perceived and how future developments are shaped.

▸ Daniel Paccoud, NOC Chair.

▸▸ Annie Louys, NOC Secretary.

The high quality of speakers, topical and comprehensive conference content, and the opportunity to network with industry leaders and experts in their fields, have consistently drawn the most influential delegations to the World Gas Conferences. Discussion and debate in Paris will engage more than 4,000 delegates, while the varied networking functions will offer conference participants the opportunity to meet and participate in industry developments that lead to business deals.



▾ The venue for WGCPARIS2015 will be the Porte de Versailles Convention Centre.

## Programme

The WGCPARIS2015 programme has been developed by the IGU Coordination Committee, supported by the 11 Technical Committees and three Task Forces. The outcomes of their research will be presented, with members of the industry being invited to submit papers through the Call for Abstracts. These are reviewed by the committees and selected papers incorporated into the conference programme along with the senior level invited speakers.

At press time, the WGCPARIS2015 line-up included the following confirmed speakers:

- Christophe de Margerie, Chairman & CEO, Total
- Gérard Mestrallet, Chairman & CEO, GDF SUEZ
- Alexey Miller, Deputy Chairman of the Board of Directors & Chairman of the Management Committee, OAO Gazprom
- Gertjan Lankhorst, CEO, GasTerra BV
- Helge Lund, President & CEO, Statoil ASA
- Khalid bin Khalifa Al-Thani, CEO, Qatargas
- Peter J. Coleman, CEO, Woodside
- Terry McCallister, First Vice Chairman, American Gas Association
- Ben van Beurden, CEO, Shell
- Hamad Rashid Al-Mohannadi, CEO, RasGas

In addition to a powerful line up of keynote speakers, WGCPARIS2015 will feature strategic panels, luncheon addresses, committee sessions, expert panels and interactive showcases with hundreds of hours' worth of content on every subject of significance to the gas industry.

## Call for Abstracts process

The Call for Abstracts process was launched on February 1 and is an opportunity offered to industry experts worldwide. Authors are invited to submit abstracts relating to topics defined by the IGU Committees (please see topics at www.wgc2015.org).

If your abstract is selected, you will have an opportunity to be part of the official conference programme, presenting in front of a global audience. This offers an ideal opportunity to showcase your expertise as well as raise the profile of your oganisation.

The deadline for submitting abstracts is September 1, 2014. Official notification as to whether or not an abstract has been accepted or not will be emailed to the author on November 28, 2014.

## Win an IGU Award

Your abstract can also be entered to win the IGU Global Gas Award or an award for Best Practices.

The topic for the Global Gas Award is "Sustainable development and innovative


promotion of natural gas". The best project, selected by the IGU Judging Panel, shall demonstrate in-depth knowledge of the industry, relevance for sustainable development and improved energy efficiency.

IGU includes in its mission statement the promotion of "Best Practices" in the global gas industry, with the objective of increasing its competitiveness and reliability as a key energy source. For this reason, we have decided to include in the Call for Abstracts a special consideration for those submissions the authors believe constitute a best practice in a particular area or activity.

## Exhibition

WGCPARIS2015 exhibitors can look forward to a one-level, fully integrated floor plan, where the conference and exhibition will share one entry and delegates move through the exhibition hall between plenary and break-out sessions, interactive showcases and lunch. Pavilion 1 is a single story building covering a floor area of 40,000m², with direct access to parking and perfectly located with metro, tram, bus and taxi services in close proximity.

The WGCPARIS2015 exhibition will boast over 300 exhibitors from more than 50 countries. In addition to delegates, thousands of trade visitors will visit Paris providing exhibitors the opportunity to meet and do business with the global natural gas industry.

The conference organisers have planned generous breaks in the conference programme to allow delegates time to visit the exhibition throughout the event. In addition to this, the exhibition has allocated three dedicated days for access for trade visitors. An extensive marketing and media advertising campaign will be deployed to target senior technical and commercial decision-makers within the natural gas industry from around the globe.

WGCPARIS2015 will see the introduction of new international exhibitor pavilions as well as the launch of the Natural Gas as a Transportation Fuel Pavilion. The Pavilion is a dedicated

area for exhibitors focused on the technology around land and marine vehicles which use natural gas as a fuel. A dedicated seminar area will be allocated within the pavilion for experts in this field to share the latest in developments and technologies.

### Sponsorship opportunities

WGCPARIS2015 sponsorship packages are designed to provide sponsors with high-level branding and exposure to key decision-makers attending the event. Sponsors will benefit from extensive branding before, during and after the event and many of the packages include delegate access and networking opportunities as well as logo and brand recognition.

### Official media partner appointed

*Upstream*, the leading quality news source for the international oil and gas industry, will produce the daily newspaper which will be distributed throughout WGCPARIS2015. With a team of 32 staff reporters located in 15 countries around the world, and its electronic news service, (UpstreamOnline.com) they can provide the unbiased, independent journalism required for the 26th World Gas Conference official daily newspaper.

### Accommodation

More than 4,000 rooms have been reserved in a range of hotels and accommodation booking is now open. We recommend you book as early as possible to secure the hotel of your choice ahead of the crowds. Shuttle services will be provided between the main hotel areas and the Porte de Versailles Convention Centre. There are also convenient public transport links by metro, tram and bus.

### Technical tours

A selection of one- or two-day technical visits will be available immediately after the event. The visits have been carefully chosen to showcase key facilities that are important to the region and the industry globally. They include:

- UGS facility Céré-la-Ronde – Storengy
- Alfortville interconnection grid – GRTgaz
- EDF Dunkirk LNG terminal
- GDF SUEZ Dunkirk combined cycle power plant DK6
- EDF Montereau thermal power plant
- FosMax Elengy Fos Cavaou LNG terminal

### Golf day

The WGC golf tournament will be held on May 31, 2015, which will be an ideal way for WGCPARIS2015 participants to network whilst enjoying a game of golf.

### Social tours

Paris is an ideal destination with a variety of sites to explore and experiences to enjoy. Special "behind the scenes" tours of world-famous attractions and guided tours of other must-see areas of Paris have been put together to offer WGCPARIS2015 participants the best of Paris.

We look forward to welcoming you to Paris.

*Daniel Paccoud is the Chair of the National Organising Committee for WGCPARIS2015.*

### Contacts and Key Dates

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*Abstracts*
**Carrie Carleton**
cfa@wgc2015.org

**Abstract submission** – September 1, 2014
**Registration opens** – April 1, 2014
**Programme launches** – June 1, 2014

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# Coordination Committee Progress Report

# Introduction and Key Developments

By Georges Liens and Yves Tournié

▲ Georges Liens.

▲ Yves Tournié.

We are now at the halfway point of the French Presidency and membership of the Working Committees, Programme Committees and Task Forces has surpassed the 1,000 mark (*see table*). They have made tremendous progress on the 2012-2015 Triennial Work Programme, which has been developed under the theme "Growing together towards a friendly planet" and will be presented at WGC 2015 in Paris. We are very satisfied with the work done and the final reports are already being prepared.

The preliminary programme for WGC 2015 has been finalised and the call for papers was launched on February 1. Each day of the conference will be dedicated to one of the four transversal themes or "pillars" which support the overall theme of the triennium:

- Day 1, Natural gas – a core pillar for a sustainable future of the planet;
- Day 2, Gas together with renewables and electricity – a perfect combination;
- Day 3, Natural gas – a growing factor for new economies;
- Day 4, Human capital for the future of the gas industry.

Some 46 sessions during the conference will cover the work of the technical committees and their study groups, while there will be 15 special panels including one for presentation of the IGU Global Gas Award and Best Practices Awards. Each morning session will end and each afternoon session will begin with keynote speeches by major industry figures. In addition there will be four luncheon addresses.

As a keen supporter of sustainable development, the Coordination Committee (CC) aims to reduce the amount of paper at WGC 2015 compared to previous World Gas Conferences. This means making minimal use of paper documents, presentations and reports wherever possible, and encouraging the use of multimedia materials and digital content.

Meanwhile, all the technical committees are using the "Growing Together" extranet collaboration platform, which helps members to discuss ideas, exchange documents and share best practices.

## Meetings

Joint meetings continue, with WOC 1 and PGC A getting together in Kota Kinabalu in September 2013, while PGC B and PGC D teamed up in Barcelona in October. As we went to press, WOC 1, PGC A and PGC C were holding a tripartite gathering in Seoul. Gas advocacy experts from TF 2 and communication experts from PGC E have also had several meetings to discuss the redevelopment of IGU's website into a global gas portal.

The CC, which is composed of the 14 committee chairs, is organising workshops on each transversal theme. There will also be a session dedicated to IGU's new global gas portal.

The first workshop (yellow pillar – combination with renewables and electricity) was held in October 2012 in Ottawa, Canada to coincide with the Council meeting.

The second workshop (blue pillar – human resources for the future) was held in April 2013 in Seville, Spain to coincide with the Executive Committee (EXC) meeting.

Two workshops on the red pillar (natural gas available everywhere) were held in October 2013 to coincide with the Council meeting in Beijing, China. A workshop during the CC meeting looked at the downstream strategy of


Georges Liens addresses the CC's October 2013 meeting in Beijing, which was held just before the Council convened.

some countries in Asia, with Yalan Li (General Manager of Beijing Gas Group) presenting the Chinese case and Dr Gi Chul Yung (from KOGAS and Chair of PGC C) presenting the Korean case. The workshop organised after the EXC meeting was focused on recent unconventional gas developments in Asia-Pacific with six presentations:

- The global development of unconventional gas (Michael Stoppard, Managing Director Global Gas of IHS Global);
- Shale gas potential and future plans (Liu Honglin, Deputy Director, New Energy Division, CNPC RIPED);
- The latest developments in Australia with a focus on CBM and tight gas (David Byers, CEO of APPEA)
- The development and challenges of gas hydrates (Nobuo Tanaka, IGU Wise Person);
- China's energy growth ambitions (Victor Zhikai Gao, Director China National Association of International Studies);
- The geopolitical consequences of large-scale development of unconventional gas in Asia-Pacific (Professor Coby van der Linde, IGU Wise Person).

A special advocacy and communications session on the global gas portal will be held during the Executive Committee meeting in Sydney, Australia in April, while the workshop on the green pillar (natural gas for a sustainable development) will be held during the Council meeting in Berlin, Germany in October.

*Georges Liens is the Chair and Yves Tournié is the Secretary of the Coordination Committee.*

**Members of the IGU Committees and Task Forces, Top 10 Countries of Origin** *(as of February 2014)*

| | |
|---|---|
| WOC 1 Exploration and Production | 73 |
| WOC 2 Storage | 84 |
| WOC 3 Transmission | 103 |
| WOC 4 Distribution | 90 |
| WOC 5 Utilisation | 76 |
| PGC A Sustainability | 69 |
| PGC B Strategy | 98 |
| PGC C Gas Markets | 58 |
| PGC D LNG | 122 |
| PGC E Marketing and Communication | 56 |
| PGC F R&D and Innovation | 46 |
| TF 1 Human Capital | 49 |
| TF 2 Gas Advocacy | 41 |
| TF 3 Geopolitics | 36 |
| Others | 29 |
| **Total** | **1030** |

| | |
|---|---|
| Russia | 118 |
| France | 116 |
| Iran | 48 |
| The Netherlands | 42 |
| Korea | 39 |
| Algeria | 39 |
| Spain | 36 |
| Brazil | 34 |
| Poland | 32 |
| Japan | 30 |

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# Progress Reports from the Committees

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

## Working Committee 1 – Exploration and Production

Chaired by Denis Krambeck Dinelli (Petrobras, Brazil), WOC 1 has been holding joint meetings with PGC A since the 2012-2015 Triennium began. The third was hosted by the Malaysian Gas Association at the Shangri-La Tanjung Aru Resort in Kota Kinabalu, Malaysia, September 4-7, 2013.

There was a big turnout with a total of 62 participants and business began with an opening joint plenary session. Presentations were given by the Secretary General, Torstein Indrebø; CC Secretary, Yves Tournié; President of the Malaysian Gas Association, Pramod Kumar Karunakaran; Immediate Past President, Datuk Abdul Rahim Hashim; and CEO of Sabah Energy Corporation, Dato' Hj Harun Hj Ismail.

Delegates then divided into their committees and study groups to discuss their work (see below for the reports from WOC 1's three study groups). WOC 1 will organise two special panels at WGC 2015, one with the World Bank on gas flaring reduction, and one with PGC A on unconventional gas. It will also have five committee sessions and expert fora. Proposals for these were discussed during the meeting and forwarded to the CC in time for the call for papers.

Technical visits were made to two facilities: the Kimanis CCGT power plant and the Sabah

▼ *From left to right:* Satoshi Yoshida, Chair of PGC A; Denis Krambeck Dinelli, Chair of WOC 1; Torstein Indrebø, Secretary General; Datuk Raymond Tan, Deputy Chief Minister and Minister of Industry of Sabah; Ho Sook Wah, former CC Chair; and Radia Aissaoui, member of PGC A; flanked by dancers in traditional Kadazan costumes at the WOC 1/ PGC A joint meeting in Kota Kinabalu.

oil and gas terminal. Delegates also visited Kinabalu Park, which UNESCO declared a World Heritage Site in 2000.

### SG 1.1 *Technical advances in gas exploration and production*

*Leader (and WOC 1 Vice Chair):* Adif Zulkifli (Petronas, Malaysia)

Rashidah Karim (Petronas, Malaysia) began the session by recapping the proposed approach and expectations for the work programme on behalf of Adif Zulkifli, following which there were several presentations.

Bramanta Subroto (Schlumberger, Malaysia) explored the use of drilling technologies in a cost-effective manner. Understanding the formation and well placement risks is of great importance, so early engagement and cooperation between operator and service provider is necessary to increase efficiency and reduce costs.

Yassine Mestiri (ATPG/ETAP, Tunisia) gave a presentation on a "virtual gas pipeline" being considered for the Bir Ben Tartar concession in Tunisia, where associated gas is insufficient to justify the development of pipeline infrastructure. Rather than flaring the gas, CNG can be produced and trucked to nearby end-users. A case study on a food factory in Nigeria was also presented, where expensive diesel was replaced by CNG to produce electricity.

There were two presentations by colleagues from Petronas. Rashidah Karim looked at the importance of innovation for the industry and Lenny Marlina Omar emphasised the importance of technology as a driver for global gas growth.

Chalermkiat Tongtaow (PTTEP, Thailand) called attention to some reservoir characterisation technologies. Full waveform inversion and velocity models result in better imaging, but electromagnetic technologies provide the best quality data, while microseismic techniques are particularly important to monitor the propagation of fractures during hydraulic estimation.

Li Yang (CNPC, China) described the concept of a shale gas factory. As new wells must be drilled continuously to sustain production, rig skidding, multi-well pads and reuse of equip-

▼ During their joint meeting delegates of WOC 1 and PGC A made a technical visit to the Sabah oil and gas terminal.

ment and resources are important factors to reduce cost and the environmental footprint.

Ekaterina Litvinova (Gazprom, Russia) looked at the history of gas production in the extreme conditions of West Siberia. Construction in permafrost and maintenance of flow while preserving the environment were some of the challenges confronted. The solution included the use of insulated pipes to prevent permafrost thawing, recycling of resources and good planning.

The second day of the meeting continued with discussions on the sessions for WGC 2015 and the way forward for the study group report. A first complete draft is expected to be ready for the spring meeting.

### SG 1.2 *Assessment of global gas reserves and resources*

*Leader:* Mohammed Kaced (Sonatrach, Algeria)
Denis Krambeck Dinelli identified some trends for gas exploration and production. His presentation included a brief analysis of the most important pricing mechanisms in place. Basically, spot pricing seems to be increasing in lieu of the traditional long-term oil-indexed contracts, and this may cause producers to be less inclined to invest in high-risk areas.

Fernando Bado (Tenaris, Argentina) used recent data from IEA, EIA and BP to analyse global reserves and resources for conventional and unconventional gas. Most of the additional throughput in the next 25 years is expected to come from the Middle East, North Africa and Russia. There is exciting potential in deep waters and the Arctic, whose basins may contain more than 30% of undiscovered gas, especially in the South Kara Sea, the Barents Sea and Alaska. Unconventional gas (UCG) resources could rise from 13% of the total in 2009 to about 20% in 2035, mostly because of the huge potential available in the USA, Canada and China.

A section of SG 1.2's report describes a few factors not often developed by analysts of the North American UCG revolution, such as drilling carries, foreign investment and subsidies, but it is important to enhance the current analysis to explain why the UCG revolution is not easily reproducible in other parts of the world.

A first complete draft of the report is expected by the time of the spring meeting.

WOC 1 Secretary, Marcos de Freitas Sugaya is presented with a gift by the Malaysian hosts.

### SG 1.3 *Gas rent and mineral property rights*

*Leader (and WOC 1 Secretary):* Marcos de Freitas Sugaya (Petrobras, Brazil)
Marcos de Freitas Sugaya presented the results of SG 1.3's gas rent survey, which was designed to assess the awareness and interests of IGU members. The existing fiscal systems were considered to be satisfactory by most respondents, who did not seem to be very interested in the development of specific systems for gas. In addition, royalties were not generally perceived by them as an old fashioned instrument, contrary to what is usually defended by some specialists in upstream taxation, so a strong effort must be developed to demonstrate the importance of the theme to the IGU community, especially gas producers, who could benefit significantly from progressive taxation schemes and uplifted depreciations. Ultimately,

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consumers would benefit from that with access to lower gas prices.

Zainal Abidin Zainudin (Petronas, Malaysia) described the evolution of production sharing contracts in Malaysia. They were conceived in 1973 and modified in 1985 and 1997 to encourage new investments. Although the number of contracts has increased, gas reserves have remained relatively stable over the last few years. Incentives to spur gas production include lower tax rates and faster depreciation for marginal fields. Additional tax allowances have also been provided for fields with a high $CO_2$ content, production in deep waters and reservoirs at high pressures and temperatures.

Michael Lee (KOGAS, Korea) continued with the studies presented in previous meetings by Ik-Hyun Park on the fiscal systems of Mozambique and Tanzania. In Mozambique corporate income tax is 32%, and cost recovery is limited to 65% of the revenues after royalties, but these are charged at 6% for gas and 10% for oil. In Tanzania there is no distinction between oil and gas, and a tax on profits is applicable when high rates of return occur. A case study was presented for the production of gas in deep waters, in which Tanzania appeared less attractive compared to Mozambique, especially if the recoverable reserves are large. A suggestion was made to decrease the government take when the volumes involved are smaller.

Alexey Semenov (Gazprom, Russia) looked at incentives that are under discussion in Russia to stimulate offshore investment, especially in the challenging conditions of the Arctic. The new regime proposed allows for regional differences and tax holiday periods on top of a reduction in the mineral extraction tax.

Liliane Wietzerbin and Vincent Trocme (GDF SUEZ, France) could not attend the meeting, but prepared a contribution on how fiscal regimes can be designed to be flexible and at the same time stable enough for investors. They gave examples from the Netherlands and UK, where fiscal incentives have been successfully adapted to new price and technical conditions. Consultation with stakeholders is important in order to avoid instabilities that could ultimately hamper investment.

The Thai members of the group arranged for a presentation from their Department of Mineral Fuels. Gas has a 45% share of Thailand's energy mix, and most of it is produced in the country. Producers must pay a special remuneratory benefit, which is applied at a maximum of 75% as a windfall profit tax. There is also a petroleum income tax of 50% and royalty rates of 5% to 15%. In the joint development area with Malaysia, the company share is at 50%, but export duties of 10% apply. The royalty rate there is 10%, and the petroleum income tax goes from 0% to 10% after eight years of production, and 20% after 15 years.

Marcos de Freitas Sugaya presented some of the information and analyses already included in SG 1.3's report. The current version defends the importance of reduced taxation for the production of gas, as it commands lower prices and the infrastructure required is more complex than the equivalent for oil. Progressive taxation is also defended in lieu of regressive instruments such as signature bonuses and flat royalty rates, especially for the production of unconventional gas. For the purpose of analysis, it is important to classify and quantify the final price paid by consumers in downstream and upstream taxation, distribution, storage, transmission and production costs.

For the next meeting a first complete draft of the report is expected, including a presentation on the Iranian buy-back system and a consolidation of the best practices identified.

### *Communications and next meeting*

In addition to the main IGU website at www.igu.org and a Lotus Quickr account created by the WOC 1 Secretariat to facilitate the exchange of large files at quickri.petrobras.com.br/intergu, committee members can use the Growing Together collaboration platform and the WOC 1


▲ Delegates to WOC 2's third meeting in Tehran pose for a group photo (TOP) and in a plenary session (ABOVE).

Facebook account to receive updates and exchange information.

At press time, WOC 1 was due to hold a joint meeting with PGC A and PGC C in Seoul, Korea, March 10-13.

### Working Committee 2 – Storage

WOC 2 is chaired by Ladislav Goryl (NAFTA, Slovakia) and has 75 members organised in three study groups. WOC 2's third meeting was hosted by the National Iranian Gas Company (NIGC) and National Gas Storage Company (NGSC) in Tehran, Iran, October 1-4, 2013.

Forty-six delegates from 10 countries attended the meeting, including the Deputy Petroleum Minister and NIGC Managing Director, Hamid Reza Araghi, who delivered the opening speech in which he referred to Iran's position in terms of oil and gas reserves. Then he reviewed the global gas market, gas industry performance and Iran's potential to enter the global gas market.

Delegates were welcomed to the opening plenary session by Ladislav Goryl and the CC Secretary, Yves Tournié. The meeting continued with a presentation by the Managing Director of NGSC, Masoud Samivand, who looked at the drivers for underground gas storage (UGS) development in Iran and introduced the Sarajeh and Shourijeh UGS projects.

In line with WOC 2's tradition, a workshop was held on the first day of the meeting entitled "UGS techniques and opportunities". There were five presentations by WOC 2 members and five by Iranian colleagues from the NIGC Research and Technology Department, Research Institute of Petroleum Industry and Petroleum Institute of Tehran University.

The Iranian colleagues focused on their experience with the screening of geological

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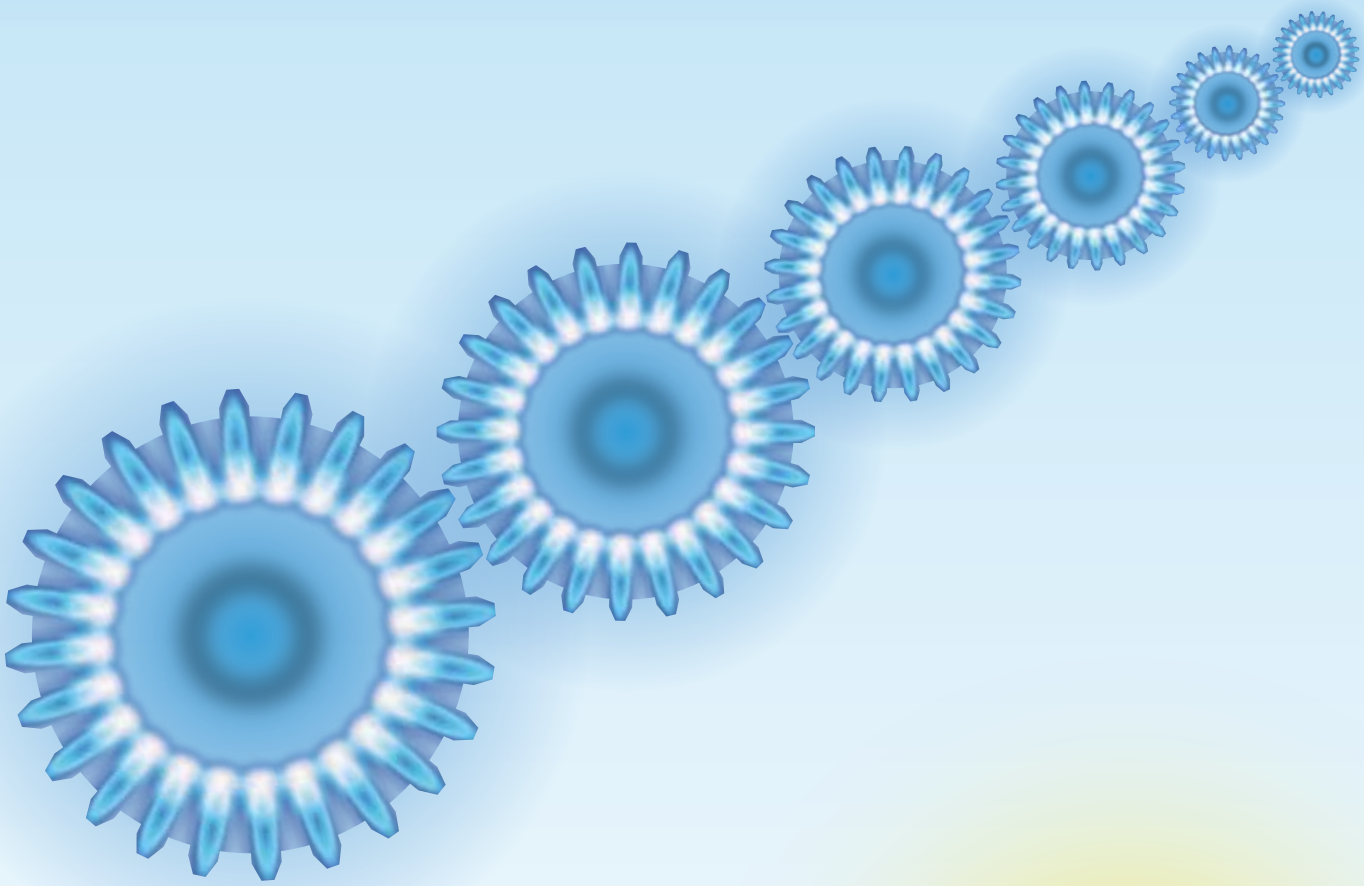

DEPA is the company that introduced natural gas to Greece's energy market by developing the necessary infrastructure and networks. It is a group of companies, consisting of DESFA, the Hellenic Transmission System Operator, and three Distribution Companies (EPA of Attica, Thessaloniki and Thessalia). DEPA 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 and also participates in ICGB AD, the company that will undertake the development and operation of the pipeline connecting Greece with Bulgaria.
DEPA works for the further expansion of the natural gas grid in Greece, so that more consumers can benefit from the environmental-friendly energy solution.

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ΔΕΠΑ

▲ WOC 2's technical visits included the South Pars facilities.

structures suitable for underground storage of natural gas. Since NGSC was set up in 2008, 220 potential structures have been identified as suitable for conversion to store natural gas. Of these, 40 structures have been selected as suitable for UGS and two are currently in operation.

Sarajeh UGS in the central part of Qom Province has a capacity of 1.5 bcm and daily deliverability of 9.8 mcm. Capacity after completion of the second phase will be 3.3 bcm. Shurijeh UGS in Khorasan Province is under trial operation with a capacity 2.4 bcm and daily deliverability of 20 mcm. After completion of the second phase, capacity will increase to 4.8 bcm with an expected daily withdrawal rate of 50 mcm.

The second day was dedicated mostly to the study groups' work (see below). This day ended with a visit to Saadabad Palace Complex in Tehran built by the Pahlavi dynasty and dinner in a traditional restaurant in the Shemiran area of Tehran.

On the third day delegates visited the Assaluyeh oil and gas industrial area and South Pars facilities on the Persian Gulf. Assaluyeh houses the South Pars terminal for the export of condensate, as well as the Pars petrochemical terminal for the export of LPG and chemicals. With an estimated 10 tcm of gas, the South Pars gas field contains about 8% of the world's gas reserves. There was also a technical visit on the last day to Sarajeh UGS.

### SG 2.1 *UGS database*

*Leader:* Vladimír Lorenc (NAFTA, Slovakia)

Progress on the final concept of the new web application for updating the UGS database was presented by Vladimír Lorenc in Tehran. The progress to date is as follows:

- The online database concept has been defined;
- An online version of the questionnaire has been developed;
- The online database concept and questionnaire have been reviewed;
- The list of contacts of has been updated; and
- The online database has been programmed.

The new web application has been placed on the IGU portal and supports an assignment of variable viewing rights to access different levels of data within and outside the IGU community. Although the application is being developed further (export and dynamic charts will be added later), it is already functional for viewing and updating data from previous triennia.

The milestones for the work programme going forward were agreed in Tehran and the call for updates of underground storage data was launched in December 2013. During 2014, work will concentrate on main data collection, analysis and visualisation of the database.

### SG 2.2 *Techniques and new opportunities*

*Leader:* Fabien Favret (EDF, France)

SG 2.2 is preparing two articles on its work for the IGU magazine and has also prepared a workshop for the spring meeting.

The article in this issue (see pages 176-180) describes new technologies to increase the efficiency and reduce the environmental footprint of UGS while ensuring high operational and safety standards. The second article is scheduled to be published in the autumn issue. It will provide a description of the current status of energy storage.

Discussion continues about the contribution of SG 2.2 to IGRC 2014 on the topic of energy storage.

### SG 2.3 *Human resources: Attracting students to work in gas storage*

*Leader:* Nikita Barsuk (Gazprom, Russia)

The main part of the SG 2.3 work programme is a competition to mark the 100th anniversary of UGS, and the rules and timeline for this were agreed in Tehran. The call for entries was subsequently launched and has been published on the IGU website. Students and young (under 30) specialists working in storage companies are invited to submit theses on storage topics linked to the green (sustainability) and yellow (combination with renewables and electricity) transversal themes of the triennium. The deadline for submission is June 15 and the results will be announced in late 2014. Three prizes of free participation in WGC 2015 will be awarded.

SG 2.3 is also analysing the gender, demographic and skill characteristics of people working in the UGS sector by means of a questionnaire-based survey which was launched in January.

#### *Next meeting*

At press time, WOC 2's next meeting was due to be hosted by Storengy and Transport et Infrastructures Gaz France (TIGF) in Pau, France, March 19-21.

### Working Committee 3 – Transmission

WOC 3 is chaired by Benjamín Guzmán (Transportadora de Gas del Sur, Argentina). The committee has 108 members who are organised in three study groups.

The third meeting of the 2012-2015 Triennium was hosted by Chevron at the Westin Galleria Hotel in Houston, USA, October 1-3, 2013. CC Chair, Georges Liens attended and joined 35 WOC 3 delegates, 20 of whom belonged to SG 3.1 and SG 3.3, which are coordinating their activities, while 15 were members of SG 3.2.

Benjamín Guzmán welcomed delegates, the new committee members were introduced and then participants divided into their study groups to discuss the progress of their work. They reviewed the purpose and scope of each group, discussed the questionnaires developed to gather information, defined deliverables and agreed the work schedule going forward (see below for the individual reports).

The second day was devoted to the plenary meeting. After a welcome address from Benjamín Guzmán, an interesting presentation on the US gas industry was given by Eric Shaw

▼ Delegates to WOC 3's third meeting in Houston pose for a group photo.

(Chevron, USA). Then the time came for each study group leader to present an activity report. There were also presentations on gas industry developments in the countries represented by a delegate in the meeting.

On the last day there were three interesting technical presentations, namely:

- The sulphur deposition in gas pipelines by Adnene Masmoudi (STEG, Tunisia);
- GL pipelines software team in Houston by Ian Fordyce (DNV GL, UK);
- Shale gas in the United States by Mike Maneffa (Chevron, USA).

Furthermore, at the end of each day's business, delegates enjoyed the social programme prepared by Chevron.

The meeting was very successful thanks to the excellent level of participation, the useful ideas put forward, the new proposals and the close collaboration among all members.

### SG 3.1 *New transmission projects, SG 3.3 Public acceptance and new technologies*

*Leader:* Peter Tóth (Eustream, Slovakia)
Deputy: Alessandro Moretti (Snam Rete Gas, Italy)

WOC 3's Chair, Benjamín Guzmán addresing a plenary session of the third meeting.

The activities of these study groups have been divided into five subject areas and during the meeting in Houston subject owners were assigned as follows:

- Transmission projects — Ansgar Brauer (E.ON, Germany);
- Compression process — Peter Tóth (Eustream, Slovakia);
- Impact of new sources — To be decided;
- Public acceptance — François Crocombette (GRTgaz, France);
- New technologies — Alessandro Moretti (Snam Rete Gas, Italy).

In the previous meeting, members had created questionnaires to find out more about each subject area as well as a survey of new gas transmission projects. In Houston, the initial responses to the questionnaires were available and the most important points/topics were highlighted. An example of the final report was also discussed.

### SG 3.2 *Pipeline integrity management systems (PIMS)*

*Leader:* Abderrahmane Taberkokt (GRTG, Algeria)
*Deputy:* Mohd Nazmi (Petronas, Malaysia)

SG 3.2's tasks have been divided into the following topics and owners:

- Ageing pipelines — Adnene Masmoudi (STEG, Tunisia);
- Third-party damage — Noureddine Said (Sergaz, Tunisia);
- Threats analysis — Deepank Gupta (Ausnet, Australia);
- PIMS — Samir Akel (GRTgaz, France).

SG 3.2 members had also developed questionnaires on the study topics as well as a survey on gas pipeline transmission prior to Houston. With the initial responses, each subgroup identified the highlights that will form part of the final report to be presented at

Photo by PAUL SUTHERLAND/NATIONAL GEOGRAPHIC CREATIVE
Java Sea, Indonesia: the gorgonian coral is a colonial organism made up of polyps that form a veritable network, exchanging not only nutrients but also valuable information.

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WGC 2015. The next task will be to carry out a detailed analysis based on all the responses received.

### *Study group action points*

The study groups agreed the following plan of tasks:

- The compilation of answers to questionnaires to be completed by the end of November 2013;
- Appointed SG 3.1, 3.2 and 3.3 members will prepare draft of their subparts by the end of January 2014;
- The subject owners will put together their chapters by the end of February 2014;
- The first draft of the final report will be discussed in the meeting in Italy.

### *Next meeting*

At press time, the fourth meeting of WOC 3 was due to take place in Turin, Italy, March 8-11. It will be covered in the next progress report. For further information about WOC 3's activities, please contact the Chair at Benjamin_Guzman@tgs.com.ar.

## Working Committee 4 – Distribution

Gas distribution covers the part of the gas chain that is most visible to the end client. To encourage clients to choose gas as their source of energy, it is important that gas distribution services are perceived as being competitive and of top quality.

In many countries, regulations are becoming increasingly important. Some of the requirements include:

- Third-party access is a pre-requisite in many countries, but the conditions often vary enormously from country to country;
- Regulatory authorities are also demanding that services be unbundled on a distribution level, despite the fact that they usually comprise a far more detailed grid structure;
- Diversified gas supplies: moving away from a single or possibly dual quality gas supply distribution grid to a multiple supply grid with many entry points;
- The political decision-making trend is to move towards carbon-free energy supplies leading to other regenerative sources of methane gas supplies and even to non-carbon combustible gases in the system;
- To improve the quality of customer service, more electronic measuring equipment and control tools are being introduced to create "smart grids" and industry personnel will require appropriate training and qualifications to use such tools.

Chaired by Dietmar Spohn (Stadtwerke Bochum, Germany), WOC 4 is assessing the factors that will have an impact on the immediate future of distribution and has three study groups. The committee held its third meeting in Paris, France, October 8-11, 2013.

▼ WOC 4's Chair, Dietmar Spohn addressing the committee's third meeting in Paris.

### SG 4.1 *Regulation of third-party access to gas distribution networks – A standard approach*

*Leader:* José Carlos Broisler Oliver (Comgás, Brazil)

In most IGU member countries, national governments have introduced regulatory measures that affect the entire energy industry. SG 4.1 will examine how the regulation of third-party access (TPA) to gas distribution networks has been developed over the past decade, with emphasis on different developments in the member countries. SG 4.1 has set out its final objectives for this triennium, which are to:

- Present different experiences around the world regarding TPA legislation and regulation, stage of implementation and evolution;
- Indicate impacts of the cases analysed;
- Identify trends in TPA around the world;
- Prepare a "World Map of TPA"; and
- Prepare "IGU guidelines" – to be referenced – instead of an "IGU network code" (prescriptive).

### SG 4.2 *Diversification of gas quality and non-conventional sources in a carbon-free future*

*Leader:* Peter Flosbach (Westnetz, Germany)

Traditionally, distribution grids comprised one or possibly two sources of supply, based on long-term delivery contracts. This is changing in many parts of the world with new sources of gas. SG 4.2 is examining the different options available for managing a diversification of gas quality, and ways distribution companies can address the growing challenge to secure stable gas supplies for their customers.

### SG 4.3 *Smart grids in gas distribution: Scope and purpose*

*Leader:* Pascal Vercamer (GDF SUEZ, France)

The main objectives of SG 4.3 are to define the functionalities of smart gas grids, to set up a set of assessment criteria, as well as to identify their value. The group has developed a first scoring matrix for gas quality control and defined their next steps:

- Define the strategy;
- Identify building blocks;
- Dig into the details/best practices sharing through a dedicated questionnaire;
- Build a technological roadmap; and
- Forge a world vision of the future of gas distribution networks.

### Working Committee 5 – Utilisation

WOC 5's third meeting was hosted by Dourogas at the Palace Hotel in Vidago, Portugal, September 16-18, 2013. It was attended by 32 delegates from 16 countries.

Opening the meeting, WOC 5's Chair, Eugene Pronin (Gazprom Export, Russia), welcomed delegates and thanked the hosts.

▼ Delegates to WOC 5's meeting in Vidago at work in a plenary session (BELOW) and socialising over dinner (BELOW RIGHT).

Presentations were then given by Nuno Afonso Moreira (Dourogas, Portugal) on the host company, Per Persson (Naturgas, Denmark) on IGRC 2014 in Copenhagen and Georges Liens, CC Chair on the latest preparations for WGC 2015 in Paris. Delegates then divided into their study groups and topic teams. The event was rounded off with a technical visit to the Dourogas small-scale LNG facility in Mirandela.

### SG 5.1 *Industrial utilisation*

*Leader:* Egidio Adamo, (Eni, Italy)

SG 5.1 is preparing a report on trends in industrial gas usage. The objective of the Vidago meeting was to discuss each member's contribution, define the structure of the report and prepare the next steps. There will be a focus on fuel switching and energy services, energy efficiency, the combination of natural gas with renewables, gas-to-power and LNG in industry. Questionnaires have been sent out to help gather information and draft chapters are due to be completed for the next meeting in Algiers.

### SG 5.2 *Domestic and commercial utilisation*

*Leader:* Martin Seifert (SVGW, Switzerland)

SG 5.2 is looking at the promotion and use of gas heat pumps and micro-CHP units with case studies of four national markets: France, Japan, Spain and Switzerland. In each market there are different challenges and levels of support, which were discussed during the meeting in Vidago. Drafts of each country report will be discussed at the next meeting.

### SG 5.3 *Natural gas vehicles (NGVs)*

*Leader:* Olivier Bordelanne (GDF SUEZ, France)

SG 5.3 is preparing a report on NGV markets around the world and information for each country is being collected through a survey. During the Vidago meeting, members agreed the format of the questionnaire to be sent out for the survey and discussed cooperation with NGVA Europe, NGV Global and the UN Economic Commission for Europe to ensure the widest dissemination of the questionnaire. The results will be discussed at the next meeting. SG 5.3 is also working on a brochure which IGU and NGV Global can use to advocate for the use of natural gas a transportation fuel.

▲ WOC 5's technical visit was to the small-scale LNG facility in Mirandela.

### TT 5.1 *Renewable energy, $CO_2$ emissions, hydrogen*

*Special Adviser:* Aksel Pedersen (Dong Energy, Denmark)

Members of TT 5.1 were not able to attend the meeting in Vidago but are continuing their work on the production and use of "green gases" in association with natural gas, investigating how renewables can be incorporated into the natural gas grid, and looking at hydrogen production from renewable power as well as at technologies to convert $CO_2$ + water to methane.

### TT 5.2 *Gas quality*

*Special Adviser:* François Cagnon (GDF SUEZ, France)

TT 5.2 is looking at variations in gas quality around the world. The diversification of supplies, including the injection of renewable gases, is leading to an increase in gas quality variations while at the same time more stringent requirements are coming from end-users. During the meeting in Vidago, members

finalised a survey about gas quality. This will provide information for case studies to be presented during WGC 2015.

### *Next meeting*

WOC 5's fourth meeting will be held in Algiers, Algeria, April 28-30.

## Programme Committee A – Sustainability

PGC A works closely with WOC 1 and the two committees are holding joint meetings during this triennium. Twenty-six PGC A members attended the meeting held in Kota Kinabalu, Malaysia, September 4-7, 2013. The joint events have been covered in WOC 1's progress report so this report will focus on the sessions of PGC A's four study groups.

Chaired by Satoshi Yoshida (Tokyo Gas, Japan), PGC A will organise two special panels and four committee sessions during WGC 2015; one of the special panels will be a joint one with WOC 1 on unconventional gas.

### SG A.1 *Carbon capture and storage*

*Leader:* Susumu Nishio (Tokyo Gas, Japan)

SG A.1 has a new leader with Susumu Nishio taking over from Hiromichi Kameyama (Tokyo Gas, Japan). The study group's session in Kota Kinabalu began with the sharing of information on a membrane for $CO_2$ capture developed by Petronas, the use of $CO_2$ in chemical products by PTT and a microbubble for $CO_2$ storage by Tokyo Gas. Members then discussed the structure of their report and assigned chapters. The report will give an overview of the status of CCS around the world, look at the technical, legal and social issues and consider the perspectives for $CO_2$ utilisation.

Members also prepared the call for papers for the committee session SG A.1 is organising on CCS. The aim is to have a range of papers covering recent developments and challenges with regard to CCS technologies, economic feasibility, legal framework and social acceptance. New and ongoing research and developments regarding capture, transport, storage

▼ Delegates of PGC A and WOC 1 and pose for a group photograph during their third joint meeting in Kota Kinabalu, Malaysia.

and utilisation will also be highlighted. All this valuable information will be shared at the SG A.1 session during WGC 2015 in Paris.

### SG A.2 *Natural gas and renewable gas*

*Leader:* Elbert Huijzer (Liander, The Netherlands)
A special presentation was given by Sazalina Zakaria (Greentech, Malaysia) about the usefulness of the Clean Development Mechanism for renewable gas projects, while Sari Siitonen (Gasum, Finland) presented a life cycle assessment (LCA) study by her company and various country reports were discussed. The call for papers was finalised, including discussion about the set-up of the WGC 2015 committee session on renewable gas. Members had an in-depth discussion about the content of the report and a workplan with responsibilities was drafted.

### SG A.3 *Life cycle assessment of the natural gas chain*

*Leader:* Anne Prieur Vernat (GDF SUEZ, France)
SG A.3 aims to establish a framework for data collection and create an international natural gas chain LCA database, covering both pipeline transportation and LNG. Marcogaz will contribute to the pipeline gas LCA and countries importing gas in the form of LNG, including the top two importers Japan and Korea, will contribute to establishing the LNG LCA.

Questionnaires have been sent out to IGU members to collect useful data and information and replies are coming in. At the time of the Kota Kinabalu meeting 11 companies had responded. Further replies are expected and more data and information will enhance LCA integrity. In addition, a survey on the use of LCA in the gas industry will be launched via the Growing Together collaboration portal. A draft outline and content of the report were agreed during the meeting and chapters were assigned to members.

As well as its WGC 2015 committee session on LCA, SG A.3 is organising a special panel "LCA: a support tool to account for environmental performances of natural gas in decision making".

Elbert Huijzer, leader of SG A.2 addressing a PGC A plenary session.

### SG A.4 *Environmental aspects of unconventional gas*

*Leader (and PGC A Vice Chair):* Mauro G. Soares (Tecpetrol, Argentina)

At the meeting in Kota Kinabalu, members updated SG A.4's goals, revised environmental and technical issues and discussed country updates and recent news. They also brainstormed for ideas to attract experienced new members and discussed a potential field trip to inspect US shale operations. The call for papers was prepared for both the committee session and the joint special panel with WOC 1.

As development of unconventional gas in North America and elsewhere will have an enormous impact on the gas industry, SG A.4 will continue to reach out to other committees and third parties to share information and possibly collaborate on studies.

#### *Next meeting*

At press time, PGC A was due to hold a joint meeting with WOC 1 and PGC C in Seoul, Korea, March 10-13.

### Programme Committee B – Strategy

Under the chairmanship of Fethi Arabi (Sonatrach, Algeria), PGC B's principal objectives are to analyse the forecasts, policies and economics affecting regional and global gas supplies, demand and trade; to examine wholesale gas price formation and gas pricing trends for both indigenous production and international trade; to share information on company strategies in relation to commercial and regulatory change; and to coordinate work on the 2050 Natural Gas Prospective Study. There are three study groups.

The last PGC B meeting was held in the beautiful coastal city of Barcelona, Spain, October 8-10, 2013. It was a joint meeting with PGC D.

### SG B.1 *World gas supplies, demand and trade*

*Leader:* Thomas Dirksmeyer (E.ON, Germany)

The meeting in Barcelona saw regional presentations on Pakistan and Bangladesh, two markets where gas demand is set to double within the next 20 years. Two progress reports on


PGC B's Chair, Fethi Arabi (*centre*) presiding over a session during the joint meeting with PGC D.

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Hervé Delain of GDF SUEZ addresses PGC B members.

developments in the European gas market, an updated review on Latin America and a statistical update of the Middle East region completed the picture.

The latest forecast for Europe published by Eurogas sees a modest increase of the role of gas in the energy mix, albeit in a shrinking total market. Uncertainty in the volume of gas demand for power generation is the main factor behind differences between the three demand scenarios developed by Eurogas. Forecast demand in 2035 ranges from 394 to 527 mtoe, corresponding to a compound annual growth rate of -0.4% and 0.7%, respectively.

Considerable growth of gas demand in the European transportation sector could make this sector an attractive niche within the next two decades. Optimistic outlooks for gas in transportation have been published for other parts of the world as well.

The US Energy Information Administration (EIA) published an early release of its Annual Energy Outlook in December 2013. Natural gas production and demand outlooks for 2040 have been upgraded again, foreseeing natural gas production of 870 mtoe in 2040 and gas demand of 735 mtoe.

After analysing gas supply and demand forecasts for the eight global IGU regions, the study group is now consolidating all the regional data to form a global overview and a cross-regional trading pattern.

### SG B.2 *Wholesale gas price formation study*

*Leader:* Mike Fulwood (Nexant, UK)

At the Barcelona meeting presentations and discussions were held on the changing parameters in long-term gas contracts, the impact of coal and renewables on gas supply and pricing in the power generation markets, with a case study of the Spanish market, and a review of markets where there is subsidised or "social" pricing and its consequences. There was also a discussion of the timetable for the next wholesale gas price survey. This was sent out in February and the results are expected to be available towards the end of April in time for the next meeting.

### SG B.3 *Strategy and regulation*

*Leader:* Francisco de la Flor Garcia (Enagás, Spain)

SG B.3 has developed a questionnaire via an online tool to gather information for its business case studies. Responses will be collected and processed accordingly.

Regarding IOCs and NOCs, a template has been developed and the group is in the process

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of analysing the list of projects proposed. Once the projects have been selected an invitation will be sent to the project promoters who will present their projects in subsequent meetings.

For the study of energy poverty a questionnaire has been sent to members of PGC B and other parties to ensure good regional coverage, and answers are being collected and processed. Preliminary results were analysed by the study group members in Barcelona.

Collaboration with the International Confederation of Energy Regulators (ICER) is being developed, especially in terms of the investment climate (which is covered by ICER's virtual working group VWG2). Synergies are also being developed with the GTE Investment Climate working group. Additionally, in the framework of ICER's VWG 4, an article which is currently "work in progress" will be published in the ICER Chronicle.

PGC B is analysing the first phase results of the 2050 Natural Gas Prospective Study which will focus on issues affecting supply/demand in the 2050 perspective. It will look at qualitative rather than quantitative issues and in particular at very long-term future issues, and assess disruption possibilities.

### *Next meeting*

PGC B's next meeting will be hosted by Gasunie in Amsterdam, The Netherlands, April 23-25.

## Programme Committee C – Gas Markets

PGC C, chaired by Dr Gi Chul Jung (KOGAS, Korea), held its third meeting in Brisbane, Australia, September 30-October 3, 2013. The meeting, co-hosted by Santos and EnergyQuest, was attended by 13 PGC C members and four guests. Participants came from eight countries: Australia, France, Indonesia, Japan, Korea, Norway, Russia and the USA. The guests were Trevor Brown and Damon Hunt, both from Santos, Rodolphe Bouchard (Total, France) and Bob Vessey (Pace Global, USA).

In the opening plenary session, Gi Chul Jung welcomed delegates and thanked the hosts for organising the meeting, while Trevor Brown gave a presentation on the Australian gas industry and Santos. There was then a special workshop session with four speakers. Bob

PGC C members pose for a group photo during their meeting in Brisbane.

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Vessey looked at US shale gas and its implications for global markets; Nak-Gyun Kim (KOGAS, Korea) considered the basic aspects and dynamics of unconventional gas development in North America; Rodolphe Bouchard looked at the E&P aspects of unconventional gas development in North America; and Karen Sund (Sund Energy, Norway) looked at the role of gas in the European electricity market.

Delegates then divided into the study groups, and the event was rounded off with a technical visit to the Gladstone LNG plant being built on Curtis Island.

### SG C.1 *The role of natural gas in the electricity generation mix*

*Leader:* Alexey Biteryakov (Gazprom, Russia)
Members discussed the approach towards further work and completion of the final report, and considered changing from a traditional to an issues-oriented structure. This was approved and the main features of the final report will be:

- The report will be substantially shorter than a "traditional" one;
- The report will consist of an issue-by-issue analysis instead of a country-by-country one;
- No long descriptions of markets will be included in the main report, although they can be included in the attachments;
- The report will have a strong focus on concrete learning and advice regarding the sustainable role of gas in different electricity systems.

Alexey Biteryakov will propose a plan for the report and share it with all study group members. This plan will be based on the presentations delivered and issues discussed in the previous meetings. Karen Sund will give her opinion and proposals on the report structure and a list of additional issues to be examined. All members will add their analyses, texts, charts and comments as well as issues relevant for the markets they focus on or have knowledge of.

To organise the group's work more efficiently, an online file-sharing service will be chosen. All members are welcome to submit their proposals.

SG C.1 plans to submit a draft of the issue-oriented report at the next meeting and the new materials and issues analysis will be gradually added to the draft. The new report structure and working plans do not mean scrapping work done on the case study market analysis, since the facts, examples and lessons will be taken from those materials and findings.

### SG C.2 *Implications of developing unconventional gas*

*Leader:* Shigeki Sakamoto (JX Nippon, Japan)
Shigeki Sakamoto invited Bob Vessey, one of the guest speakers of the plenary session, to join SG C.2's meeting and he participated in a discussion on the business environment of US shale gas. Members of the study group shared opinions on the prospects for US Henry Hub gas prices, US LNG export projects, the status of gas price hedging, the costs of tight oil and gas production in North America, and the comparison of the costs among major LNG suppliers to East Asian markets. Members also discussed topics related to the LNG spot trade, Australian CBM-based LNG export projects, the tariff for the Panama canal and LNG price formulas.

Members also discussed the schedule for their work going forward. It was agreed that the drafts of the three regional sub-groups would be completed by early 2014. These will then be discussed and completed during the fourth and fifth PGC C meetings. Concurrently, the WGC 2015 session will be prepared. SG C.2 will complete the final draft of its report by December 2014, and submit the report to the committee in the sixth PGC C meeting in March 2015.

Each sub-group will prepare the report as follows. The Americas sub-group agreed that new data and any new developments should be

incorporated regularly, and more information on South America should be added. The report is based on EIA data and supplementary information can be added from other sources. The Asia Pacific sub-group will monitor activities in Russia, Indonesia and India, where shale gas is in its initial exploration phase. The study of the impact of US LNG imports will be conducted in cooperation with the Americas sub-group. The Europe, Middle East and Africa sub-group should include coverage of Algeria and Ukraine, which have been evaluated by EIA as having potential. Each sub-group will prepare brief presentations for the next meeting.

### *Next meeting*

At press time, PGC C was due to hold a tripartite meeting with PGC A and WOC 1 in Seoul, Korea, March 10-13.

## Programme Committee D – LNG

PGC D's third meeting was a joint one with PGC B and was hosted by Enagás in Barcelona, Spain, October 8-10, 2013. It was held in the Melía Sarrià Hotel and attended by 46 PGC D members.

The Chair, Dirk van Slooten (Vopak, The Netherlands) welcomed participants at the opening joint plenary session and reviewed PGC D's contribution to the strategic objectives of the triennium before outlining the work schedule going forward. PGC D's five Study Groups then held individual meetings to discuss their work. In addition to the business sessions, there was an evening social visit to Barcelona's renowned opera house, the Gran Teatre del Liceu, and a technical visit to the Enagás LNG import terminal.

### SG D.1 *Remote LNG*

*Leader:* Simon Frost (Repsol)

SG D.1 has a new leader with Simon Frost taking over from Jean-Yves Capelle (Total, France) who becomes the deputy leader. In general terms, remote LNG production involves sites which are far removed from any logistically developed centre, and therefore usually involve extreme conditions. These projects demand a special approach in terms of design, construction and operations. SG D.1 is evaluating the challenges and will make recommendations for future developments with LNG production greater than 3 mtpa.

In Barcelona, members formalised the change of leader and reviewed the work done to date with particular attention to the remoteness index. They also worked on the content of some sections of the report, updated assignments and agreed a plan of action to complete their work. This group is still fairly small and could do with some more experts on remote LNG projects.

### SG D.2 *LNG as fuel*

*Leader:* Richard Lammons (Chevron, USA)

SG D.2 is carrying out a comprehensive analysis of LNG as an alternative fuel for transportation, remote power and fixed facilities in land and marine applications. The study is addressing technical, regulatory and commercial considerations. The aim is to provide valuable information and resource references to potential consumers and suppliers considering the feasibility of switching to LNG, which offers cost savings and a reduced environmental footprint.

In Barcelona, members reviewed the data gathered to date and identified any further


▼ PGC D's Chair, Dirk van Slooten addressing a plenary session of the joint meeting with PGC B in Barcelona.


▲ At the end of the meeting there was a technical visit to the Enagás LNG import terminal in Barcelona.

functional expertise and participation necessary to ensure the credibility of the final report. A questionnaire was developed and there were key discussions on the distribution system and regulatory landscape. The aim is to have a first draft of the report ready for the next meeting in May.

### SG D.3 *Small-scale LNG*

*Leader:* Wouter Meiring (Shell, The Netherlands)
SG D.3 is looking at the options, opportunities and challenges for LNG facilities with a capacity of less than 1 mtpa. The aim is to provide an overview of potential regions/countries of interest as well as tailor-made technical requirements/solutions. Three sub-groups are collecting data in different geographical regions using a template, while a fourth is looking at definitions and technology across the regions.

In Barcelona, members reviewed the report template and discussed logistics, boil-off gas management, safety, regulations and small-scale LNG archetypes. The regional sub-groups shared progress on data gathering and observed trends. A first draft of the report will be ready for discussion during the May meeting.

### SG D.4 *LNG life-cycle assessment*

*Leader:* Ted Williams (American Gas Association, USA)
SG D.4 is carrying out a life-cycle assessment (LCA) of the LNG chain which for the purposes of the report has been divided into modules covering liquefaction, transportation, regasification and end-use delivery. SG D.4 is collaborating with SG A.3.

In Barcelona, members discussed the template for analysis which looks at technology, air emissions, point sources and fugitive emissions, emission rates per unit of output/shipping distance, scale-related differences in emission factors, flaring and other fuel handling outside the fuel cycle and the quality of emissions data. They refined the module definitions and agreed that closer integration with the work of SG A.3 was needed in terms of LNG chain definitions and upstream and end-use links.

### SG D.5 *Annual World LNG Report*

*Leader:* Philippe Corbière (Total, France)
IGU's World LNG Report provides up-to-date information on LNG liquefaction plants, carriers and regasification terminals and is an important reference document for the industry. SG D.5 is

# Repsol Energy in North America

Repsol conducts a full service natural gas marketing and trading operation in North America. Its clients include producers, local distribution companies, power generators, industrial end users, market aggregators and other trading counterparties.

Repsol's largest market in North America is currently New England where it serves customers from a portfolio of gas supply unmatched by others. It has under contract 100% of the capacity of the Canaport™ LNG facility, of which it owns 75% and is the managing general partner. Through this facility and with other gas supplies, Repsol provides valuable services to its New England customers.

Canaport™ LNG is the first land-based LNG receiving and re-gas facility built on the East Coast of North America in over 30 years and the first ever built in Canada. It can provide up to 1 BCFD of natural gas, on a firm basis, into the market and has 10 BCF of storage. Canaport™ LNG's facility has a year-round ice free port and is able to receive the largest LNG tankers currently designed.

Repsol is expanding its presence in other North American market areas where it is able to position itself favorably. Its current sales are approximately 800 million cubic feet per day and are expected to grow substantially over the next few years.

REPSOL

*Let's invent the future*

responsible for producing three reports during the current triennium and is working with consultants PFC Energy.

At presstime, the aim was to have the latest 2014 edition ready for the Gastech Conference and Exhibition at the end of March. It will include a section on retail LNG as well as special reports on small-scale LNG and competing fuels.

### *Next meeting*

PGC D's next meeting will be hosted by Osaka Gas in Osaka, Japan, May 13-16.

## Programme Committee E – Marketing and Communication

Chaired by Alfredo Ingelmo Torres (Sedigas, Spain), PGC E has two objectives. On the one hand, it will identify and develop ideas, tools and products for a successful promotion and sale of natural gas. On the other, it will define effective communication methods to convey the merits of natural gas and its role in sustainable development, and in a clean economy. Membership of the committee continues to grow (with recent recruits from Australia, Canada, Qatar and Russia) and has reached 66 nominated members.

PGC E's third meeting took place in Washington DC, USA, October 7-9, 2013. It was jointly hosted by the American Gas Association (AGA) and Energy Solutions Center (ESC) and was attended by 24 members.

### SG E.1 *Marketing natural gas and promoting new usages*

*Leader:* Luis Pinto (Shell, The Netherlands)
During the Washington DC meeting, study group members discussed the work programme going forward.

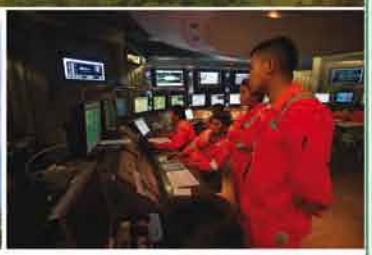
SG E.1 is organising a panel discussion during WGC 2015 on successful marketing campaigns that have increased the market share of gas. As the world realises the benefits of natural gas (Abundant, Affordable, Acceptable, Adaptable) the industry is finding ways to promote current and new uses for it within an ever-changing environment. By leveraging advances in technology and marketing, there are opportunities to expand the use of natural gas in current and new applications, and in sectors such as residential and industrial, which

PGC E members pose for their group photo in Washington DC.

# *Sustaining Operational Excellence*

## Ready for More Business Beyond 2013

*Top Performing Organisation*
*Producing LNG since 1972*
*High Caliber Professionals*
*Never Missed A Contractual Cargo*
*Remarkable HSSE Performance*
*First LNG export plant to achieve calculative level in Asset Integrity and Process Safety*
*ISO 14001 and 9001 Certified*
*Accredited as a BTEC approved centre*
*Received Shell's 'Make it Safe Award' for their commitment to making their assets safe everyday*

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will bring environmental and economic benefits to the market place. The panel discussion will seek to highlight best practices from around the world that have successfully bridged the gap between suppliers and customers to increase market penetration.

The next steps are to analyse feedback from the survey on finding alternative uses for gas, and to try to get responses from Asia as well as from other members of PGC E. A review and ranking of best practices will be completed for the next meeting in Doha. There will also be analysis of global marketing campaigns within and outside the industry to gauge their effectiveness and success to highlight during the WGC panel.

### SG E.2 *Competing and coordinating with other energies*

*Leader:* Barbara Jinks (Gas industry advisor, Australia)

SG E.2 is pursuing two objectives: to encourage the audience to learn new ways of being effective in communicating the gas message; and to inform the audience of what other industries are doing to communicate their message more effectively than the gas industry.

The content of the work being developed includes results from global leadership and internal communications surveys, the presentation of case studies of gas marketing campaigns and the presentation of examples of effective marketing campaigns by other industries.

▼ During their third meeting SG E.3 members made a technical visit to the Marcellus Shale.

### SG E.3 *Communication and public acceptance of natural gas projects*

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

During the Washington DC meeting, members worked on their final report. Afterwards, Shell hosted a technical tour of its shale gas production facilities in the Marcellus Shale near Pittsburgh and showed how it builds local support.

SG E.3 is actively promoting the debate on how to address public concern on natural gas developments. Communities have to trust our sector to do the right thing, or they will say N.I.M.B.Y. The message from the study group is that communication is key: our hardware has to come with soft skills.

Addressing public concern about natural gas development requires substantially more effort from companies. Communities have to trust the natural gas sector to do the right thing. Therefore, we have to invest in building our reputation locally and engaging with communities, local leaders, small businesses, non-governmental organisations (NGOs) and the local government.

SG E.3 will organise an expert forum during WGC 2015 together with WOC 3. The study group will also participate in the 2014 European Autumn Gas Conference in October in London, UK.

### *i-gas Industry: Contribution to a special report*

*Leader:* David Konvalina (RWE Transgas, Czech Republic)

All study groups are covering this transversal topic looking at the impact of online and digital media on the gas industry. PGC E also aims to continue work on the 2011 "IGU Online Proposal" report produced by SG E.3 in the previous triennium.

### *Next meeting*

At press time, PGC E's next meeting was due to be hosted by RasGas in Doha, Qatar, March 3-5.

SINGAPORE INTERNATIONAL ENERGY WEEK
27 - 31 October 2014

# SIEW 2014

## 7th Singapore International Energy Week
## 27-31 October 2014
## Sands Expo and Convention Centre, Marina Bay Sands



## Where the energy world meets and sparks ideas

The resurgence of oil and gas supplies and technological advancements are sparking changes in global energy landscape. How will these spell opportunities and challenges for the region? How can businesses and governments prepare and benefit from these changes?

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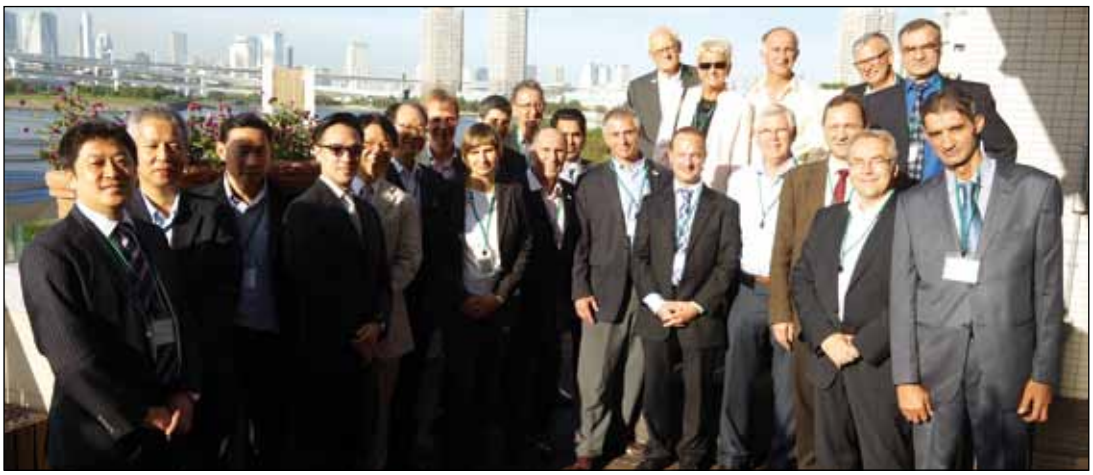

Delegates to PGC F's third meeting in Tokyo pose for their group photo.

## Programme Committee F – R&D and Innovation

PGC F is progressing in its activities to further information exchange and collaboration in global gas research, technology transfer and emerging technology and innovation. The gas industry is experiencing rapid advancement in technical and commercial innovations. Global gas supply is expanding due to development of unconventional resources such as coal-bed methane, tight sands and shale gas, as well as advances for deepwater and Arctic areas. On the demand side, innovations are creating expanded opportunities for gas in traditional markets as well as rapidly growing markets such as transportation. Meanwhile, safety continues to be a focus area for the gas industry.

The impact of R&D and technology innovation is a foundational element across the spectrum of the gas industry – from the substantial growth in global resources with the resultant expansion in gas transportation infrastructure, to development and implementation of efficiencies and new applications in energy utilisation.

PGC F has established three study groups under the chairmanship of Dr Jack Lewnard (Chesapeake Utilities, USA) to address key natural gas research and innovation topics. The committee's third meeting was hosted by Tokyo Gas in Tokyo, Japan, October 8-9, 2013. At press time, the fourth meeting was due to be hosted by Sonatrach in Oran, Algeria, March 10-11.

### SG F.1 *Technical Programme for the IGU Research Conference (IGRC2014)*

The primary deliverable for PGC F is IGRC2014, which will be held in Copenhagen, Denmark, September 17-19.

The scope of IGRC2014 includes technology developments as well as innovations in products, services and business models across the entire gas value chain. SG F.1 has been responsible for setting the structure of the conference; issuing the call for papers; selecting papers and speakers for technical sessions and workshops; and administering awards including the Young Researcher Prize and the Dan Dolenc Best Paper Prize. The study group has drawn across the expertise of the entire PGC F committee as well as external experts to define programme structure and compelling, high-interest topics from the record number of abstracts submitted.

### SG F.2 *Development of international gas RD&D collaborative programmes*

The goal of this study group is to review, identify and assess means for the effective promotion of R&D within the global gas industry. Over the last decade there has been a decline in R&D investment by the gas industry, particularly in gas utilisation. The first task is developing an

inventory of global R&D programmes and facilities to establish a baseline level. Follow-on tasks investigate business models for gas R&D in terms of short- and long-term drivers, and the intrinsic value from research and technology investments. Deliverables will include a database of natural gas R&D facilities, capabilities and programmes as well as frameworks for inter-company and international cooperation and collaboration.

**SG F.3** ***Convergence of gas with electric and renewable energy***

The goal of this study group is to identify positioning and new business models that anchor natural gas as part of the future energy mix. For example, zero-carbon renewable gas, produced from biomass via anaerobic digestion or gasification/methanation, can be integrated into the existing gas infrastructure. Gas can augment renewable geothermal and solar energy for heating and cooling loads. It can also back up intermittent electricity production from renewable sources. In addition, the gas grid has enormous potential to provide energy storage. Given these scenarios, the gas infrastructure becomes critical for integrated energy grids that holistically manage electricity and thermal loads. Specific tasks for SG F.3 will include identification of innovative technology and business models to maximise the value of gas and integration, and the relationship with renewable power and electric distribution systems.

# Progress Reports from the Task Forces

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

### Task Force 1 – Human Capital

TF 1's third meeting was held on December 11, 2013 in Paris at the French Gas Association offices. This was the day after the IGU/UNESCO workshop on Women in Engineering in African and Arab States, which was held in the French capital at UNESCO's headquarters.

The meeting opened with a welcome from Georges Bouchard, CEO of the French Gas Association. This was followed by an overview of the progress of the IGU Human Capital survey by TF 1's Vice Chair, Abdulaziz Mohammed Al-Mannai (Qatargas) and Marius Popescu (Energy Brains Consulting, Romania). The survey of senior executives and HR professionals in the gas industry focuses on the evolution of the industry, the type of people required for companies to move forward, the role of women in the gas industry, issues faced by young professionals and how to attract more young talent. There was also discussion about the content of sessions for WGC 2015.

Georgia Lewis (Managing Editor, IGU Magazine) presented a summary of the discussions from the previous day's IGU/UNESCO workshop. The group agreed that the main themes to come out of the workshop included: the need for mentoring and role models; educational opportunities for girls; social and cultural issues; and political issues in African and Arab nations. For a full report on this event, see pages 146-155.

Marc Mopty (GDF SUEZ, France) updated the group on the progress of plans for the Youth Programme during WGC 2015. He outlined the budget and facilities for the programme and there was a discussion about catering for both students and young working professionals.

TF 1 members Napaporn Dewang and Orusa Khuntong of PTT at the women in engineering workshop.

A presentation entitled "Attracting, developing and retaining young graduates and women: Best practices at Total" was given by Stephane Pla, Total's Head of International Recruitment for Development Organisations. The presentation outlined Total's "professionalisation path" for graduates in which young professionals undertake a succession of two or three positions over a six-year period. In relation to the role of women at Total, Mr Pla reported that women currently make up 31% of the company's employees, 23% of managers, 16% of executives, 15% of the management committee and 33% of board members.

Total is looking to improve this through initiatives such as a Diversity Council, parenthood charter and equal pay policy. Mr Pla also presented TWICE (Total Women's Initiative for Communication and Exchange) through which female employees can seek support, mentoring, gain confidence and express themselves on issues such as business objectives. Events such

TF 2 members pose for a group photograph during their third meeting in Milan.

as workshops, breakfasts, cultural outings and exchanges within the company are all part of this initiative.

The meeting concluded with a presentation by Jupiter Ramirez (Qatargas). He outlined three case studies of STEM- and gender-related work programmes which could be included in TF 1's final report. The first case study involved Texas A&M University's Qatar campus, which engages local high school students, familiarising them with the university's engineering disciplines.

Secondly, Mr Ramirez looked at the University of Texas pre-freshman engineering summer school programme. This prepares middle school and high school students for success in STEM careers by exposing them to rigorous mathematics and problem solving tasks and information about engineering careers. The summer schools are open to all students and there is a focus on enhancing female and minority student participation.

The third case study outlined the Qatargas-Shell Women in the Workplace programme. This programme provides a learning environment that enables knowledge-sharing and creates a professional network for female employees.

At press time TF 1's next meeting was due to be held in Muscat, Oman, March 5-6.

## Task Force 2 – Gas Advocacy

TF 2 has reached the midpoint of the triennium. Chaired by Michele Pizzolato (Eni, Italy), the group is continuing its efforts to sustain the essential role of natural gas in the global energy mix.

Over the past year, TF 2 has focused its activities on the crucial role of natural gas in ensuring the security of power supply and on the potential of unconventional gas resources.

As a "voice" for natural gas, TF 2 has supported the Presidency in lobbying activities with the production of a position paper on capacity remuneration mechanisms (see the article TF 2 has contributed to this issue on pages 158-161). It has also prepared a covering letter to go with the report on shale gas prepared for WGC 2012 in order to present the report to selected institutional stakeholders.

TF 2's third meeting was hosted by Comitato Italiano Gas and Eni in Milan, Italy, January 23-24. Members agreed the agenda for the second part of triennium and are working on the following topics:

### *Competitive relationship between coal and natural gas*

Although the environmental benefits of natural gas as the cleanest-burning fossil fuel are widely known, some markets are experiencing a growing role of coal in power generation.

TF 2's members have collaborated in order to reach a global view of the phenomena and the group is planning to release a position paper on the policy actions that could establish an equilibrium between natural gas and coal, taking into account the environmental aspects with reference to all the pollutants.

The topic was analysed in depth during the last meeting by Massimo Tavoni (Deputy Coordinator of the Climate Change Economics research programmes at the Fondazione Eni Enrico Mattei (FEEM) and Euro-Mediterranean Centre on Climate Change (CMCC), who was invited to present the results of his studies.

### *Natural gas as a fuel for sustainable transportation*

Natural gas has strong potential for development as a fuel for passenger and heavy duty vehicles. Increasing use of NGVs could play an important role in improving air quality. Furthermore, the potential offered by the use of gas in both inland waterway and maritime shipping should be fully recognised and reflected in future policy measures all over the world. In particular, it should be acknowledged that LNG bunkering could make an important contribution to reducing $CO_2$ and $SO_X$ emissions. TF 2 has agreed to monitor and collect information on this topic in order to produce a position paper.

### *Natural gas facts and figures*

Emmanuelle Wicquart, who has joined the National Organising Committee of WGC 2015 as an advisor, is now collaborating with TF 2 in order to update the database of information about natural gas and other fuels. This database could be useful to all IGU members in their own gas advocacy activities. During the last meeting she presented a new approach to the database and her proposals for keeping the information updated. Over the following months TF 2 will complete work on this important gas advocacy tool.

The French Gas Association will host TF 2's next meeting in Paris in November or December.

## Task Force 3 – Geopolitics

After the summer break TF 3 restarted its activities during the meetings in Beijing in October 2013. Prior to the Executive and Council meetings, a roundtable was hosted on the demand supply balance in East Asia and the prospects for cooperation in the region. Together with Russian, Korean and a large group of Chinese delegates, we looked into the geopolitics involved in creating long-term natural gas import contracts – particularly by China – and the impact of these deals on the gas supply balance in the region. Indeed, at the time of the roundtable, a Russian delegation, headed by Prime Minister Dmitry Medvedev, had arrived in Beijing to continue the longstanding talks on a gas contract between Russia and China. It's no secret that the two parties so far have not been able to agree on the price level in the contract, and during our meeting some of these issues were reflected in the discussion.

Something that took off earlier in 2013, early May to be more precise, was the online battle organised by our Task Force to involve students and young professionals in the natural gas debate. TF 3 challenged students and young professionals to share their thoughts with us on oil and gas development in the Arctic. Close to three dozen young people from all over the world picked up the challenge and submitted their articles on our website www.challengetheworldof.com. Marjolein Admiraal (The Netherlands), Kostantin Kollar (Germany) and Carlos Varela Martín (Spain) were the lucky winners. Their approach to the subject ranged from methane hydrate production to renewable energy sources in the Arctic, and to a debate on how much oil and gas could actually be developed in the Arctic region and whether that makes sense. The jury, consisting of academics and a former Canadian minister of natural resources, unanimously

voted for these three submissions and was pleasantly surprised by the very high quality.

The winners were given the opportunity to join our roundtable meeting on the Arctic, held on November 28, 2013 in The Hague and organised in cooperation with the International Peace Institute (IPI). The NGOs WWF and Wetlands International joined us together with academics, government representatives from Canada, Norway and The Netherlands as well as representatives from the industry. There was an open debate on the impact of Arctic oil and gas development, both from an environmental and a security perspective.

Even though most participants agreed that the development of the Arctic hydrocarbon deposits will happen, one particular question about the oil reserves was raised frequently: should we take this huge environmental risk of drilling for oil when ultimately the Arctic holds only oil reserves for a couple of years of production and oil is abundantly available in other regions of the world?

For natural gas the environmental picture looks a bit better, although the co-production of gas liquids also involves great risk. The economic picture of natural gas production in the Arctic seems a bit bleaker, however. Most delegates did not expect the opening up of the Arctic to oil and gas production to evolve into a race among countries to access these reserves, particularly since most reserves are located in the exclusive economic zones of the Arctic rim countries. On the other hand, it was recognised that the shrinking of the ice cap created new opportunities, particularly the opening up of new sea routes, and that it is not unthinkable that countries will try to increase their influence over the region.

On December 11, 2013, the Task Force headed to Strasbourg to participate in the EU-Russia energy dialogue, hosted in the European Parliament. The main topics discussed were the future of the Energy Charter Treaty, the possibility of integrating the European and Russian gas grids, enhancing security of supply and cooperation between the EU and EEU (Eurasian Economic Union, comprising of Russia, Belarus and Kazakhstan). The current standoff between Russia and the EU on certain issues, i.e. South Stream – where the European Commission has declared all the signed contracts with the different parties to be in breach of EU law – and the antitrust case against Gazprom, was also on the agenda. Both parties recognised that a mutually reinforcing engagement is urgently needed and stressed the need for continued dialogue and cooperation.

▲ The winners of the Arctic battle with IGU President Jérôme Ferrier, TF 3 Chair Geert Greving (*rear left*) and TF 3 Secretary Rik Komduur (*rear right*).

At the World Future Energy Summit held in Abu Dhabi, January 20-22, TF 3 visited a roundtable meeting organised by IPI on the Eastern Mediterranean and the Middle East. As IPI's Task Force on Energy and Security and IGU's Task Force on Geopolitics have overlap in their activities, the two task forces seek to cooperate in areas where the interests align. Issues raised in this meeting touched upon the impact of the gas finds in Cypriot and Israeli offshore waters, the position of Iran and the Iran-Saudi relationship and the consequences of energy subsidies in the Middle East.

Papers from this meeting and from the Arctic roundtable in The Hague are available on the TF 3 section of the Growing Together collaboration platform.

# LNG projects: a new stage for Total in Asia-Pacific

An artist's impression of the Ichthys LNG liquefaction complex.

**Total – a historic player**

Total has been developing Liquefied Natural Gas (LNG) since the beginning of the sector in the 1960s and is a world leader in the industry. The Group contributed to pushing growth of the industry in Asia and the Middle East with the building of an LNG plant in Bontang, Indonesia and ADGAS in Abu Dhabi, both opened in 1977.

Nowadays, Total is present in 10 production sites and associated with three developing projects and three currently under study in all the most important production zones (Middle East, Africa, Europe and Asia Pacific). Its access to markets is provided through reserved regasification capacity in six terminals, one of which is under construction.

Late in 2013 we announced the final investment decision for the onshore Yamal LNG project in Russia. This will strengthen our global portfolio to sustain production in the decades after 2017 and will further increase our presence in a region of Russia with high gas potential.

We are also involved in LNG projects in Angola, Australia, Indonesia, Nigeria, Norway, Oman, Qatar, the United Arab Emirates, and Yemen. We have secured LNG purchases from the Sabine Pass gas terminal in the United States and long-term access to regasification capacity in key LNG markets.

The Group is currently positioned along the whole LNG chain, from gas production to marketing to industrial end users. Lastly, Total has optimised its portfolio and increased the value of its production through its Exploration & Production business and Gas & Power division.

**Why the interest in Liquefied Natural Gas?**

In the next 10 years, natural gas will meet an increasing proportion of the world's energy needs and, in the form of LNG, offers numerous advantages in term of transport and flexibility. LNG will constitute an essential element of this rise in gas supply, in response to growing demand in many areas like Asia, Europe and the Middle East.

North America remains, by far, the leading gas market while Asia and Europe have rapidly become the most important regions for LNG imports. Indeed, growth is driven mainly by Asia and, to a lesser extent, Europe, currently gripped by an economic crisis. Demand for LNG is expected to rise as a result of declining North Sea production and policies to limit carbon dioxide emissions.

On its own, Asia absorbed 71% of world LNG production in 2012. In the absence of domestic production or pipeline import networks, LNG is the only gas supply source for Japan, South Korea or Taiwan. In 2020, this geographical area will stay the largest LNG consumer, with annual imports estimated by Total of around 268 Mt. China and India should contribute a lot to this increase, and the growth of domestic production and pipeline imports won't be sufficient to satisfy this very strong growth in demand.

**Why does Total plan to expand its LNG portfolio in Australia?**

As we explained, the long-established markets of north-east Asia constitute the main LNG demand hub while the Chinese and Indian markets are developing quickly. The region is also willing to supplement domestic production to enhance energy security.

The distinctive geography of Australia naturally leads Total to invest substantial means in order to bring energy to the Asian market. Because the Group wants to contribute significantly to satisfying Asian demand in the coming years, Total decided to make Australia one of the strategic axes of its development in LNG production.

**Two projects that will make Total one of the major players in Australian LNG**

Total has held leasehold rights in Australia since 2005. The Group owns 30% of the Ichthys LNG project, 27.5% of the Gladstone LNG project and seven offshore exploration licenses, including three that it operates, off the north-west coast in the Browse and Bonaparte basins. The Group's production was 5 kboe/d in 2012.

In 2012, Total signed an agreement to enter four shale gas exploration licenses in the South Georgina basin in the centre of the country. Under the terms of the agreement, Total can increase its stake to

68% and become the operator in the event of development.

### ICHTHYS LNG

The Ichthys LNG project centres on the development of Australia's offshore gas resources from the Ichthys field in the Browse basin, which will supply an onshore liquefaction complex to be built not far from Darwin. It is the first large-scale gas development project in this basin, and will consist of a subsea production system, a floating gas processing platform, a floating production, storage and off-loading vessel and a gas pipeline stretching nearly 900 km to the liquefaction site.

The LNG plant will be equipped with two liquefaction trains for an aggregate capacity of 8.4 Mt/yr. The site is large enough to allow the construction of up to four additional trains.

Production start-up is expected in 2016 and its LNG production will be distributed on the Asian market, mainly to Japan (70% of total production).

### GLADSTONE LNG

In late 2010, Total acquired a 20% stake in the Gladstone LNG (GLNG) project, followed by an additional 7.5% stake in March 2011. This integrated gas production, transport and liquefaction project is based on the development of coalbed methane from the Fairview, Roma, Scotia and Arcadia fields.

GLNG is part of the development of production of unconventional gas resources. These specific resources, called coalseam gas in Australia, are located onshore in Queensland. The LNG plant will be equipped with two liquefaction trains for an aggregate capacity of 7.2 Mt/yr. Located near Gladstone, north of Brisbane, production start-up is expected in 2015.

Total is a major gas producer (sixth in the world, third in Europe) and a leading LNG player (among the top three in the world). Total's portfolio of long-term contracts is one of the biggest and most diversified compared to other oil and gas majors.


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# Features

This issue's features section starts with reports on three important events IGU organised in cooperation with international partners: a training seminar in West Africa, a symposium during COP 19 and a workshop on Women in Engineering in Africa and the Arab States.

Next up are articles on capacity remuneration, pipeline finance, India's plans to expand its gas grid and underground storage operations, as well as short profiles of IGU's new members and a review of the AFG's 2013 Gas Conference in Paris.

We round up with a description of the publications and documents available from the Secretariat and the events calendar.

# EXPLORING TO DEVELOP

Since 1975, the National Oil Company of Côte d'Ivoire, Petroci, ensures oil and gas exploration and production in Côte d'Ivoire and abroad.
To this end, it has improved its organization by acquiring logistics and strategic infrastructures, mainly for the logistics base of Vridi , the Abidjan- Bouaké pipeline, the expansion capacity of Gestoci in Yamoussoukro and the new filling station with a capacity of 300 tons / day and a new storage tank of 400 tons / day.

To date, 218 wells were drilled and 29 blocks over 50 were allocated (thus 30% of our sedimentary basin being explored).
The Government, by intensifying exploration activities, aims to rapidly reach a production of 200,000 barrels of oil per day and 300 million cubic feet of natural gas per day.

**The dynamism inspired by such a change aims to promote the opening of new horizons; so the best is yet to come ...**

**Producing energy for a strong nation**

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**Producing energy for a strong nation**

PETROCI

# Inaugural African Training Seminar Offers Wide Perspective

By Marc-André Boisvert

In partnership with international and regional organisations, IGU held its first African training seminar on November 4-5, 2013, in Abidjan, the economic hub of Côte d'Ivoire. The seminar in the Golf Hotel, which was opened by HE Adama Toungara, Côte d'Ivoire's Minister for Mines, Petroleum and Energy, offered more than 70 West African gas industry representatives a forum to share experiences in energy development, infrastructure management and business models.

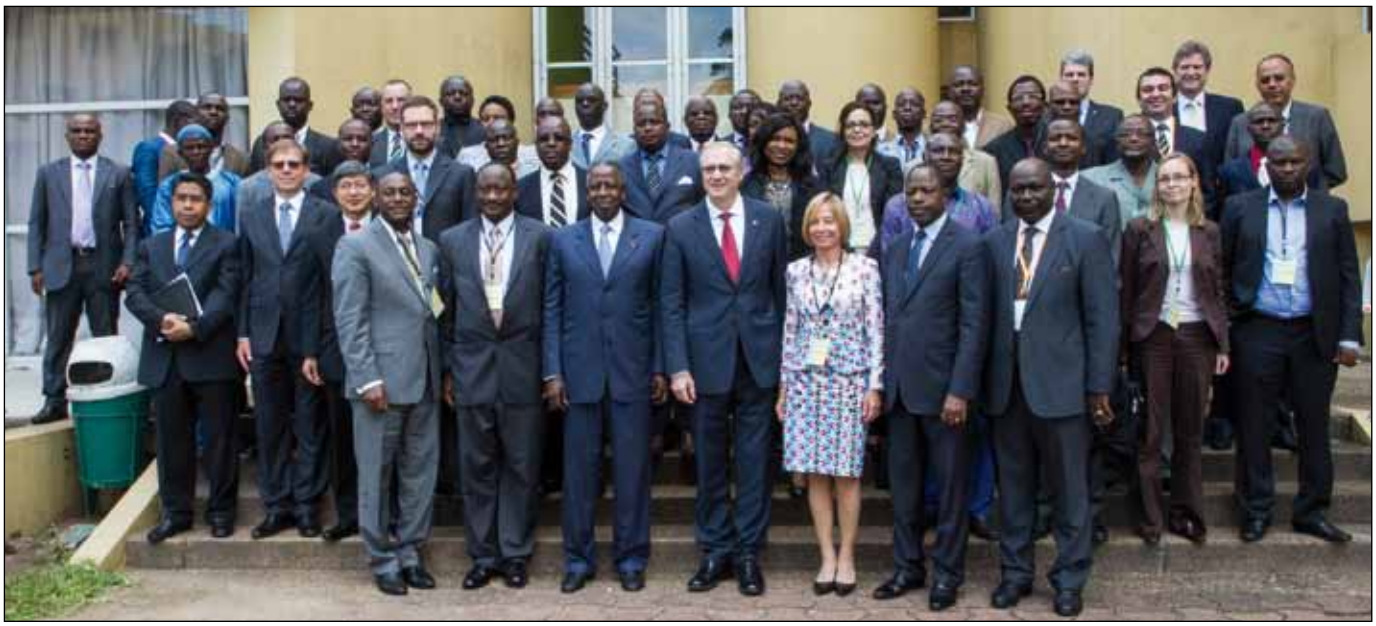
"We covered a broad range of topics," said IGU Secretary General Torstein Indrebø. He explained that under the theme "Access to sustainable energy for all with gas", the seminar focused on developing strategic use of gas in combination with renewable energies. Through such events, IGU intends to develop more partnerships and increase membership in a region where gas has an important role to play in the future energy mix.

Other opening speakers were high-level representatives from IGU's partners in organising the seminar: the United Nations Industrial Development Organisation (UNIDO), UN Sustainable Energy for All (SE4ALL) initiative, Economic Community of West African States (ECOWAS), ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and Côte d'Ivoire's national oil company, Petroci.

The seminar was held just before the Gulf of Guinea Gas Conference, the 16th edition of which was held in Abidjan.

## Opportunities for West Africa

West Africa has one of the lowest levels of access to electricity in the world with major infrastructure issues. Around 20% of households have access to electricity with severe inequalities between cities (40%) and rural areas (6-8%).



▼ Delegates to the Abidjan seminar pose for a group picture.

"Energy access is a major challenge for West Africa. It is possible to solve it, but it is a question of faith and determination," said Akmel Akpa, UNIDO's Officer-in-Charge, Programme Support and General Management.

While Africa is home to some of the world's fastest growing economies, energy investments do not follow economic growth, limiting growth sustainability. In the region, coal is used to generate more than 40% of electricity. But gas is in second place at 30% and is an increasingly attractive solution.

Sunil W. Mathrani, Senior Energy Specialist at the World Bank, underlined the significance of gas and called for this to be acknowledged at government level. "Economies are growing fast," he said. "We need electricity, but we need fuel to generate electricity."

Mr Mathrani gave a presentation on the several possible funding options for governments to boost gas production, especially the five World Bank finance instruments: partial risk guarantees, partial credit guarantees, policy-based guarantees, loans and partial risk guarantees for enclave projects (projects in which the World Bank mitigates critical government performance risks that private financiers are reluctant to assume), and public sector loans.

Hyacinth Elayo, ECREEE's Energy Policy Officer, presented the sustainable energy planning of ECOWAS. Supported by the EU and UNIDO, ECOWAS has set renewable energy targets of 2,425 MW by 2020, an increase of 10%, and 7,606 MW by 2030. It also intends to reduce the marginal electricity generation cost to between 10 and 15 euro cents per kWh, to limit current distribution losses of 15-40% to 10% in 2020, and to diversify energy production, notably by focusing on building mini-grids.

Mr Elayo stressed that any solution has to be regional, highlighting projects like the West African Gas Pipeline that currently connects Nigeria, Benin, Togo and Ghana, as well as the West African Power Pool to increase interconnection between countries. LNG import terminals are being evaluated in several countries such as Senegal and Ghana, offering even more opportunities for gas in the region. In addition, there have been major recent gas finds, notably in the host country, Côte d'Ivoire, and its neighbour, Ghana, adding even more importance to strategic planning for the future of gas.

▲ HE Adama Toungara, Côte d'Ivoire's Minister for Mines, Petroleum and Energy, and Torstein Indrebø, IGU's Secretary General, are flanked by Ho Sook Wah, Secretary General of the Malaysian Gas Association, and Carolin Oebel, Director in the IGU Secretariat.

## Comparing case studies

The seminar offered participants several perspectives from other countries. Carolin Oebel, Director in the IGU Secretariat, reminded the


▼ Akmel Akpa: energy access is a major challenge for West Africa.


▲ Elbert Huijzer: innovative technologies in the renewable gas sector.

audience that gas has been an important factor in the progress of several developing countries. But she also pointed out that there are several limitations to sharing practices. "All countries are different; we cannot apply one concept for everything," she said. "Therefore it is important to evaluate what would work best. The right pricing models are very important and having a regional perspective is too."

In some cases, the experiences of other markets seemed far from the local reality of West Africa, but still allowed a new perspective on energy. Elbert Huijzer, senior strategist at Dutch firm Liander, presented innovative technologies in the renewable gas sector, notably the latest technologies for converting biomass into biogas. He also discussed tri-generation, and several new paths towards sustainable and renewable energies.


▼ Odd Ivar Biller: lessons from experiences in Norway and Qatar.

Also reporting from Europe, Norsk Hydro Vice President Odd Ivar Biller portrayed Norway's experience as an oil and gas producer. While acknowledging that it is difficult to emulate Norway's "success story", he offered a broad overview of the necessary conditions to sustain an efficient gas industry from a country with offshore production.

He emphasised the role of a capable business environment. For him, good governance is necessary to regulate increasing competition in a fast-changing landscape. Providing physical security, recruiting competent labour forces, and funding massive capital-intensive projects on a long-term basis are all challenges that countries involved in the gas industry must address.

Mr Biller went on to describe how Norsk Hydro has participated in a joint venture in Qatar since 1969, starting with the production of chemical fertilisers. "It was the first and most significant step in Qatar's industrial diversification programme to utilise its abundant gas resources," he said.

Since then, Qatar has become the world's largest exporter of LNG. As well as being a producer, it has successfully diversified its economy through gas, notably by attracting several energy-consuming industries such as aluminium production, brick-making and metallic alloys, thus diversifying its economy.

Mr Biller acknowledged that there are significant differences between Norwegian and Qatari industries. "It is important to know where you are, and where you are coming from," he said. But he also indicated that common lessons have been learned, notably about the necessary governmental intervention.

Both Qatar's and Norway's stories share the importance of ownership models upstream and downstream, where oil and gas in the ground belongs to property owners, often national

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## At the heart of global energy markets


▲ Ho Sook Wah (TOP) and Abdul Rahim Mahmood (BENEATH): Malaysian case study highlights how energy resources have driven economic growth.

states, and where oil and gas streaming from wellheads belong to concession holders for a defined period of time.

## Malaysia: the energy transformation

The Malaysian case study offered important lessons for West African states on how to transform oil and gas resources into an economic engine for growth for developing nations. By 2020, this Asian country aims to be a developed nation, and believes that both gas and oil are important contributors to achieve that target.

Ho Sook Wah, Secretary General of the Malaysian Gas Association, presented the story of a country where indigenous energy resources have been utilised to spur the growth of the local economy. Although oil was first discovered in Malaysia in the early 1900s in Sarawak in East Malaysia, it was only in the 1970s that the petroleum resources were developed in a major way, both as a domestic fuel and for export. "Before that, the main fuels for cooking in Malaysia were charcoal, wood and kerosene," Mr Ho reminded his audience.

Now, after 40 years, Malaysia is regarded as a global player in the oil and gas industry and is a success story in terms of how its oil and gas industry has fostered industrial development and a value-added economy. Through good government policies, strong visionary leadership and sound planning, the country has avoided the effects of the "resource curse" and citizens have benefited from the wealth generated from the resource.

Malaysia's experience offers a thoughtful insight on the challenges of supplying reliable and affordable energy in developing countries while pursuing a policy towards market liberalisation. In Malaysia, the price of oil and gas is subsidised by the government and Petronas (the state-owned national oil company) in an effort to provide affordable energy for all. However, the government has put in place the policy framework and pricing regime for a competitive liberalised market to emerge.

"Subsidised pricing is not a sustainable model. Low regulated prices have artificially increased demand, decreased efficient use and hampered upstream investments," said Abdul Rahim Mahmood, Head of Strategic Research within the Corporate Strategic Planning Division at Petronas. "It costs the government a lot of money. We have come up with a programme to reduce subsidies gradually, but we cannot do it overnight."

He explained how current programmes will refocus on offering a social safety net for the poorest, rather than subsidising energy for everyone, when many can afford it.

The story of Malaysia and Petronas highlights the role of the energy industry as an economic driver for national development, and demonstrates how companies can contribute and share benefits that will strengthen the entire nation. Mr Mahmood focused his presentation on the importance of sound energy governance and how the energy industry needs long-term strategies and integrated planning. For oil and gas producers, these are necessary conditions for transforming energy resources into sustainable economic growth.

"A strategy of integration and value-adding production has helped to spur and stimulate Malaysia's economic growth. It is important to craft coherent and cohesive directions in energy policy to ensure orderly development of the industry," he said.

Malaysia has successfully implemented three industrial master plans, which provided the framework for gas utilisation in major economic sectors. With the government providing a conducive environment for the industry to flourish, the positive economic legacy which the Malaysian gas industry has thus far been able to create for the nation will continue well into the future.

## Egypt: gas for economic and social development

In Egypt, gas accounts for around 55% of the total energy consumption, and the country is an example of how partnerships between the public and private sectors can work to develop the entire country.

Rob Bennett, Board Member and Managing Director of TAQA EPC Group, part of the TAQA Arabia group of companies, presented a case study on the Kom Aushim Industrial Area in Fayoum. This study emphasised how investment in gas infrastructure can lead to important economic developments.

Mr Bennett explained how building a pipeline that offers an uninterrupted gas supply, intended to secure more jobs in the area, has led to several medium and long-term benefits.

▲ Rob Bennett: investment in gas infrastructure brings benefits.

Now, existing companies have expanded significantly, and over 85 industries have relocated to the area in the last decade, offering more than 2,500 long-term employment opportunities. This success has also been possible due to other incentives, notably favourable tax exemptions and access to the Fayoum/Cairo highway, but would not have been possible without the pipeline project. For him, smart and targeted integrated planning in the gas industry is an important engine of economic growth.

Business Development General Manager of TAQA Arabia, Akmal Zaghloul offered in his presentation a glimpse of how public and private companies have evolved together in Egypt. The country has slowly moved from a state monopoly on gas towards deregulation and the emergence of private partners for distribution. He spoke on how to build a successful business model in a context of state liberalisation based on shared responsibility with private companies. Egypt, according to Mr Zaghloul, has created public-private partnerships (PPPs) that have offered the capacity of funding the gas sector, while lightening the state budget and allowing the "appropriate allocation of resources, risks and rewards".

He presented a range of PPPs to deliver a combination of governmental planning abilities


▲ Rob Bennett (*left*) and Akmal Zaghloul of TAQA Arabia.

▼ *Pictured from left to right are:* Daniel Gnangni, Managing Director of Petroci, HE Adama Toungara, Dr Kandeh K. Yumkella, CEO of Sustainable Energy for All, and Torstein Indrebø.

and the private sector's financial expertise and capacities, especially for fast delivery.

Egypt's opening to PPPs has earned more than $1 billion of foreign investments in the gas sector. Mr Bennett explained how this is possible, notably in mandating private companies as local distributors. TAQA Arabia now owns four licences for natural gas distribution in 11 Egyptian governorates. For compressed natural gas, the state remains the sole supplier and the sole owner of the supply grid nationwide. However, private partners have played an important role in offering innovative finance strategies for conversion of cars and taxis, and stimulating demand.

## Looking ahead

The seminar offered a wide perspective on past experiences. But the region is already looking ahead. Dr Kandeh K. Yumkella, Special Representative of the UN Secretary General and CEO of Sustainable Energy for All, who is also an IGU Wise Person, summarised this enthusiasm. "We can change the energy story in Africa," he declared.

From the production of biogas with cocoa and coffee industry biomass residues to building new infrastructure, Dr Yumkella believes that more African countries will soon be able to offer positive case studies to share.

*Marc-André Boisvert is a freelance journalist who regularly contributes to Associated Press, Canadian daily* La Presse*, Inter Press Service and several economic magazines. Based in Abidjan, he has been covering West Africa for nine years. The seminar brochure and speakers' presentations can be downloaded from www.igu.org by clicking on the IGU events tab.*

# Höegh LNG

Listed on the Oslo Stock Exchange, Höegh LNG owns and operates a fleet of LNG carriers and floating storage and regasification units (FSRUs). Since 2011, the company has ordered four new 170,000 m³ FSRUs and taken delivery of one additional LNG carrier.

With rising demand for natural gas, the company has emerged as a leading provider of floating regasification services.

In January 2012, Höegh LNG signed an agreement with Perusahaan Gas Negara (PGN) to provide an FSRU to serve as a new LNG import terminal in Sumatra, Indonesia, where it will be moored offshore and connected to the existing gas grid via subsea pipelines. The agreement is a firm 20 year time charter party with two five year extension options. Operations are scheduled to start in 2014.

In the first quarter 2012, Höegh LNG also entered into a 10 year time charter party for an FSRU to be moored in the Port of Klaipeda, Lithuania, to provide an alternative source of natural gas to the country. The FSRU is expected to commence operation in the second half of 2014.

Three of Höegh LNG's newbuildings HN 2548, HN 2549 and HN 2550 alongside the quay at Hyundai Heavy Industries' yard in Korea.

The GDF SUEZ Cape Ann was delivered in June 2010 from Samsung Heavy Industries and is chartered to GDF SUEZ LNG Trading SA on a 20 year time charter.

Höegh LNG's strategy remains to continue its growth within the FSRU market, and the company is actively involved in several tender processes for new floating LNG import terminals.

FSRUs offer a low cost and flexible fast-track LNG import solution. Höegh LNG offers the most efficient FSRUs in the market with availability from 2014.

## Gas Conference Urges Clean, Green Progress for West Africa

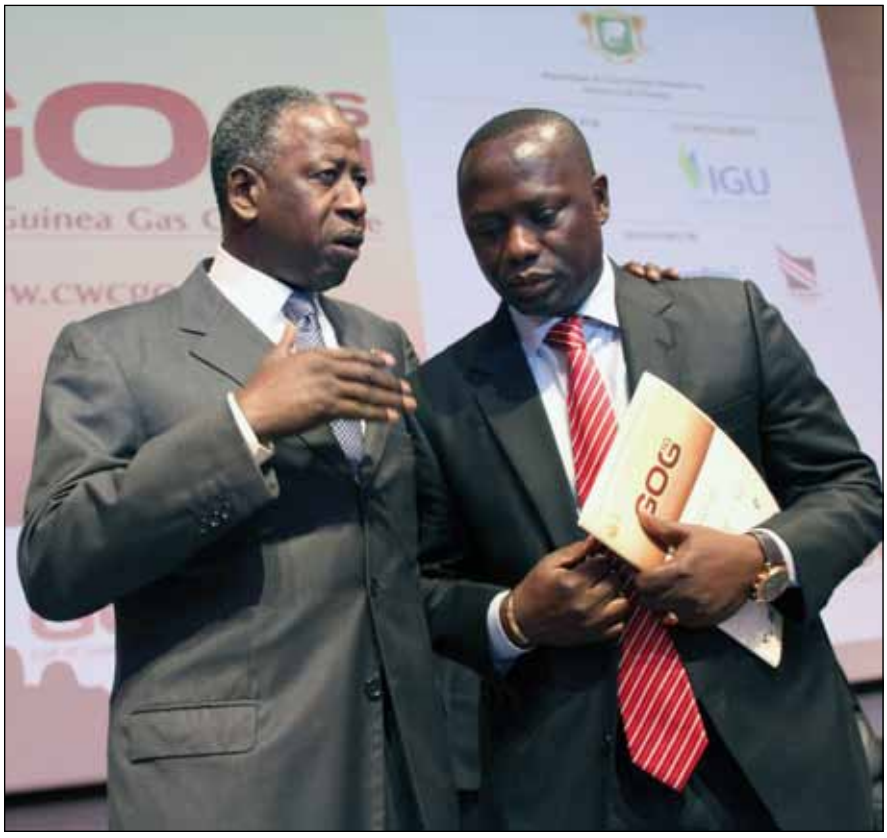
*By Marc-André Boisvert*

The 16th Gulf of Guinea (GoG) Gas Conference attracted more than 450 delegates from 27 countries when it was held in Abidjan, November 6-8, 2013. It was the first time this annual event organised by CWC and co-sponsored by IGU had taken place in Côte d'Ivoire. For 2013, the conference was held under the auspices of the Ivorian Ministry of Mines, Petroleum and Energy and co-hosted by Petroci.

After offering the traditional Akan greeting "Akwaba", Ivorian Prime Minister Daniel Kablan Duncan highlighted the importance of the conference for his government. "Gas is an important part of our economies, a significant production factor and a source of economic and social progress," he said. "Gas is at the core of our industrial development and of job creation."

Côte d'Ivoire currently produces around 1.5 bcm of gas a year and aims to increase this. Major investments have been made in five offshore projects and further investment was announced during the conference by Total with partners Anadarko and Canadian Natural Resources.

During his address, IGU President Jérôme Ferrier discussed the potential for gas in a continent where some 585 million people live without electricity, and 653 million without clean cooking facilities, making it the poorest continent in terms of energy consumption per capita. "Developing natural gas in sub-Saharan Africa is a major objective of IGU," he said. "Growing needs in energy in the region can be met with natural gas."




HE Adama Toungara (*left*), Côte d'Ivoire's Minister for Mines, Petroleum and Energy confers with Hon. Emmanuel Armah-Kofi Buah, Ghana's Minister of Energy and Petroleum, during the 16th GoG Gas Conference in Abidjan.

### *Sustaining developing economies*

Petroleum exploration and production is an important driver of economic development in the Gulf of Guinea region, and the conference was an opportunity to look at a rapidly changing environment. "Natural gas has allowed Côte d'Ivoire to achieve a GDP growth rate of 9.8% in 2012," said Adama Toungara, the country's Minister for Mines, Petroleum and Energy. Côte d'Ivoire is not the only country flirting with double-digit growth rates in the region, but to sustain those numbers will depend on the ability of national economies to take advantage of new opportunities in a sector that has seen a tripling of the number of drillings since 2000.

Dr Kandeh K. Yumkella, Special Representative of the UN Secretary General and CEO of the Sustainable Energy for All initiative, highlighted the urgency of boosting the energy sector. "Energy is central to wealth creation," said Dr Yumkella, arguing that greater private investment is needed to increase the use of renewable energies. "This conference provides a framework for cooperation," he continued. "A new scramble for gas is on and West Africa is a leading exploration centre. But Africa needs to move faster if it is not to be left behind."

West Africa's electricity production is currently insufficient and there are major shortages. In 2011, the electricity deficit during peak hours was 1,257 MW. Despite major investments that will increase production from 50,221 GW in 2011 to 170,697 GW in 2025, the peak hour deficit is forecast to reach 5,516 MW in 2025.

### *Opportunities and challenges*

There is a wide recognition that the future of West African countries depends on more than supplying gas to the world. "Currently, the priority is to export outside the region. We need to focus more on regional cooperation. We need more strategic planning from states to develop a holistic approach to gas development," explained Daniel Gnangni, Managing Director of Petroci.

Several speakers stressed that African countries need to think more about local transformation to strengthen national economies. Ousmane Fall, Senior Investment Officer at the African Development Bank, explained that increasing national transformation capacities is tied to better regional cooperation among neighbours. "There is a need to pool resources to build a gas-based industry," he said. "Nigeria should act as a big brother and help to develop common resources."

Under the leadership of ECOWAS, several projects have been initiated in the last decade to ensure more cooperation among countries and to unleash energy potential. Among them is the West African Gas Pipeline (WAGP), a 678km offshore, high-pressure pipeline that transports gas from Nigeria to Benin, Togo and Ghana. WAGP was inaugurated in 2011, but was damaged in August 2012 by an act of piracy. It is now back in full operation and expansion projects are under evaluation to connect to Côte d'Ivoire and Liberia.

The GoG Gas Conference was also an occasion to share national experiences, look at several ongoing projects, notably in the LNG sector, and consider environmental issues.

Equatorial Guinea and Nigeria are LNG exporters, while Cameroon is evaluating an export plant and several countries are considering import terminals. The latter include Benin, Côte d'Ivoire, Ghana, Liberia, Mauritania and Senegal.

The issue of cleaner energies was a source of vivid exchanges, notably on gas flaring. Dr Ibrahima Diaby, Managing Director of Hydrocarbons in the Ivorian Ministry of Mines, Petroleum and Energy, highlighted the waste of a valuable resource. The latest figures from the World Bank-led Global Gas Flaring Reduction (GGFR) partnership show that 35 bcm of gas was flared in Africa in 2011. GGFR partners Angola and Nigeria have major projects to use flared gas but more needs to be done.

Cleaner alternatives also need the development of local distribution markets in countries where most of the cooking is still dependent on coal and biomass, causing over 4 million premature deaths from air pollution.

IGU Secretary General, Torstein Indrebrø reminded delegates that gas is a strong partner to intermittent renewable energy sources by acting as a back-up. In several countries, hydroelectricity is not reliable as droughts

IGU President, Jérôme Ferrier addresses delegates.

are frequent, and solar has a capacity utilisation of 20-25% in Africa. "The flexibility of gas-fired power generation allows a flow of energy to be maintained 24 hours a day, seven days a week," he said.

### *Emerging energy hub*

The conference was an opportunity to assess where West Africa stands with its gas industry and it also confirmed the region as an emerging energy hub. The 17th GoG Gas Conference will be held in Abuja, Nigeria, October 28-30.

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THE NATIONAL GAS COMPANY OF TRINIDAD AND TOBAGO LIMITED

**Vision**

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**Mission**

To create exceptional national value from natural gas and energy businesses.

**Introduction**

The National Gas Company of Trinidad and Tobago (NGC) is an investment grade company. Our credit ratings are as follows:

- Standard & Poor's: A-
- Moody's: Baa1
- CariCRIS: AAA

As a diversified state-owned company, NGC operates in all areas of the local natural gas value chain of Trinidad and Tobago's gas-based energy sector. With an asset base of close to $6 billion, the Company is one of the largest companies in the Caribbean and Latin America measured by assets. Consistently profitable throughout its existence, NGC is a significant contributor of taxes and dividends to its shareholder the Government of Trinidad and Tobago.

**What We Do**

NGC purchases, transmits, sells and distributes natural gas to industrial and commercial users. We construct, own, maintain and operate a pipeline network of approximately 1,000 km, comprising both offshore and onshore segments. Through our investment shareholdings, we are engaged in the development of industrial sites, port and marine infrastructure and services at Port Point Lisas, Brighton, La Brea and Galeota; upstream gas and oil production in the Teak, Poui and Samaan (TSP) and Angostura offshore fields; NGL and LNG production and marketing.

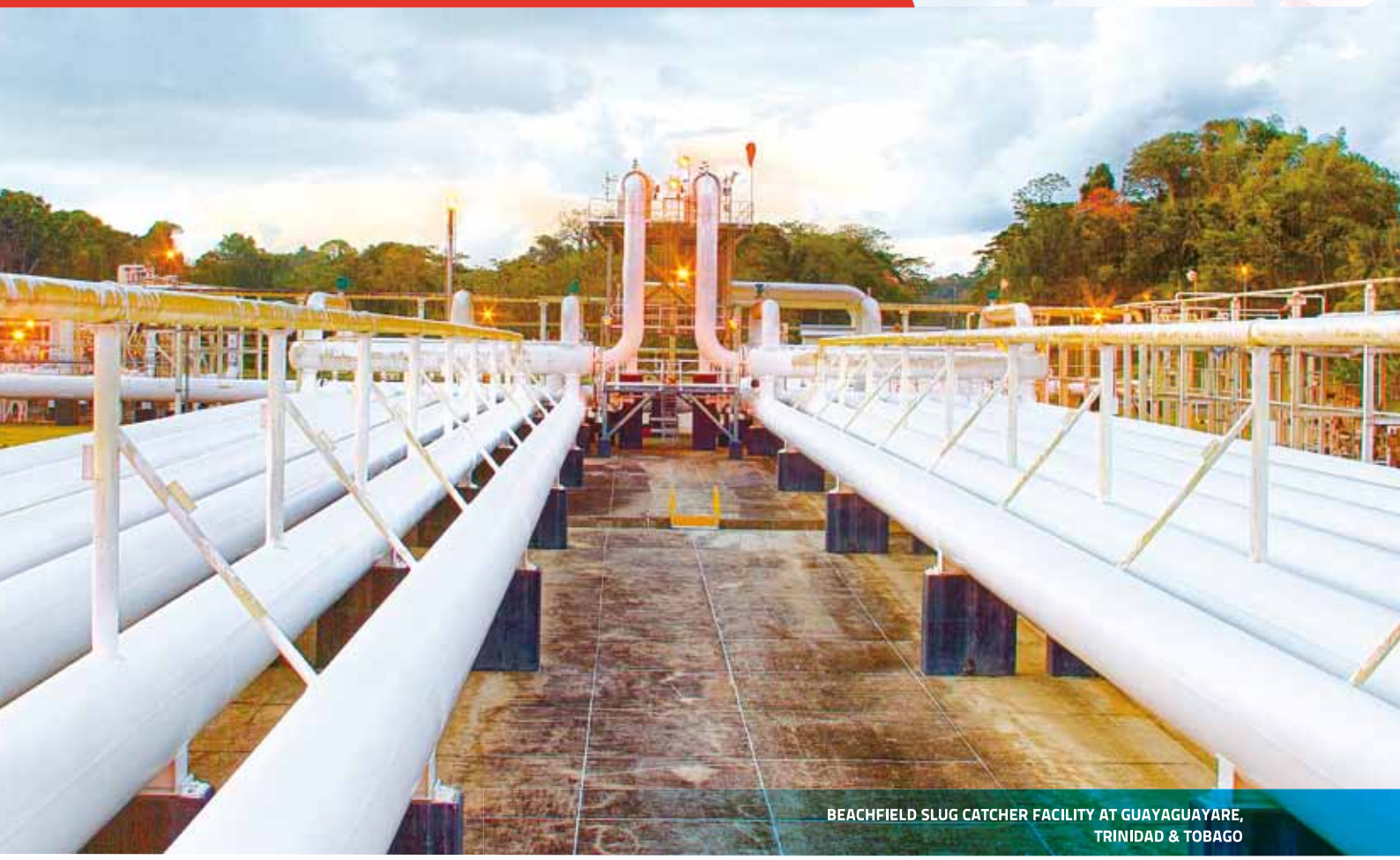
The Beachfield Upstream Development (BUD) Facility, commissioned in late 2006.

**Where We Are**

NGC's head office is based in the world-class Point Lisas Industrial Estate, one of the world's most outstanding examples of natural gas success stories. With 5% year-on-year growth since 1998, an over 40% contribution to national GDP and a position among the top five ammonia, methanol and LNG exporters in the world, Trinidad and Tobago's effective exploitation of its gas resources is universally acclaimed. As the creators and implementers of the Trinidad Model of Natural Gas Development, NGC is well positioned to partner with investors across the globe who want a proven strategy of natural gas development.

The Phoenix Park Valve Station, located at the Point Lisas Industrial Estate in Couva, is designed for the collection and distribution of natural gas and is a critical facility in NGC's pipeline system.

# A **MODEL** FOR **SUCCESS**



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Boasting an asset base valued at over US$6 billion, not only does NGC construct, operate and maintain pipeline networks and gas inlet facilities, we also compress, transmit, distribute and sell natural gas to energy industries and commercial concerns. In addition, we provide world-class industrial facility management and marketing services. With year-on-year gas sector growth averaging 5 percent for more than a decade, the Trinidad Gas Model is a success.

**NGC can do it for you.**

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***THE NATIONAL GAS COMPANY OF TRINIDAD AND TOBAGO LIMITED***

# IGU's COP 19 Event Discusses Clean Energies

By Mark Blacklock

The annual UN Climate Change Conference is an important forum for IGU. For COP 19 in Warsaw, IGU joined forces with the Polish Oil and Gas Company (PGNiG) to organise a natural gas symposium.

"Development of Clean Energies: Need for an Unprecedented Scale of Innovation" was the theme of the symposium, which took place midway through COP 19 on November 17, 2013. It was held in the Warsaw Gas Museum and attended by around 70 people.

The symposium was moderated by IGU's Secretary General, Torstein Indrebø, and divided into two panel discussions. The first looked at supporting innovation in low-carbon technologies, while the second focused on gas-based power generation as a reliable, efficient, competitive and clean energy source fuelling economic growth.

Piotr Woźniak, Poland's Deputy Environment Minister and Chief National Geologist, addressed the opening session. He was introduced by Jacek Murawski, Vice President of PGNiG's Management Board.

Mr Woźniak underlined the importance of events such as IGU's gas symposium: "The industry's voice must be heard in climate change negotiations." He went on to talk about the need to foster technological innovation and gave an overview of developments in Poland's shale gas sector. "Over 50 wells have been drilled and 30 have been fracked," he said. "I expect commercial production within the next year."

In his opening address, IGU's President, Jérôme Ferrier noted the "worrying" comeback of coal for power generation in Europe, but said he was confident that the gas industry had the capacity to reverse this trend. "Natural gas is a cornerstone of the global energy mix," he declared.

## Supporting innovation in low-carbon technologies

The first panellist was Marcin Lewenstein, PGNiG's Head of Strategy, who looked at the potential for Poland's shale gas resources to drive sustainable economic development. "In Poland the principle of sustainable development is enshrined in the constitution," he explained.

Currently Poland imports three-quarters of its gas so increased domestic production will strengthen the country's energy independence.


▼ Piotr Woźniak, Poland's Deputy Environment Minister and Chief National Geologist, addresses the opening session.

Jérôme Ferrier: gas is a cornerstone of the global energy mix.

Marcin Lewenstein: our job to explain the benefits of unconventional gas.

However, there will be more than a national strategic benefit. The Warsaw Energy Studies Institute estimates that Polish shale gas could cost 25-30% less than imported gas.

"It is our job to explain how the exploitation of unconventional gas can benefit local communities," said Mr Lewenstein. "We know that it is fear of the unknown which drives objections."

PGNiG has developed a multimedia communications campaign to reach out to the general public with the slogan "Polish Shale – Good Gas". The campaign details the comprehensive measures taken to protect the environment and explains that increasing domestic gas production will accelerate economic development, increase the competitiveness of Polish industry and boost government revenues. In the longer term, it will reduce the country's reliance on coal and lignite to generate electricity and thus help reduce emissions.

The message is getting across and Mr Lewenstein cited a recent survey which found that 78% of residents in the Pomerania and Lublin regions, which are covered by shale gas exploration licences, are in favour of extraction. However, he cautioned that the development of shale gas in Poland will be gradual: "We will not replicate the US overnight; it will be a long process – an evolution not a revolution."

The second panellist was Vegar Stokset, Head of Communications for the $CO_2$ Technology Centre Mongstad (TCM) in Norway, a joint venture of Gassnova, Statoil, Shell and Sasol. TCM offers companies the opportunity to test their technologies for carbon capture from flue gases. The aim is to reduce the costs and risks of carbon capture and accelerate the development of qualified technologies which are capable of wide-scale international deployment.

"The testing done at Mongstad will benefit the global community," said Mr Stokset. "We believe it is very important to share knowledge."

TCM launched an international test centre network in January 2013, which includes the National Carbon Capture Center and Southern Company's CCS demonstration facility, both in Alabama, USA, the Wakamatsu Research Institute in Japan, ENEL Engineering and Research (Italy), E.ON (Germany) and Doosan Power (UK). TCM also participates in international conferences and has welcomed 5,000 visitors to its facilities.

TCM has an amine plant and a chilled ammonia plant, while a third area has been set aside to test future technologies. Testing began in 2012 and the results are encouraging. Amine solvent carbon absorption was tested in collaboration with technology partner, Aker Solutions, and chilled ammonia capture with Alstom. In each case a $CO_2$ capture rate of 90% was achieved.

Mr Stokset said that four companies have been shortlisted for further utilisation of the amine test plant and there have been 14 applications to use the third test area.

Next up was Statoil's Leading Advisor Climate Change, Arne Eik, who looked at

Arne Eik: energy-related $CO_2$ emissions must be halved by 2050.

overcoming barriers for the development of new clean technologies. "Energy-related $CO_2$ emissions must be halved by 2050," he declared if the global temperature rise is to be held at 2°C. "Gas is an important part of the solution."

Mr Eik explained that Statoil's climate change strategy is based on supplying more gas to markets around the world, improving the efficiency of operations, using CCS and engaging with policymakers. "We need to make sure we have the right policies," he said, lamenting the slow progress in achieving a global climate agreement. He urged that a regulatory framework should be developed which is technology-neutral and provides the ground for innovation and cost-effective actions to reduce emissions. Warning against a fragmentary approach to tackling emissions, Mr Eik said he would like to see a global carbon market in the future.

In the discussion after the presentations there was general agreement that one of the biggest obstacles to reducing emissions is that the current carbon price is too low.

Gérard Moutet: synergies can be developed with renewable energy sources.

## Gas-based power generation

Kicking off the second panel session, Gérard Moutet, Total's Vice President for Climate, Energy, Sustainable Development and Environment, looked at the challenges and opportunities for increased use of gas.

The share of gas in Total's overall portfolio is increasing and Mr Moutet first reviewed improvements in production techniques. He explained that Total's objective is to halve gas flaring in the fields it operates by the end of 2014. He went on to look at the expanding market for gas as a transportation fuel and the power generation market. Gas, he said, is set to become the second largest energy source by 2030 and synergies can be developed with renewable energy sources. Gas-fired power stations and the gas grid can provide the back-up generation and energy storage capacity needed to cater for the intermittent nature of wind and solar generation.

Focusing on gas-fired power generation, Mr Moutet outlined the efficiency and low emissions of new turbine technologies and the scope for combination with CCS to further reduce emissions. When evaluating CCS, he said, "Don't look at the cost per tonne injected into the ground but per kWh". On this basis the cost of CCS with gas-fired power generation is no more expensive than CCS with coal-fired generation as the latter involves the transport and storage of far more carbon.

In the next presentation, Tanya Morrison, Shell's Climate Change Government Relations Manager reviewed the global energy outlook. A growing population and rising living standards are driving demand, which is forecast to increase 60% by 2050. But global energy supply is as carbon intensive today as it was in 1990, largely because coal has been dominating the growth in power generation. "We need to make the case for gas and for CCS," she said.

Tanya Morrison (LEFT) and Ksenia Gladkova (RIGHT) address the second panel session.

Ms Morrison outlined Shell's tight gas and LNG developments and said that with major resources of conventional and unconventional gas, global supply can easily cover a doubling of gas demand by 2050. "Gas and gas infrastructure are the backbone of the transformation of the energy system," she declared.

Philippe Benoit, Head of IEA's Energy Efficiency and Environment Division, agreed. "Gas technologies in the power sector are essential for achieving the 2°C scenario," he said. "We see CCS being an important complement to the use of gas in power generation."

Mr Benoit reviewed the work done on CCS and said that to meet the 2°C scenario, 40% of gas-fired electricity generation by 2050 needs to come from natural gas with CCS and biogas. But to get there, first-generation, large-scale gas plants with CCS need to be demonstrated and deployed and financial support mechanisms for CCS put in place.

Ksenia Gladkova, Senior Advisor in the IGU Secretariat, began with a briefing on IGU's activities and then looked at how gas supports social and economic development. Clean-burning gas is abundant and widely distributed, she pointed out, while having a wide range of applications and offering the flexibility to complement renewables.

A robust and sustainable energy policy can be achieved, said Ms Gladkova, "through improved energy efficiency, greater use of gas in power generation and transportation and a phasing in of renewable energy".

The last panellist was Tomasz Solarski, Director of PGNiG's Exploration and Production Branch, who gave a detailed presentation on the steps taken in Poland to protect the environment during shale gas operations. This is a long-term project and ultimately, he said, "Our aim is to return the land to its original state".

## Conclusions

The importance of developing and implementing CCS was a key message of the symposium. "The industry's activities in this field are part of our licence to operate," said Torstein Indrebø.

Participants agreed that the gas industry needs to reach out to all stakeholders, and there were valuable lessons to take away from Poland's success in building public support for developing its shale gas resources.

There was a wide-ranging discussion of the growing market for gas, particularly in the power generation sector where gas has a role to play in complementing renewables.

However, concerted action is needed to encourage technological innovation and greater use of cleaner fuels, notably in terms of developing a conducive regulatory framework. As Torstein Indrebø pointed out, "The Golden Age of Gas does not happen by itself".

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

## Results from COP 19

COP 19 kept governments on track towards a universal climate agreement in 2015 and included significant new decisions that will cut emissions from deforestation and on loss and damage.

"Warsaw has set a pathway for governments to work on a draft text of a new universal climate agreement so it appears on the table at the next UN Climate Change Conference in Lima. This is an essential step to reach a final agreement in Paris, in 2015," said Marcin Korolec, President of COP 19.

In the context of 2015, countries decided to initiate or intensify domestic preparation for their intended national contributions towards that agreement, which will come into force from 2020. Parties ready to do this will submit clear and transparent plans well in advance of COP 21, in Paris, and by the first quarter of 2015. Countries also resolved to close the pre-2020 ambition gap by intensifying technical work and more frequent engagement of ministers.

COP 19 resulted in agreement to establish an international mechanism to provide the most vulnerable populations with better protection against loss and damage caused by extreme weather events and slow onset events such as rising sea levels.

In addition, governments provided more clarity on mobilising finance to support developing country actions to curb emissions and adapt to climate change. This includes requesting developed countries to prepare biennial submissions on their updated strategies and approaches for scaling up finance between 2014 and 2020.

There were also concrete announcements of forthcoming contributions of public climate finance to support developing nation action, including from Norway, the UK, EU, US, Korea, Japan, Sweden, Germany and Finland.

Meanwhile, the Green Climate Fund Board is to commence its initial resource mobilisation process as soon as possible and developed countries were asked for ambitious, timely contributions by COP 20 in December.

### *Further progress in help for developing nations*

The agreements included a significant set of decisions on ways to help developing countries reduce greenhouse gas emissions from deforestation and the degradation of forests (REDD), which account for around one-fifth of all human-generated emissions. The Warsaw Framework for REDD+ is backed by pledges of $280 million financing from the US, Norway and the UK.

In Warsaw, a milestone was passed after 48 of the poorest countries of the world finalised a comprehensive set of plans to deal with the inevitable impacts of climate change. With these plans, the countries can better assess the immediate impacts of climate change and what they need in the way of support to become more resilient. Developed countries, including Austria, Belgium, Finland, France, Germany, Norway, Sweden and Switzerland have also paid or pledged over $100 million to add to the Adaptation Fund, which has now started to fund national projects.

Governments completed work on the Climate Technology Centre and Network (CTCN) so that it can immediately respond to requests from developing countries for advice and assistance on the transfer of technology. The CTCN is open for business and is encouraging developing countries to set up focal points to accelerate the transfer of technology.


COP 19 President Marcin Korolec (*centre*) addresses a plenary session.

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# Women in Engineering Workshop Tackles Big Issues

By Georgia Lewis

On December 10, 2013, IGU partnered with UNESCO to hold a Workshop on Women in Engineering in Africa and the Arab States at the UNESCO headquarters in Paris. Eminent speakers from both regions, IGU and UNESCO focused on four issues: the need for mentoring and role models; educational opportunities for girls; social and cultural issues; and political issues in African and Arab nations. The workshop was sponsored by Total, GDF SUEZ, Oman LNG and Qatargas.

Dr Gretchen Kalonji, UNESCO's Assistant Director General for Natural Sciences, began proceedings with a short eulogy for Nelson Mandela whose funeral was taking place as the workshop started.

The Deputy Director General of UNESCO, Getachew Engida welcomed delegates and said that UNESCO is deeply committed to expanding the role of women in engineering. "There are positive trends we must accelerate but they are not enough," he said. "No country can afford to ignore 50% of its human resources."

Mr Engida stressed the need to invest in the skills and talents of Africa's young people, citing the statistic that there is only one engineer per 6,000 head of population in Zimbabwe compared to one per 200 people in China.

In his opening address IGU President, Jérôme Ferrier emphasised the importance of achieving the third Millennium Development Goal, which is to promote gender equality and empower women.

"It is no longer time to raise the question why aren't there more women engineers, but to gather feedback on the result of actions developed to increase the global ranks of women engineers and to share all the positive experiences and efforts to foster access for women and young people to engineering careers, as well as pitfalls encountered," he said.

The workshop was organised as two round-tables. The first discussed how to entice young women in Africa into science, technology, engineering and mathematics (STEM) education. It was moderated by Dr Lidia Brito, Director of UNESCO's Division of Science Policy


UNESCO's Deputy Director General, Getachew Engida welcomes delegates.



IGU President, Jérôme Ferrier giving his opening address.

Maha Ayoub: unsustainable to not use female talent.

and Capacity Building, and the panellists were: Maha Ayoub, Deputy Ambassador of Sudan to UNESCO; Anne Wangari Kirima-Muchoki, Chair of the Kenya Investment Authority; Dr Tonya Blowers, Programme Coordinator, Organisation for Women in Science in the Developing World; and Dr Gretchen Kalonji.

The second roundtable sought to identify best practices for attracting women to careers in engineering in the Arab states. It was moderated by Khaled Abu Bakr, Executive Chairman of TAQA Arabia, who is IGU's Regional Coordinator for the Middle East and Africa. The panellists were: Dr Laila Rashed Iskandar, Minister of State for Environmental Affairs, Egypt; Dr Amina Benkhadra, General Director, National Office of Hydrocarbons and Mines, Morocco; Dr Fareeha Zafar, Government College University, Pakistan; and Fadwa Abu Ghaida, President, Arab Women Engineers Committee (AWEC), Federation of Arab Engineers.

Dr Kandeh Yumkella, the UN Secretary General's Special Representative on Sustainable Energy for All, who is also a member of IGU's Wise Persons' Group, sent a video message to the opening session; and two videos featuring interviews with young women engineers from Kuwait and Algeria were shown during the second roundtable.

## The need for mentoring, role models and supportive employers

In addition to ensuring more women are drawn to study engineering, it is important to retain the skills of women who have graduated with engineering degrees in the workforce. Many speakers addressed this issue with an emphasis on the need for mentoring, strong role models and improved workplace practices.

Ms Ayoub cited multiple factors that may discourage women from the engineering industry. These included a lack of awareness of


Lidia Brito introduces the panellists for the African roundtable.


Anne Wangari Kirima-Muchoki: need for gender-blind workplace policies.

what engineers do and the male-dominated environment of engineering globally. She pointed out that it is "unsustainable" to not use female talent.

Mr Ferrier said gas industry employers need to develop local talent pools of engineering capacity and retain women in the engineering workforce, recognising that "in this field there is no one-size-fits-all solution and specific packages must be tailored in accordance with social and cultural regional frameworks".

He also cited reasons women may fail to meet their full professional potential. These included a lack of attention and supporting policies, which can stagnate or end women's engineering careers, and marginalisation which diverts women from the leadership track into less rewarding careers. He said that IGU is addressing these priorities through the Task Force on Human Resources.


Gretchen Kalonji: engineering curriculum needs to be inverted.

On the issue of work-life balance, Dr Kalonji raised the point that a better balance helps men as well as women. "We can all benefit from changes to the system and a better work-life balance," she said.

Ms Kirima-Muchoki stressed the need for "gender-blind workplace policies" to fight prejudice and help women engineers find a balance between work and family. "[There is a] need for women to speak out. If everyone did that we would change the world," she said.

The IT industry was cited by Ms Kirima-Muchoki as a positive industry for women who studied STEM subjects. She said this is because many IT employers offer flexible working conditions, such as using technology to allow staff to work from home. Major websites have been developed by women in Kenya, such as www.ushahidi.com, an information-sharing site that was the brainchild of Ory Okollol.

In relation to positive female role models, Dr Blowers said that they are important for girls in school as well as tertiary education. Practical actions are also important she said, explaining that the Organisation for Women in Science in the Developing World provides PhD and MSc fellowships for women in developing countries. The programme is funded by the Swedish International Development Cooperation Agency and 50 fellowships, each worth $5,000 a year, are awarded annually. "You can't just get women into education, you have to maintain them there," said Dr Blowers.

Dr Zafar said that, "women need to be brave enough to reject stereotypes". She gave the examples of the late Arfa Kareem who was awarded a Microsoft certification in 2004 at the age of nine, and Kinnaird College for Women Engineers in Pakistan which had six female IT students in 2010 and now has 72.

Dr Benkhadra offered one way employers in the gas industry can help develop careers and improve retention among women engineers:

"More leadership training and career development is needed for women in the science and technology field so they can be promoted to a higher level within companies."

The role of AWEC in supporting women, offering role models and training opportunities was outlined by Eng. Abu Ghaida. AWEC was founded in 2010 and is based in Jordan with members from 12 Arab countries. "There need to be better workplace conditions for women engineers and better opportunities. There is a mindset that women are not good for the engineering sector and this needs to be overcome," she said. "More data on working conditions for women is needed so concrete numbers can be cited as examples of how women's conditions need to improve, such as pay gap data."

Eng. Abu Ghaida also stressed the importance of women in engineering receiving special training to develop "soft skills" such as media liaison, leadership and interpersonal skills. She gave an example of the importance of self-confidence and leadership skills, sharing an anecdote from her own career where the King's brother visited her workplace and she was the only engineer to come forward and answer his questions.

Dr Zafar offered ways gas industry employers can help advance the careers of women. These included identifying appropriate jobs in engineering, greater use of e-learning so women can fit in study and career development around family life, flexible training and retraining and family-friendly workplaces which offer childcare, so women are encouraged to stay in engineering roles after marriage and childbirth.

## Educational opportunities for girls

Workshop participants emphasised the need for high-quality access to education and particularly scientific education.

In his video message, Dr Yumkella focused on the role access to energy, including gas, can play in ensuring girls are able to attend school. "Women and children in developing countries spend 20 hours a week collecting firewood and water and the children are usually girls who should be at school," he said, telling delegates that access to LPG for cooking and using gas to generate electricity will save lives.

"Energy is the golden thread that runs through all the pillars of sustainable development," said Dr Yumkella.

Dr Brito asked what can be done to entice young women to study STEM subjects. "We know that it is important to empower women," she said. "There are a lot of issues that are not addressed because men do not think they are important."

Dr Kalonji called for "the radical reformation of the education system" especially in regard to engineering, which she described as "one of the main mechanisms to address the challenges facing the world". Promoting engineering as "a very human, intellectual profession" with a focus on teamwork and problem-solving could help attract and retain more women, she said.

Engineering has traditionally been taught with an initial focus on theory rather than problem-solving, but Dr Kalonji said the curriculum needs to be inverted: "Having problem solving in the first year, inter-disciplinary work [and] more hands-on work early on" will "retain students in general and attract women."

Ms Ayoub pointed out that 55% of undergraduates in Sudan are women and girls consistently achieve the highest scores in education yet only 5% enter STEM industries. "This is a problem for all countries, not just Sudan," she said.

Dr Zafar urged that more scholarships for women in STEM fields be given by banks, as well as education loans for women at an attractive rate, such as those offered by First Women Bank Ltd in Pakistan.

Dr Iskandar focused on people, especially women, who are illiterate but perform engineering tasks. She cited the women who sort through rubbish in Cairo's municipal dump and know about recyclables, such as high and low density plastic, describing them as "environmental engineers", and women who grow food

Laila Rashed Iskandar: Education needs to cater to adults as well as children.

sustainably, whom she described as "biodiversity engineers".

"If you have a degree it is science, if you don't it is just 'local knowledge'," Dr Iskandar declared, stressing that education needs to cater to adults as well as children. She said that as well as ensuring children go to school, the Egyptian government needs to develop the skills of uneducated adults.

"These people need to be linked to doing good; this is not charity," said Dr Iskandar, giving as an example the teaching of geometry to women who then made quilts from recycled rags for an income. She also mentioned the Egyptian women who produce biogas from rural waste without engineering degrees or formal education. "The next step is for multinationals to see the value in this and to invest in biogas for the purposes of job creation as well as energy security," she said.

Dr Benkhadra spoke about positive improvements and the challenges Morocco still faces in attracting women into engineering. While there were only two women studying engineering in Morocco in the mid-1970s, women now make up 30% of engineering students. "More Moroccan women are engineers in mines and performing previously male-dominated jobs at every level," said Dr Benkhadra. "But there is room for improvement and much work to be done in the next decade."

Morocco is still struggling to attain gender equality in school attendance and this has a knock-on effect for women going into tertiary education. "There is still a big gap in school attendance levels between rural and urban Morocco and this is a big barrier to more women accessing tertiary training," according to Dr Benkhadra.

She called on the gas industry to help redress this imbalance: "The development of the gas industry is an important part of this as it will help more families in rural areas access electricity and girls will spend less time performing tasks such as fetching wood for fuel. This, in turn, should help more girls to access education."

Speakers agreed that primary education for girls is just as important as tertiary education. "Girls need opportunities to play with science-orientated things in junior school [such as] practical problem solving," said Dr Kalonji. She also said schools need adequate science teachers, saying this can be a problem because training science teachers can be expensive.

There was discussion of how life sciences attract more women and this was largely attributed to a direct link to making things better (e.g. in agriculture), whereas the contribution of subjects such as maths to human development can be less obvious. Dr Brito said it is important for the media to communicate to the world what engineers do. Dr Benkhadra agreed: "The media should play a role in raising awareness of the achievements of women in science and technology."

## Social and cultural issues

In African and Arab nations, social and cultural issues may be playing a role in holding women back from careers in engineering. However, panellists also made interesting points about inaccurate stereotypes about the progress of women in the African and Arab regions.

When Eng. Abu Bakr introduced the second roundtable, he said that the rights of women have become a hot topic in the wake of the

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Khaled Abu Bakr: rights of women have become a hot topic in the wake of the Arab Spring.

Arab Spring and that the energy, efficiency and devotion of women will benefit the engineering sector and help overcome social or cultural barriers.

In a broad-ranging presentation, Dr Zafar focused on problems faced by women engineers in Arab states and corrected myths and stereotypes about women in the Islamic world.

"In the Quran and in hadiths, there are texts focusing on the importance of every Muslim, male and female to seek education," said Dr Zafar. She quoted statistics showing that some Islamic countries lead non-Islamic countries when it comes to numbers of women in higher education. For example, 55% in Malaysia and 54% in Lebanon compared to 44% in Switzerland. There are high numbers of female science students across the Arab world, such as 74% in Bahrain, compared to 43% in the US. However, in some Arab countries, there is still low representation of women in science and technology, such as Saudi Arabia where 1% of engineering students are women.

Dr Zafar explained that across cultures, not just Islamic ones, an image of delicacy is reinforced among girls. "Engineering is still considered a bold field for women," she said.

Dr Benkhadra discussed the importance of change within families in the Arab states: "Culturally, it is traditional for the husband or father to be the breadwinner but it is important for husbands and fathers to support wives and daughters so they can pursue careers as well as family life. Stereotypes still exist culturally and within families about the role of women as cooks, mothers and house cleaners instead of decision-makers."

Eng. Abu Ghaida made the point that in the home, children should share responsibilities so tasks such as housework are not seen as "just for women".

Dr Zafar said that "young men in the Arab world are not always comfortable with more women in engineering, but they are adjusting." She says this is largely because more boys are growing up in households with working women.

A social and cultural issue common to many engineers was raised in the morning question-

Fareeha Zafar: some Islamic countries are leaders when it comes to numbers of women in higher education.

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Fadwa Abu Ghaida: women need to network better and take the initiative to form their own groups.

and-answer session. Lori Traweek, Chief Operating Officer for the American Gas Association, a mechanical engineer with a degree in communications, pointed out that engineers are often poor communicators and this can make it "more difficult to motivate young people". She recommended communications training for engineers. Dr Blowers agreed, saying engineers should "practise making a pitch in two minutes about their work to a person at a party" by starting with the big picture and then going into detail.

Another question raised the issue of women not being allowed into male-only spaces in the Arab world, such as mosques and the majlis, where decisions are often made. Eng. Abu Ghaida responded to this saying that women need to support each other, network better and take the initiative to form their own groups.

Amina Benkhadra: greater political will is needed.

## Political issues in Africa and Arab nations

Political issues and policy decisions in African and Arab countries have had an impact on gender equality and this, in turn, affects the careers of women in engineering.

During the morning session on Africa, Ms Kirima-Muchoki spoke in favour of affirmative action and told delegates that the revised Kenyan constitution now stipulates a minimum of one-third women at all levels of government.

Ms Ayoub said that in Sudan legal equality is important but other shifts need to be made by schools and companies, such as aligning school hours with work hours "so women don't have to take time off work to pick up kids or beg favours from relatives or feel guilty".

Dr Iskandar offered the Egyptian perspective, explaining that the interim government is leading the country "on a road map that means the country is returning to stability" and that "this should bring advances for girls and women". She also focused on Egypt's growing use of public-private partnerships for investing in women's education.

"Montessori methods have been adapted to teach illiterate women the basics but more investment is needed in investing in teaching the underprivileged, such as children who work in quarries and brick factories," said Dr Iskandar. She also cited the example of public-private partnerships in adult education with the teaching of first aid and midwifery skills by doctors in mobile health clinics in impoverished areas.

Dr Benkhandra said that more women than ever are going to university in Morocco, and state policy reforms for gender equality have been instigated by the King. Morocco has also seen the promotion of women politically through quotas, improvements in family law and citizenship rights for women. However, Dr Benkhadra also reported that there has been a drop in women's political representation in

Morocco recently which means "greater political will is still needed".

Eng. Abu Ghaida said political changes in the Arab world should be the catalyst for women's empowerment: "[Women] can meet real development targets if they are ready … they should be encouraged to work hard and take the chance to improve their conditions."

Dr Zafar said that the status of women in Pakistan can only be improved with greater political representation for women. She recommends all public boards be made up of 50% women and for anti-harassment laws to be passed universally. Dr Zafar also said it is up to companies to play their part. She told delegates companies should have "warning systems in place so women are comfortable reporting any incidents of harassment".

## Conclusions

The Paris event follows on from the UNESCO engineering initiative, which was launched at the general meeting in November 2011. This means there is now data-gathering on women in engineering worldwide through the UNESCO data centre in Montreal. Important partners include professional engineering associations, companies and student associations.

Dr Benkhadra said that challenges such as mitigating climate change and overcoming poverty, in which the gas industry can play a leading role globally, can be met if women's skills are leveraged and if women are mobilised and trained. She cited UNESCO's streamlined teaching, networking and communication programmes to improve women's access to quality education in engineering, which can ultimately lead to more women choosing careers in gas.

Promoting "competent women, not token women" was an important point made by Dr Benkhadra. This was reflected by Eng. Abu Ghaida: "If a woman engineer makes a mistake, it is not because she is a woman but because she is a human being."


Saniye Gülser Corat: importance of overcoming stereotypes and prejudice.

In her concluding address, Saniye Gülser Corat, Director of UNESCO's Division for Gender Equality, said that encouraging women in science and technology is "a core competency for UNESCO".

Ms Corat said that UNESCO's focus on improved literacy will help more women have careers in engineering and help more mentors to become available. In many countries, the education gap between boys and girls has not improved in 20 years and this must be addressed if more women are to study STEM subjects, Ms Corat told delegates.

She also touched on the importance of overcoming stereotypes and prejudice, and to improve the media's portrayal of women. Ms Corat put the onus on employers to encourage better work-life balance for women engineers, especially after marriage and childbirth.

Tackling the constraints on women in engineering identified during the workshop is a job for everyone. As Ms Kirima-Muchoki declared: "For women to have their rightful place there must be a combined effort of women and men."

*Georgia Lewis is the Managing Editor of International Systems and Communications. The full transcript and the video addresses can be downloaded from www.igu.org by clicking on the IGU events tab.*

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48 TAHUN

# Creating a Prosperous Indonesia **Through Good Energy**

Over the last five years, Indonesia has seen average annual economic growth of 5.9%. The high growth rate also has a direct impact on national energy needs. According to data from the 2013 BP Statistical Review of World Energy, oil accounted for 45% of Indonesia's energy consumption in 2012. The volume also continues to increase each year, while Indonesia's oil production fell at an average of 3% per year.

Due to increased oil consumption, the value of oil and gas imports has continued to rise over the last three years. In 2011, oil imports were valued at $40.71 billion which increased to $42.56 billion in 2012. As of June 2013, the value of Indonesia's oil and gas imports reached $22.1 billion. As a result of the oil and gas imports, the national trade deficit in July 2013 reached $5.65 billion.

To curb steep expenditure on imported oil, the government has been striving to reduce the country's dependence on petroleum by, for instance increasing the utilisation of natural gas. The National Energy Council (DEN) even increased the proportion of gas in the national energy policy plan in 2025 to 22% from the initially planned 19.7%.

In order to realise the 22% gas mix in 2025, one of the main factors that must be considered is the availability of gas pipeline infrastructure. For more than 48 years, PGN has made a very significant contribution to the provision of natural gas both in terms of gas infrastructure and natural gas itself. As a State Owned Enterprise (SOE) publicly listed as PGAS on the Indonesian Stock Exchange, PGN has a mandate to develop natural gas infrastructure in Indonesia. Based on the calculations of PGN, to support the gas energy mix policy in 2025, Indonesia's gas transmission network has to be able to cover 15,528 km or twice the current length (7,900 km). Furthermore, the distribution pipes need to be extended 10-fold compared to to the existing pipeline owned by PGN (currently around 3,800 km).

The utilisation of natural gas will be maximised if entrepreneurs in this sector have a commitment and responsibility to develop the necessary infrastructure. Infrastructure owners should also be given priority in the allocation of gas from producers. This can expand the use and the market of natural gas in Indonesia.

To promote the expansion of Indonesia's gas pipeline infrastructure, PNG is currently developing new networks in various regions of the country. However, building a new pipeline infrastructure is challenging. In addition to massive capital expenditure, there are risks that call for further assessment. To realise conversion to natural gas, the three main pillars, namely gas supply, infrastructure development and market (consumers), would need to be integrated and synegised.

Infrastructure development must also be supported by strong regulations. PGN and its subsidiaries have built and currently operate a gas distribution network that extends for 3,865 km and a 2,047 km gas transmission network in Indonesia. PGN is also capable of delivering natural gas to more than 90,000 subscribers, of which the largest gas allocation is intended for the domestic sector. To build a pipeline network worth tens of trillions of rupiah, PGN has implemented a bundling strategy, which functions as a distributor and trader of natural gas.

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Due to the bundling concept, PGN's customers in West Java can benefit from energy cost efficiency of more than Rp 5 trillion per year. Furthermore, compared to using oil, PGN's industrial customers in East Java are able to save Rp 3.1 trillion on energy costs. Each year PGN is also one of the largest state-owned enterprises that contribute dividends to the government with a payout ratio of over 50%.

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# Capacity Remuneration Ensures Security of Power Supply

By Michele Pizzolato, Federico Mauri and Giulia Migueles Pereyra

Renewable energy – due to its intermittency – needs to be backed up to ensure that consumers have a constant supply of electricity. Power plants using combined-cycle gas turbines (CCGTs) provide the ideal back-up as they can be started up and closed down quickly and use clean-burning natural gas. But back-up capacity often lies idle so it cannot be financed solely by the sales of the electricity it generates. This is where capacity remuneration comes in.

## Natural gas as a destination fuel

Clean, affordable, reliable, efficient and abundant. These are the characteristics which make natural gas a fundamental energy source for sustainable growth and for granting security of supply at a reasonable price. Natural gas is also identified as a fundamental energy source in those countries where decarbonisation issues are included as priorities in the energy policy agenda. It has been widely recognised as the best partner of renewable energy sources (RES), due to:

- Its environmentally-friendly footprint; and
- The technological characteristics of efficiency and flexibility of gas-fired power generation plants which are able to comply with security of supply requirements in a context of growing intermittency linked to the increasing role of RES.

As of now, natural gas plays a major role in the power generation sector, covering up to 22% of the total power output worldwide and, for the above mentioned reasons, it has to be considered, even in the long-term evolution of the global energy mix, a destination fuel, and not just a transition fuel.

Intermittent renewable energy sources such as solar need to be backed up.

## Natural gas in the power sector

In the past few years the power generation sector has experienced structural changes worldwide: the effects of the economic crisis, the global trend towards decarbonisation policies and – in some regions – the growth of RES. These structural changes are having significant impacts on the current economics and the future development of the natural gas industry.

In some countries, such as the USA, the so called "shale gas revolution" has resulted in a gradual switch from coal-fired to gas-fired power generation. In other markets, such as Europe, gas-fired generation has experienced a 24% drop in the last three years. This has been caused by a complex mix of factors. The most relevant ones, in particular in the European region, are:

- The fast growth of the share of RES – as a result of subsidy programmes – in the power generation mix;
- The abundance of coal, as an outcome of the USA shale gas revolution, which freed up coal volumes for other markets;
- The failure of $CO_2$ emission trading schemes to provide a sound price signal reflecting the differences of externalities associated with coal and gas consumption.

The most notable consequence of these phenomena is that, notwithstanding the tight policies put in place by many European countries and the conspicuous resources allocated to RES subsidy programmes, the carbon intensity[1] of the EU27 area has slightly increased since 2010 – after years of constant decrease – mainly due to the sharp and sudden growth of emissions by coal-fired power plants.

## Market failure

A well-functioning market framework is the best way to promote an efficient and secure energy system: where the institutional framework allows the market forces to determine price and quantity, the environmental compatibility of natural gas and its highly flexible use should be fully recognised in the energy mix and, most notably, in the power generation merit order.

On the other hand, in the context of heavily regulated markets, market failure can easily be

1 The ratio between carbon emissions and the electricity produced, in terms of grams of $CO_2$ per kWh produced.

Power plants using CCGTs such as this one in Ferrara, Italy are efficient and flexible.

Security of supply is a basic goal of the power generation sector.

exacerbated by the lack of a proper and balanced regulatory approach (regulatory failure). This seems to be the case of the power generation sector, which is often required to achieve conflicting goals in terms of environmental targets on one side and security of supply targets on the other.

It is noteworthy that a growing share of RES does not guarantee per se the security of supply for final customers, given their power output's intrinsic lack of predictability. A growing share of RES in the power generation mix implies a higher degree of intermittency in the system power output, leading to a higher need for flexibility and real-time balancing services. These services can be efficiently provided by gas-fired plants, thanks to the environmentally-compatible characteristics of natural gas and to the flexibility and the high technical standards of these plants (in particular CCGT plants).

In some markets a poorly designed regulatory framework may lead to potentially dangerous market distortions. In particular, where environmental regulatory targets (e.g. RES targets in the energy mix) are present, without a coherent regulatory framework on security of supply, the consequent market equilibrium may not be compatible with the economic and financial sustainability of those natural gas power generation plants which are necessary to support the overall security of the system. For example, this is the case with an asymmetric regulatory framework when:

- Environmental targets are sustained by strong regulatory interventions (e.g. support schemes for RES);
- The resulting growing level of intermittency and the consequent higher needs of back-up capacity are left to market forces.

A typical market failure may emerge when the market itself, under such an asymmetric regulatory framework, is not able to correctly evaluate the role that gas-fired plants play in supporting the security of the system.

This inefficient outcome is clearly evident in many European countries. The growing role of RES – sustained by support schemes and helping to meet important environmental targets – implies a significant reduction of the average load factors (i.e. the number of hours the plant actually operates compared to its technical maximum workload) of CCGT plants. Without appropriate market rules, this asymmetric regulatory framework could, in the near future, risk forcing many plants out of the market

(namely, CCGT plants), depriving the system of a cost-effective mechanism to deal with RES intermittency.

## Capacity remuneration mechanism as a solution

These points are widely recognised by many energy regulatory bodies. It is a matter of fact that a growing number of regulators have started to discuss how to tackle this evident market failure – as the price signals emerging from the market are not sufficient to ensure the delivery of the needed amount of flexibility to the system – and the introduction of a capacity remuneration mechanism (CRM) is emerging as a policy option.

CRMs are essentially aimed at explicitly recognising the value of this security of supply service, where a regulatory asymmetric framework fails to grant it. CRMs can be a useful tool in assuring that a sufficient amount of flexible capacity is actually available for the system, both in the short- (maintenance of existing capacity) and in the long-term (investments in new plants).

The implementation of CRMs should promote the optimal use and valorisation of the entire natural gas value chain, from transportation infrastructures to generation facilities, aiming at delivering the least-cost solution for the energy system. It is a matter of fact that the underutilisation of already existing infrastructure would give rise to significant stranded costs.

Moreover, CRMs should be – as for any other major regulatory effort – aligned with regional environmental targets regarding $CO_2$ and other harmful emissions.

In those countries that are currently experiencing a market failure in power generation a well-designed CRM mechanism, based on a market approach, can be a useful tool to recognise the correct market value of secure, flexible and environmentally sustainable gas-fired power generation capacity and to balance environmental targets, costs and security of supply.

*Michele Pizzolato of Eni is the Chair of Task Force 2 – Gas Advocacy, Federico Mauri is a power market specialist with Eni and Giulia Migueles Pereyra of Eni is TF 2's Secretary.*

### The European Commission's Views

Following the analyses and evaluations autonomously carried out by a relevant number of European regulators, transmission system operators (TSOs) and academic research centres over the possible implementation of a CRM, the European Commission started to develop a proposal for a common framework for such interventions, focusing on their relationship with the policy goal of further integrating the European market, up to the creation of a single energy market.

In the view of the Directorate General for Competition (DG COMP), CRMs are a fully legitimate tool to deal with generation adequacy and security of supply issues given that they do not interfere with the further integration and development of energy markets. Under this principle, a CRM should be run through competitive tenders, open to both existing and new capacity and designed to be non-distortive with respect to cross-border trade.

Finally, while the DG COMP states that any CRM should be technology-neutral, CRMs should not be in open contrast with other policy instruments. Therefore, support should be primarily targeted at low emission plants.

In a nutshell, a CRM can be identified as compatible with the European legal framework if it does:

- Not reduce incentives to invest in interconnection capacity;
- Not act against existing market mechanisms which contribute to the provision of capacity;
- Not undermine investment decisions on generation which predated the measure or decisions by operators regarding the balancing or ancillary services market;
- Not unduly strengthen market dominance;
- Give preference to low-carbon generators in case of equivalent technical and economic parameters.

# In the Pipeline

By Rod Morrison

A number of major pipeline projects have recently arranged or are looking for debt finance. The most high profile financings this year will be the pipelines from Azerbaijan and Russia to Europe. But there are other projects too – including Central Asia to China, new networks across India and from the USA to Mexico.

All multi-billion dollar energy schemes are complex and require a good deal of time to put together, finance and build. Pipelines are perhaps the most complex of the mega energy schemes and have suffered as a result. They usually run across a number of countries, creating a whole range of headaches. They are often environmentally controversial. And once built, they are vulnerable to attack if located in a politically sensitive part of the world.

No wonder, then, that the pipeline has not been as favoured as the more flexible LNG project in the recent past. LNG can be shipped in relative safety on the high seas to a range of destinations. Pipeline gas is limited by obvious constraints.

In the old days, there was a rule of thumb as to when a pipeline became more attractive – basically over shorter distances – than an LNG project. These days, the issue is more blurred, given the dramatic growth of LNG.

Pipelines are highly inflexible economic assets. But they can be extremely valuable in a commercial/economic sense and in a geopolitical/strategic sense. They can unlock landlocked gas reserves and send those reserves great distances across land.

The best example of suppliers and customers being well served by pipelines is the relationship between Russia and Germany, which dates back to the Cold War when huge pipelines were built across the former Soviet Union and Eastern Europe to Germany. These are now complemented by the Nord Stream project led by Gazprom with partners E.ON, Wintershall, Gasunie and GDF SUEZ. Nord Stream comprises two subsea pipelines crossing the Baltic Sea straight into Germany, bypassing the former transit countries. The project was driven by economics and geopolitics.


An in-line inspection tool arrives at the German terminal of Nord Stream in Lubminer Heide.


▲ South Stream will take gas from Russia across the Black Sea into Europe.

Both Nord Stream pipelines were funded by project financings – a €3.9 billion deal in 2010 and a €2.775 billion deal in 2011. Nord Stream is now seeking to refinance the debt on the 2010 financing via a bond issue to get better terms.

Refinancing the Nord Stream debt will also help Gazprom free up the lending capacity of its commercial banks for the $30 billion-plus South Stream project.

## New routes from Azerbaijan and Russia

South Stream will take gas from Russia across the Black Sea to Bulgaria and up to the Italian border via Serbia, Hungary and Slovenia, bypassing the existing transit countries such as Ukraine. It competes with the Southern Gas Corridor project to take gas from Azerbaijan – ultimately possibly even from Turkmenistan – across Turkey to Greece, Italy and the rest of Europe.

Both the South Stream and Southern Corridor schemes are going ahead. And both will be seeking external project finance shortly. But it is noticeable that while Gazprom has been pushing full steam ahead with South Stream, the Southern Corridor scheme has become less ambitious and more linked directly to gas buyers' needs. The EU-backed Nabucco gas pipeline, which was due to run into the heart of Europe, from Azerbaijan, has been dropped in favour of a shorter pipeline to Italy with a smaller transit capacity – the Trans Adriatic Pipeline (TAP) – linked to the Trans Anatolian Gas Pipeline (TANAP) which will run across Turkey.

South Stream is a massive undertaking. The €10 billion debt financing to be offered to the international banks will cover the 925km, €17 billion Black Sea part of the scheme, ultimately capable of carrying 63 bcm a year. Gazprom will finance the pipelines inside Russia itself. The remaining 1,455km Balkans section will be financed by joint ventures between Gazprom and the local host gas utilities and governments.

About 35 banks attended the South Stream gas pipeline briefing session in London in September 2013, which acted as a warm up exercise for the financing. Crédit Agricole, ING and Russian Project Finance Bank are advising the project company and its sponsors – Gazprom, Eni, EDF and Wintershall.

The London presentation focused on the technical elements of the Black Sea section.


The ceremonial welding of the first joint of the Serbian section of South Stream took place in November 2013.

When the deal is formally launched, the bankers will require more detail on the gas agreements with gas buyer Gazprom Export and more detail on the rest of the pipeline route in the Balkans. Formal negotiations have already started with the export credit agencies (ECAs) which will back the scheme – Germany's Hermes, Japan's JBIC, Russia's VEB and Italy's Sace.

ECAs are state-owned bodies which provide political and commercial risk insurance to banks on large international project financings. In addition, they can provide their own direct loans to schemes. They are a vital part of any major energy financing. Their involvement is linked to the national strategic interest of companies in their own country. In the case of South Stream, ECA involvement will be linked to equipment contracts won on the scheme by companies from the home of the ECAs. The first South Stream contracts have already been awarded – to Germany's Europipe, half of the pipes, Russia's OMK 35% of the pipes and Russia's Severstal's Izhora Pipe Mill, 15%. However, these awards are just the first of a series of four tenders on the scheme.

On the rival Southern Corridor scheme, the final investment decision (FID) on the gas field project in Azerbaijan, Shah Deniz 2 – which will supply TANAP and TAP via an expansion of the South Caucasus Pipeline through Azerbaijan and Georgia – was taken at the end of 2013. This means work will now begin in earnest on financing the two pipelines.

BNP Paribas and Mitsubishi UFJ have been appointed to advise on the cross-Turkey 2,000km TANAP scheme. This is 80% owned by Azeri energy company Socar. Turkey's Botas and TPAO have 15% and 5% respectively. BP, shareholder in Shah Deniz II has agreed to buy 12% of the scheme.

Financing a pipeline which crosses Turkey has a precedent, the BP-led Baku-Tbilisi-Ceyhan (BTC) oil pipeline which transports Azeri oil to the Mediterranean. The scheme and its financing stirred up a fair amount of controversy in the early 2000s but was finally put to bed in early 2004. ABN AMRO, Citigroup, Mizuho and Société Générale led the $3 billion deal for the commercial banks. The deal had a host of ECAs and multilateral funding institutions involved, hence its high profile.

The BTC financing was backed by pre-completion guarantees from the sponsors which meant any cost overrun on the construction phase was covered by the sponsors. This was just as well as the oil pipeline cost went 30% over budget, up to $3.9 billion from $2.95 billion. No two project financings are the same but it will be interesting to see how TANAP compares to BTC.

Société Générale has won the mandate to advise the sponsors of the TAP scheme. The

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870km scheme will take gas from TANAP at Kipoi across Greece, Albania and beneath the Adriatic Sea to southern Italy, where it will link into the European gas network. Its sponsors are BP, 20%, Socar, 20%, Statoil, 20%, Fluxys, 16%, Total, 10%, E.ON, 9% and Axpo, 5%. The initial capacity of TANAP will be 16 bcm to serve customers in Turkey as well as to feed TAP, which will have a 10 bcm capacity, but both can be expanded later if gas supply and demand so dictate.

## Asian growth

There have been long standing ambitions to send gas from Turkmenistan to Europe via Azerbaijan and Turkey, which would require a pipeline across the Caspian Sea. Indeed, Enron was one company which once proposed such a link. However, the geopolitical complexities involving the rights of the littoral states mean that it will take some time to agree to such a pipeline. So instead, Turkmenistan has turned east.

The Central Asia Gas Pipeline takes Turkmen gas to China via Uzbekistan and Kazakhstan. Exports from Uzbekistan to China came onstream in 2012 and exports from Kazakhstan are planned. The scheme is 1,833km long and can carry 40 bcm a year in two pipes. A third section is due to add 25 bcm a year. China National Petroleum Corporation (CNPC) is the sponsor of the project. It raised $7.7 billion of project debt for the $12.5 billion scheme in 2013 from China Development Bank.

While the scheme is very much a China Inc. deal, the financing was structured on an international project finance basis. ING was employed as the financial adviser to put together an international structure for the deal. Hogan Lovells and Clifford Chance worked on the legal aspects.

The debt funding was raised through three different loans by three separate borrowers – that is special purpose vehicles (SPVs) – for each part of the pipeline. CNPC formed the SPVs, one each with the three different partners – Asia Trans Gas, which is a 50:50 JV of CNPC and Uzbekneftegaz in Uzbekistan; Asia Gas Pipeline, which is a 50:50 JV of CNPC and KazMunaiGas of Kazakhstan; and Beineu-Shymkent Gas Pipeline, which is a 50:50 JV of CNPC with KazTransGas in Kazakhstan. The sponsors are providing construction guarantees to


FID for Shah Deniz Stage 2 in Azerbaijan was reached in December 2013 and Azeri gas is due to start flowing to Europe in 2019.

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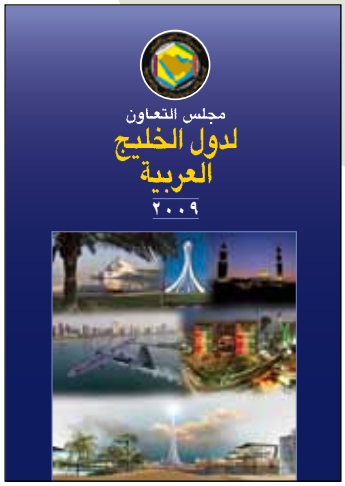
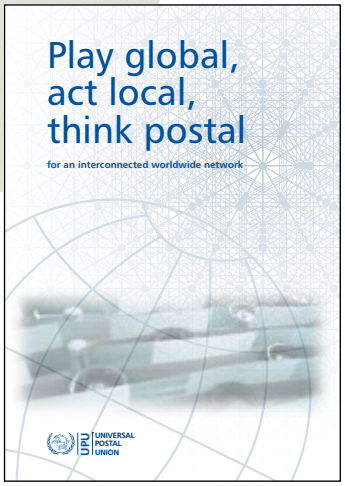


the project and are giving strong support, including a six-month debt service reserve account.

Growing economies such as China and India have an ever-increasing need for gas that outstrips domestic supply. LNG is usually the best import option, although as we have seen pipelines can play an important role. Once the gas gets to the country, of course, pipelines are essential.

India is building up its gas supply options. Overseas it is lining up LNG offtake contracts from new developments in East Africa, the USA etc. Internally it is building out its pipeline network. The country's midstream and downstream regulator, the Petroleum and Natural Gas Regulatory Board (PNGRB) last year put out to tender three major cross-country gas pipelines – the 1,688km Mallavaram-Bhopal-Bhilwara-Vijaipur pipeline (MBBVPL), the 1,611km Mehsana-Bhatinda pipeline (MBPL) and the 740km Bhatinda-Jammu-Srinagar pipeline (BJSPL). The pipelines are being built on a public-private partnership (PPP) basis with 25% of the gross pipeline capacity to be available on an open-access basis.

MBBVPL will originate in Mallavaram (Kakinada, Andhra Pradesh), go through the states of Andhra Pradesh, Maharashtra, Madhya Pradesh up to Bhilwara (Rajasthan) and Vijaipur (Guna, Madhya Pradesh). MBPL will pass through the states of Gujarat, Haryana, Punjab and Rajasthan while BJSPL will pass through the states of Punjab and Jammu and Kashmir.

PNGRB awarded the schemes to a consortium comprising Gujarat State Petroleum Corporation, Indian Oil Corporation, Bharat Petroleum Corporation and Hindustan Petroleum Corporation. The projects were financed with a traditional, albeit large, project finance loan – provided in rupees by domestic banks led by SBI Capital. The concession to run the pipelines lasts for 25 years and the loan tenor, 14 years. Nearly $2 billion of debt was raised at just 75 basis points over the local interbank rate. The projects were funded on a 65/30/5 basis, that is 65% debt, 30% equity and 5% sub-debt. The sponsors provide cost overrun support and in the event of problems at one of the projects, excess cash from another can be transferred over.

## USA to Mexico

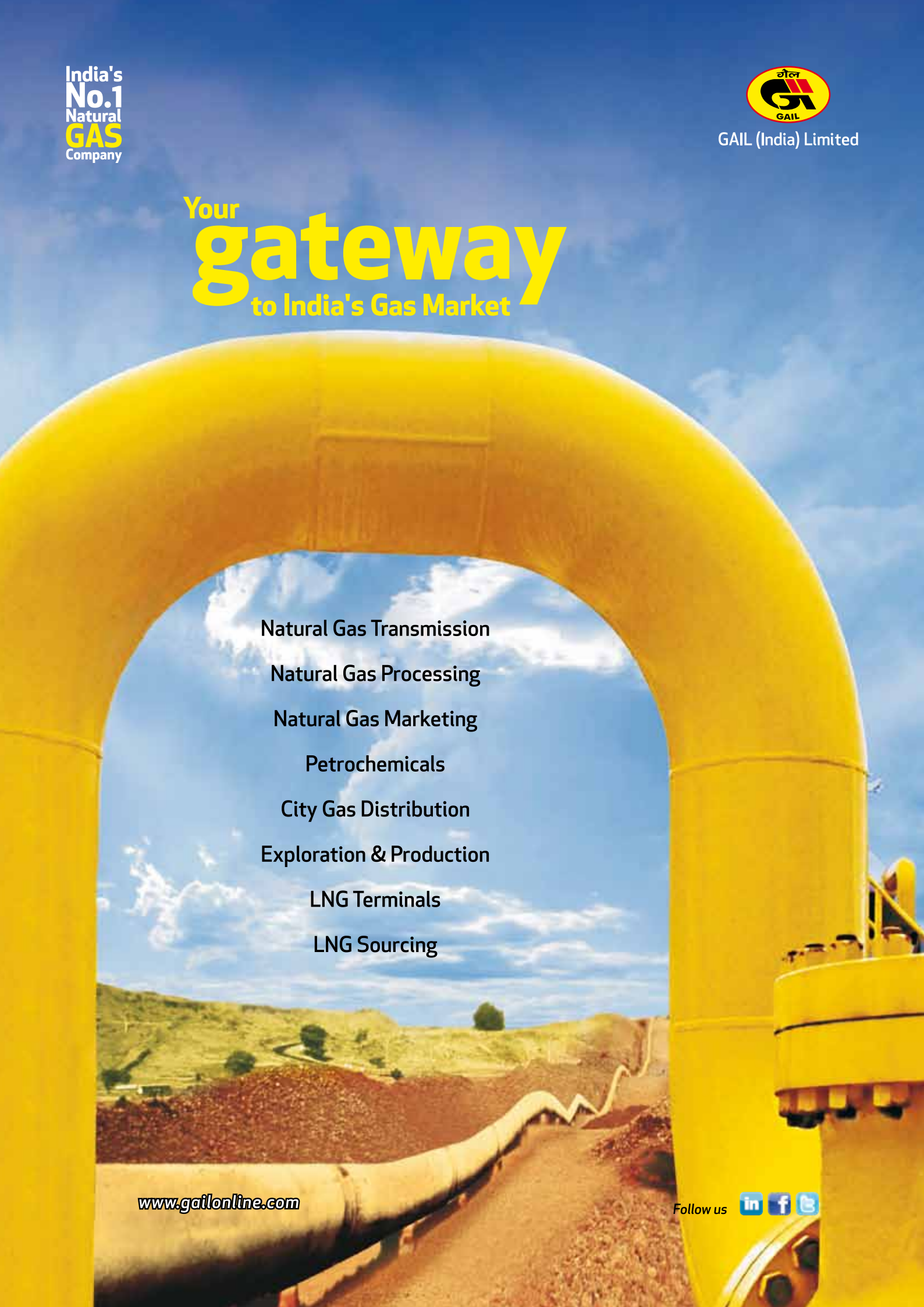
While India gets ready to import large quantities of gas, the USA faces the challenge of building new pipeline infrastructure to cope with the massive increase in domestic production led by shale gas.

One area where gas pipeline development has already started is in Texas where work on building a link to take gas from the Eagle Ford shale play to Mexico is well underway. Net Midstream, 50% owned by private equity house ArcLight, and Mexican state company Pemex, have recently financed the Agua Dulce scheme via a $650 million bank loan from BTMU, BBVA, Credit Agricole, ING, Natixis, NordLB, RBC and Santander. The loan runs for six years plus the construction phase. Net Midstream will hold 90% of the equity and Pemex will buy all the gas.

Agua Dulce will take gas to the Mexican border. Pemex is building new pipelines inside Mexico, Los Ramones 1 and 2, to distribute the gas inside the country. The 118km Los Ramones 1 will be financed from funds recently raised by refinancing the existing Gasoductos de Chihuahua (GDC) pipelines assets in a $500 million, 12-year deal led by BTMU, BBVA, Mizuho and NordLB. GDC and Los Ramones 1 are jointly owned by Sempra and Pemex.

Los Ramones 2 was due to be let out to an international consortium in 2013 by Pemex. But it decided to split the scheme into Ramones North, led by Pemex and GDC, and Ramones South, led by Pemex and GDF SUEZ. Work on financing these 728km links, costing $2 billion, has just begun. The whole network, when built, will supply one fifth of Mexico's gas.

*Rod Morrison is a London-based journalist specialising in project finance.*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# India Expands Gas Transmission Grid

By David Hayes

Work is underway in India on a series of long distance gas pipeline projects that when completed will more than double the length of the national gas transmission grid to 24,000km.

The projects will expand the national coverage provided by the transmission network, carry growing offshore gas production from the east coast to new markets across the country and connect new LNG import terminals.

Addressing the Indian Parliament last year, Petroleum and Natural Gas Minister, M. Veerappa Moily, told MPs that the total length of pipelines to be constructed in nine ongoing projects was 12,650km.

GAIL (India) Ltd is responsible for six of the nine projects: the Dadri-Bawana-Nangal pipeline, the Chhainsa-Jhaijjar-Hisar pipeline, the Dabhol-Bangalore pipeline, the Kochi-Koottanad-Bangalore/Mangalore transmission scheme, the Jagdishpur-Haldia pipeline and the Surat-Paradip pipeline.

Two joint-venture companies led by Gujarat State Petronet Ltd (GSPL) are running the other three projects. The joint venture partners are GSPL, Indian Oil Corporation (IOC), Bharat Petroleum and Hindustan Petroleum. GSPL India Gasnet has responsibility for the Mehsana-Bhatinda and Bhatinda-Jammu-Srinagar pipelines in northern India, while GSPL India Transco is developing a pipeline which will connect the cities of Mallavaram, Bhopal, Bhilwara and Vijaipur.

## Growing gas consumption

Plans to expand the length and geographical coverage of India's gas pipeline grid are designed to increase the share of natural gas in India's primary energy mix, which is currently 10% compared with a global average of about 24%.

Major consumers of natural gas are power plants, steel mills, petrochemical plants and fertiliser factories. In future, India plans to

India is expanding and upgrading its gas transmission grid. Pictured is the Dahej-Vijaipur pipeline upgrade project for which GAIL appointed Tractebel Engineering as engineering consultants.


TAPI commercial parties signed an agreement appointing the Asian Development Bank as transaction advisor for the gas pipeline project in Ashgabat in November 2013. *From left to right:* Kakageldy Abdullayev, Turkmengaz; Saleh Mohammad Fazli, Afghan Gas Enterprise; Mobin Saulat, Inter State Gas Systems; A.K. Gumber, GAIL; Klaus Gerhaeusser, ADB.

install piped gas systems in a large number of cities to supply the residential sector and commercial customers including hotels, offices and shopping malls.

India's annual gas consumption doubled between 2002 and 2012 with approximately two-thirds covered by domestic production and the balance imported. In 2012, India imported 15.17 million tonnes of LNG and imports are expected to grow to 60 million tonnes by 2022.

India also hopes to import gas from Turkmenistan in five years' time following progress in inter-government negotiations during 2013 over proposals to build the Turkmenistan-Afghanistan-Pakistan-India (TAPI) gas pipeline. TAPI is planned to supply India with 30 million cubic metres a day (mcm/d) from 2017-18.

By the end of India's 12th Five Year Plan in 2017, total gas supply is forecast to reach 305 mcm/d, although with projected demand of 473 mcm/d there will be unmet demand.

## Transmission companies

GAIL (India) Ltd is the nation's largest gas transmission company operating about 75% of the country's gas pipeline network, all of which is run on a common carrier open access basis for third-party use.

In the financial year ending March 31, 2013, following a fall in domestic production, GAIL carried 104.9 mcm/d, a decrease of 11% compared with 117.6 mcm/d the previous year.

Following completion of various new pipeline sections totalling about 1,300km over the past 20 months, GAIL's natural gas transmission network is around 10,700km in length and capable of transporting 210 mcm/d.

In addition to natural gas transmission pipelines, GAIL owns a 2,040km LPG transmission system designed to carry 3.8 mtpa from Jamnagar to the capital, New Delhi, a distance of 1,415km. It also owns a 620km LPG pipeline running from Visaka Putnam to Bijawallah. The two pipelines are estimated to carry about 25% of all LPG consumed in India.

Apart from GAIL, India's other gas pipeline operating companies are Reliance Industries, GSPL and IOC.

Reliance Industries' gas pipeline subsidiary, Reliance Gas Transportation Infrastructure Ltd (RGTIL), operates the 1,600km East-West cross-country pipeline running from Kakinada in Andra Pradesh to Ahmedabad in Gujarat. Designed with a capacity of 80 mcm/d, it carries most of the gas output from the company's offshore KG-D6 gas field in the Krishna Godavari Basin to supply customers in western India.

These clients include the Dhabol power plant via a connection to GAIL's pipeline network in Maharastra state. Dhabol originally used gas supplied from Petronet's Dahej LNG import terminal in Gujarat state but switched to using gas from Reliance's KG-D6 field when production started in 2009 as the government-

▲ Major industrial consumers of gas in India include Essar's steel complex in Hazira.

controlled KG-D6 gas price is cheaper than using imported LNG.

GSPL currently operates gas pipelines in its home market in Gujarat state in western India that total about 2,160km in length and supply around 22 mcm/d to various customers. It is owned by Gujarat State Petroleum Corporation (GSPC).

As noted above, GSPL-led joint ventures are working on three interstate gas transmission pipelines. This follows the signing of a cooperation agreement with GAIL several years ago that includes access to GAIL's gas transmission network on a toll fee basis.

IOC is mainly an oil pipeline operator with a network of 11,000km. It currently operates the 130km Dadri-Panipat gas pipeline and has plans to expand its gas transmission network.

## New applications

India's Petroleum and Natural Gas Regulatory Board (PNGRB) is considering two applications to build natural gas transmission pipelines in central and southern India totalling 1,520km that will extend the national gas supply grid to serve new areas of the country.

IOC has applied to build a high pressure gas transmission pipeline totalling 1,175km in length designed to carry 18.35 mcm/d when completed. The main pipeline will run 325km from the Ennore LNG import terminal being developed by IOC to Puducherry and on to Nagapattinam. Three spur pipelines will be built to transport gas to inland areas of east coast southern India in Tamil Nadu state terminating at Madurai, Tuticorin and Bengaluru.

The Thiruvallur-Bengaluru pipeline will run 290km while the Nagapattinam-Trichy-Madurai spur line will cover 242km. The other spur line will run 318km connecting Nagapattinam-Ramnathapuram-Tuticorin.

IOC is developing the LNG import terminal at Ennore Port in Tamil Nadu state with an initial capacity of 5 mtpa. Start-up is projected in 2017 and future plans involve increasing the terminal size to handle 10 mtpa, and possibly 15 mtpa, depending on local demand growth. The main customers for the LNG will be power plants, industrial estates and about 21 city gas systems serving different towns and cities.

RGTIL, meanwhile, has applied to build a 345km high pressure gas pipeline to transport coal-bed methane (CBM) from a new production centre in Shahdol in Madhya Pradesh to Phulpur in Uttar Pradesh, where the new pipeline will feed into the existing Hazira-Vijapur-Jagdishpur cross-country gas transmission line.

According to Reliance, two CBM blocks at Sohagpur in Madhya Pradesh are capable of producing 3.5 mcm/d of CBM. Although the blocks are ready to produce, progress with the scheme has stalled over CBM pricing with Reliance seeking parity pricing with imported LNG for its CBM.

## Delays

Not all gas pipeline construction projects are progressing smoothly, mostly schemes in areas of southern India where there is local resistance to pipeline construction.

GAIL, for example, is facing delays constructing the 884km Kochi to Bangalore pipeline of which 310km pass through Tamil Nadu state. Following complaints from farmers, the Tamil

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▲ India's CBM production is expected to increase as more blocks enter commercial production.

Nadu state government asked GAIL to build proposed gas pipelines to transport gas from the new Kochi LNG import terminal along national highways and to remove recently completed pipeline sections from agricultural land.

GAIL has rejected the state government's proposal, saying that laying gas pipelines along the state's highways is technically unfeasible.

Elsewhere, the Chief Minister of Kerala state has expressed hope that opposition to GAIL's Kochi to Bangalore pipeline project in some parts of the state will subside as work continues in Kochi to connect industrial users to the already completed transmission pipeline sections that will supply gas from the Kochi LNG import terminal.

Several Kerala state government ministers have pointed out that local opposition to the pipeline in some areas mirrors previous campaigns against power transmission lines being built from Koodamkulam power plant and protests against the construction of four-lane national highways in the state.

The delayed pipeline sections are the underground transmission sections from Kootanad, where the pipeline from Kochi divides, to Mangalore and Bangalore. Plans call for the pipeline to be laid at a depth of two metres and for a 20 metre wide land corridor to be used to lay the pipeline. Once laid, the land will be recovered and can be used for agricultural purposes.

## Tenders sought

Meanwhile, PNGRB is due to invite tenders shortly to establish city gas distribution systems in nine cities under the government's City Gas Distribution Project.

PNGRB originally invited bids for the city gas systems in October 2010 in the fourth round of bidding for city gas systems in India. However, the bids were later cancelled when stakeholders called for guidelines to the bidding process to be revised.

According to PNGRB the guidelines have since been revised and will be applied to the new round of bidding.

In addition to Ernakulam district in Kochi, Kerala state, the eight other areas tendered were Rangareddy, Medak, Nalgonda and Khammam districts in Andhra Pradesh; Alibag, Lonavala/Khapoli in Maharastra; Guna in Madhya Pradesh; and Shahjahanpur in Uttar Pradesh.

By the end of India's 13th Five Year Plan period in 2022, gas demand is expected to reach over 600 mcm/d. In addition to increasing domestic gas production, India will need to continue investing in new LNG import terminals and gas transmission facilities to ensure its gas infrastructure can meet as much of this demand as possible.

*David Hayes is a freelance journalist writing on the natural gas industry and energy markets.*

# CWC Group

CWC is proud to collaborate with IGU to host the World Shale, Latin America Shale and Europe Shale Oil & Gas Summits and the Gulf of Guinea Gas Conference to promote the technical and economic progress of the gas industry.

The most recent of the series of partnership events to be held were the 4th World Shale Oil & Gas Summit (Houston, USA) and 16th Gulf of Guinea Gas Conference (Abidjan, Côte d'Ivoire). Both events were attended by senior-level government officials, representatives from national oil and gas companies and leading global operators. Renowned industry speakers and leaders shared their expertise and best practices while offering insights into future industry developments.

Speaking at the 4th World Shale Oil & Gas Summit, David Carroll, Vice President of IGU, highlighted the abundance of technically recoverable global shale gas and oil resources, with others reiterating that gas continues to be a key driver for economic development globally. Other renowned speakers in Côte d'Ivoire discussed the need for synergy in oil and gas sector operations, urging governments to exchange ideas and devise future strategies to increase the participation of local players in gas activities.

In addition, CWC organises events on behalf of industry partners and clients. Currently working on upcoming IGU events the 26th World Gas Conference (Paris) and the 27th World Gas Conference (Washington DC), our close ties with the industry for over a decade make us the most experienced global Professional Conference Organiser (PCO) purely dedicated to the energy industry. We look forward to welcoming you to future events.

# Improving UGS Operations

By Dr Fabien Favret

Operators of underground gas storage (UGS) facilities have to react quickly to changing market demands for gas while raising safety standards and reducing environmental impacts. IGU's Working Committee 2 (WOC 2) is studying the latest developments as part of its remit and this article focuses on recent findings. The first part looks at subsurface integrity management and the second at the reduction of the environmental footprint of UGS operations and the enhancement of their energy efficiency.
I would like to thank all the members of WOC 2 and other contributors for their input.

## Subsurface integrity management

Integrity management involves taking a risk-based rather than a uniform approach to safety and was pioneered by pipeline operators. Asset integrity is the ability of an asset to perform its required function effectively and efficiently while safeguarding life and the environment. It ensures that the people, systems, processes and resources which deliver integrity are in place, in use and fit for purpose over the whole life-cycle of the asset. As regards the subsurface integrity of UGS, there have been some interesting developments.

### *Well integrity management*

Wells are key assets for storage operators and their integrity has to be controlled not only during their ageing phase but starting from their drilling or building phase (some UGS wells have been in operation for more than 50 years[1]).

Well integrity management (WIM) involves a six-stage process:

- An initial collection and review of all the data sets available, such as geological, drilling and completion data, to create an "identity card" or database entry for each well;
- Regular monitoring should be carried out during normal operation or maintenance. The parameters (such as tubing/wellhead pressure, annulus pressures, productivity) to be measured (every day, or every week or every year, according to the expected evolution of the parameters) depend on many factors: operator's needs, national regulations and availability of those data;
- Then, every change or abnormal evolution of the parameters should be analysed. These failures could be more or less negative in their consequences according to the specific environment (on surface and at subsurface) of the well. The assessment of the criticality of the risk has to be adapted according to

▼ WOC 2 is studying the latest developments in UGS.

1 2009-2012 Triennium WOC 2 report for WGC 2012 in Kuala Lumpur.

the concern (safety, environmental protection, performance). In any case, a multi-criteria analysis, similar to risk assessment methods used in different industrial sectors and project management, has to be applied;
- In this case, detailed diagnostic and specific measurements (such as logging, gas analysis, borehole video, flow logging) have to be implemented. In most cases the detailed diagnostic cannot be based on a single measurement. Several logs and measures are needed for a better understanding of the situation;
- Afterwards and if necessary, a repair has to be done. Methods which can be performed without work-over (repair using a drilling rig) are preferred, taking into account that a work-over is expensive and possibly risky and also not always successful;
- Once the repair job is completed the well's database entry is updated and the WIM process continues.

Various UGS operators such as Edison, E.ON Gas Storage, Gazprom, Nafta and Storengy have implemented WIM.

### *Integrity management of reservoirs and caverns*

Passive microseismic can be used to monitor the integrity of UGS facilities such as mined rock caverns, salt caverns, natural gas storage reservoirs and more recently $CO_2$ sequestration projects. It consists of tracking microseismic events resulting from stress release within the subsurface rock mass via a network of geophones connected to a continuous recording device. The technique is increasingly being implemented by UGS operators in naturally seismically active areas or whenever a risk of occurrence of sizeable induced seismic events with potential consequences on stability and/or containment is identified.

The sensitivity of the monitoring network is set to detect and localise even minor seismic events with sufficient accuracy to demonstrate that the operation does not induce any failure process within the rock mass, which is likely to impair the storage stability or containment. Continuous recording of minor events and analysis of spatial and historic evolution of their characteristics provide a reference for establishing an advanced warning and traffic light system, based on pre-validated criteria. A traffic light system is usually defined as follows:

- *Green:* no risk, operations proceed as planned;
- *Amber:* alertness, be prepared to alter plans. Operations proceed with caution, possibly at reduced rates, and monitoring is intensified;
- *Red:* warning, operations are suspended immediately.

We will focus on two types of seismic events here, micro and abnormal.

Micro events can occur as a normal response to the storage cycles and to pressure changes in the storage space. Such induced microseismic events are inherent to UGS operation and reflect minor readjustments of the stress field within the rock mass. The events are extremely small (typically with negative magnitude) and require very sensitive monitoring equipment to be detected.

Abnormal events can be related to reactivation of existing geological features such as discontinuities, triggered or induced by storage operation. This class of events whose magnitude is usually positive and which may sometimes be felt at surface level, is linked to processes involving large amplitude injection/production cycles of gas or fluids into the storage space. Occurrence of such events can often be forecast by interpreting forerunner signals detected by the microseismic monitoring network (such as a sudden increase of the number and/or the magnitude of micro-events or a change in their location). In such events, the monitoring records provide a reliable basis for:

- Analysis and characterisation of the events and of their triggering mechanisms;
- Prevention of further occurrence, by proper adjustment of the operating parameters,

### Scale of Seismic Events

| Magnitude range | Class | Length scale | Displacement scale | |
|---|---|---|---|---|
| 8 – 10 | Great | 100-1,000km | 4-40m | Earthquake seismic hazard domain |
| 6 – 8 | Large | 10-100km | 0.4-4m | |
| 4 – 6 | Moderate | 1-10km | 4-40cm | |
| 2 – 4 | Small | 0.1-1km | 4-40mm | |
| 0 – 2 | Micro | 10-100m | 0.4-4mm | Watch and warning |
| -2 – 0 | Nano | 1-10 km | 40-400μm | Imaging |
| -4 – -2 | Pico | 0.1-1m | 4-40μm | |
| -6 – -4 | Femto | 1-10cm | 0.4-4μm | Lab test domain |
| -8 – -6 | Atto | 1-10mm | 0.04-0.4μm | |

Induced seismicity **Microseismic domain**

**Note:** Rupture length/displacement ranges are approximate with apparent stress drop of 3 MPa.

**Source:** Bohnhoff et al., International Lithosphere Programme (ILP), 2010.

based on the results of relevant modelling and simulation studies.

Additionally, the microseismic monitoring system helps to demonstrate the absence of adverse impacts resulting from a natural earthquake in the storage vicinity, or conversely in the case of hard rock or salt storage caverns, to identify potentially unstable areas and block falls triggered by earthquakes.

The key concern is to define anomalous behaviour based on geomechanical modelling and/or knowledge gained from case studies and similar projects and/or historical seismic records of the zone before the UGS development. Instances of man-made induced seismic activity have been documented and the level of potentially induced seismicity is available from case studies. The table gives a scale of seismic events.

Microseismic monitoring systems in operation include:

- Geosel/Geomethane salt sites (France) for discriminating micro-seismicity vs Durance valley seismicity;
- $CO_2$ sequestration in Rousse (France) for identifying micro-seismicity vs Pyrenees mountains' seismicity;
- Collato UGS (Edison, Italy) for a depleted gas field survey;
- Bayou Corne (Texas Brine, USA) for survey of salt caverns.

## Reducing the environmental footprint of UGS operations

### *Reducing natural gas emissions*

Methane is an extremely potent greenhouse gas and although UGS is a very low methane emitting activity, efforts have been made in recent years to reduce emissions. More and more UGS operators are reducing the venting of gas during maintenance and emergency sequences. These efforts are mainly voluntary since regulations in the field of methane emissions have yet to be widely implemented. Three countries have methane emission regulations: Germany, Russia and the UK.

From various sources it is possible to estimate the average ratio of methane emissions compared to working gas volume to be approximately 500 m³(n) per million m³(n) of working gas, i.e. 0.05%. This has decreased by a factor 2 in around 10 years[2].

Best practices are mainly the following:

- Control of compressor (dry) seal emissions by either a gathering system for re-injecting in pipes or the installation of an encapsulated compressor (no methane emissions during normal operation);
- Replacement of natural gas driven process or safety valves by electrical, mechanical (spring), air or hydraulic driven valves;
- Recovery of gas during planned venting, including well testing, by re-injection in pipes;
- Reduced blow-down gas volumes during emergency sequences by the segmentation of gas facilities allowing areas to be vented independently depending on the location of related alarms.

### *Reducing methanol/glycol consumption*

Methanol/glycol consumption may be reduced by the adoption of operational practices or facilities such as:

- Suppression of methanol/glycol injections at

2 "Efforts to reduce methane emissions in UGS operations" by P. Marion and H. Giouse, *International Gas*, October 2011.

wellhead or in gas lines before and after withdrawal period;
- Strict follow-up of related methanol/glycol consumption during operation;
- Optimisation of injection of methanol/glycol by automated monitoring procedures linked to the pressure and temperature of the gas in facilities.

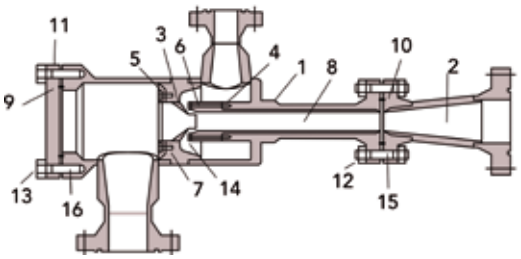
As an example, Storengy reports to have significantly decreased the ratio of methanol consumed to produced gas by a factor of 2 to 3 between 1993 and 2013.

### *Compressor technology*

Efficiency of compressors has been improved in the last decade by the development of:
- Encapsulated high-speed power-driven compressors with a rigid or flexible motor/compressor rotor levitated on magnetic bearings which provide a very high flexibility but also a high energy efficiency (no gear box means no lubricant and a reduction in energy consumption);
- High efficiency gas turbine-driven compressors with very low $NO_x$ and CO emissions and reduced $CO_2$ emissions.

### *Ejectors*

Ejectors (also known as jet pumps or Venturi pumps) are the most efficient way to pump or to move many types of liquids and gases in the petrochemical, process and power industries. Ejectors utilise the kinetic energy of one liquid or gas to cause the flow of another. They consist of a converging nozzle, a body and a diffuser, and resemble siphons in appearance. In operation, the pressure energy of the motive liquid/gas is converted to velocity energy by the converging nozzle. The high velocity liquid/gas flow then entrains the suction liquid/gas. Complete mixing of the motive and suction liquids/gases is performed in the body and diffuser section. The mixture of liquids/gases is then converted back to an intermediate pressure after passing through the diffuser.




1 Case
2 Diffuser
3 Nose piece
4, 5 Sealing ring (flouroplastic)
6, 7 Bolt
8 Mixing chamber
9, 10 Sealing ring (metal)
11 End plug
12, 13, 14 Screw nut
15, 16 Lock pin

▲ Ejectors at Peschano-Umetskoye UGS (TOP) and a cross-section of a typical ejector (ABOVE).

Ejectors may be used in UGS facilities to:
- Increase the compressor gas injection rate above the total power of gas compressor units;
- Reduce energy consumption (fuel gas, electric energy, motor oil, etc.);
- Regulate the injection rate;
- Increase compressor mean time before repair;
- Recover the products of gas combustion in the boiler stacks and igneous vaporisers;
- Increase the performance of individual low-pressure wells by reducing the backpressure;
- Enhance gas recovery from the storage in the presence of high-pressure gas sources;
- Reduce negative environmental impacts on inhabited areas near the UGS site (less compressor units).

Examples of the successful implementation of ejector technology include:
- UGS developed in a depleted gas field – Peschano-Umetskoye (Gazprom, Russia) where there is a centrifugal power-driven compressor station and 10 identical supersonic gas ejectors have been installed.

This modification has led to an increase in the daily injection rate of 27.3% and a reduction in power consumption of 11%;

- UGS in salt cavities at Bernburg (Verbundnetz Gaz AG, Germany) which has a piston power-driven compressor station. Injection performance has been improved by an average of 65,000 m³/h during test operations in a one compressor/two ejectors configuration.

### *Optimisation of operations and reduction of energy consumption*

Apart from ensuring fulfilment of nominations, while at the same time respecting limits set by reservoir engineering and equipment availability, there has been a growing demand on storage dispatching to fulfil client nominations as efficiently as possible. Conversely, there has been a strong demand from customers for flexible, even intra-day, re-nominations with a short lead time affecting decision making time. The main area for operating cost savings is linked to the consumption of energy for gas compression. Compressor efficiency varies substantially with different pressure and flow conditions. This requires finding the most efficient operating point at given conditions.

However, in the case of complex storage facilities (e.g. multiple reservoirs at different depths and pressures within the same field or UGS salt cavern pools operating at different pressures) or if several storages are managed from one dispatching, optimisation goes far beyond the setting of efficient operating points for compressor sets. Rather, it is focused on finding an optimal gas route via the storage facility. Such optimisations require sophisticated and either market or tailor-made tools based on data from several information systems dealing with the status of reservoirs, equipment availability, gas grid simulations and last but not least an information system for receiving, aggregating and confirming the client's nominations.

Moreover, operating data are supplied by supervisory control and data acquisition (SCADA) control systems. From these data, the optimisation tool searches for the most efficient set-up of storage operations either by calculating all possible gas routes with their respective energy consumption or via mathematical algorithms. Optimisation tools are complemented with other features such as reporting (enabling the dispatcher's decisions to be evaluated over time) or simulating the costs of planned maintenance or storage reservoir testing.

While implementation of an optimisation tool is likely to save only a small amount of fuel gas or electricity per day, the cumulative savings over a year can make a substantial difference to the economics of storage operations. Energy saving also helps to reduce the environmental impact of storage operations.

Various UGS operators such as Edison, E.ON Gas Storage, Gazprom, Nafta, RWE Gas Storage and Storengy have implemented and are improving such optimisation tools.

## Conclusion

UGS operators are taking advantage of sophisticated and advanced technologies which were mainly developed by and for oil and gas majors or engineering service companies. But UGS operators are also investing in R&D to adapt these technologies to their specific needs in order to continuously improve their practices. The aim is to limit as much as possible the risks and the environmental impacts of their facilities in a changing worldwide gas market.

*Fabien Favret (EDF) is the leader of Study Group 2.2 in Working Committee 2 – Storage. WOC 2 members Hélène Giouse (Storengy), Nikita Barsuk (Gazprom), Jacques Grappe (Géostock), Ladislav Goryl (Nafta and Chair of WOC 2) contributed to this article. The external contributors were Gianbattista Retegno from Edison (EDF Group) and Christophe Maisons from Magnitude (a Baker Hughes – CGG Joint Venture).*

# The answer to climate change, is change.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www.petronetlng.com

# Presenting IGU's New Members

*At the Council meeting in Beijing in October 2013, IGU welcomed two new Charter Members and five new Associate Members. Here we have a short profile on each of them.*

## Iraq

The new Charter Member for Iraq is the Oil Marketing Company, which is a state-owned company responsible for the marketing of Iraq's petroleum exports overseas and the coverage of domestic demand. It was established in 1998 when the State Oil Marketing Organisation was corporatised and retains the abbreviation SOMO.

Iraq has the world's fifth largest proved oil reserves at 150 billion barrels. Currently, SOMO exports oil via the Basrah and Khor Amaya terminals on Iraq's Arabian Gulf coast and the Ceyhan terminal in Turkey. It is based in Baghdad and headed by Director General Dr Falah J. Alamri.

Iraq ranks 12th in terms of proved gas reserves, with 3.6 tcm, and is seeking to develop its gas industry. Membership of IGU will help the country's petroleum engineers and managers widen their experience and knowledge. SOMO seeks to cooperate with international partners and is keen to get involved in IGU's activities.

*For more information, visit somooil.gov.iq.*

## Lebanon

The new Charter Member for Lebanon is the Ministry of Energy and Water represented by Eng. Zaher Sleiman, Head of the LNG Unit, who is coordinating the introduction of natural gas for power generation to diversify the country's energy mix. This was planned in the Electricity Policy Paper that was presented by the Minister of Energy and Water, Gebran Bassil, and duly approved by the Council of Ministers on June 21, 2010.

Initially, gas will be imported as LNG via a floating storage and regasification unit (FSRU), for which tendering is in progress, and used for power generation. This will save more than $1 billion per year on the country's fuel bill. The Ministry's responsibilities include the management of the FSRU project and LNG imports, and ensuring security of supply. In addition, a feasibility study is being carried out for a 36" natural gas coastal pipeline with a length of 173km, mostly onshore, that will act as a backbone for the supply of natural gas to all existing and future power plants. In the longer term, domestic production will start. Lebanon has significant offshore oil and gas potential in its sector of the eastern Mediterranean, with gas resources estimated at 2.7 tcm.


▼ Gebran Bassil, Lebanon's Minister of Energy and Water, speaking at the Lebanon International Oil & Gas Summit in December 2013.

The Ministry sees IGU membership as giving it valuable exposure to the international gas sector.

*For more information in Arabic, visit www.energyandwater.gov.lb.*

## ADNOC Distribution

Abu Dhabi National Oil Company for Distribution (ADNOC Distribution) is a government-owned integrated energy company which markets and distributes petroleum products and allied services within the United Arab Emirates and internationally. It was founded in 1973 with a mission to provide value to customers and shareholders, care for employees, be socially responsible, environmentally conscious and maintain high standards of health and safety.

ADNOC Distribution's primary products are lubricants, LPG, aviation and vehicle fuels, and it operates a network of service stations and Oasis convenience stores, with services including vehicle inspection and auto servicing. The company also maintains an advanced central laboratory with the latest quality control and precision equipment.

In 2005, ADNOC Distribution was mandated by the Government of Abu Dhabi to set up the infrastructure to supply natural gas to the residential, commercial, industrial and transportation sectors as an alternative eco-friendly, safe and reliable source of power.

Since launching the project, ADNOC Distribution has given full technical support and guidance to all new residential and commercial developers (50+) and the Industrial City of Abu Dhabi (ICAD II) to build their own natural gas and/or synthetic natural gas (SNG) infrastructure. In the second quarter of 2013, the company acquired the operation, maintenance, metering and billing of 18 natural gas commercial customers on Yas Island and Raha Beach in Abu Dhabi Emirate.


▲ ADNOC Distribution offers a range of products and services.

In 2010, ADNOC Distribution moved forward in distributing and marketing natural gas in the transportation sector. Under phase I, the first five vehicle conversion centres were commissioned at the end of the year followed in 2011 by the opening of 16 NGV filling stations in Abu Dhabi and Al Ain in Abu Dhabi Emirate and in Sharjah Emirate.

Currently, 17 NGV filling stations are operating with four more being commissioned, while an additional 38 stations are planned under phases II and III. There are now almost 2,900 vehicles running on natural gas in Abu Dhabi Emirate. The conversion programme has focused on the fleets operated by government organisations, taxi and rental car companies.

ADNOC Distribution's intention is to be a fully integrated natural gas utility company engaged in the sales of natural gas, LPG and

SNG as well as LNG and CNG through the NGV refuelling stations.

Since IGU is a worldwide organisation that advocates for and supports the gas industry in all aspects and applications, ADNOC Distribution as an Associate Member will have an excellent opportunity to network as well as to share knowledge and experience with natural gas industry experts worldwide.

*For more information, visit www.adnoc-dist.ae.*

### INPEX Corporation

INPEX Corporation is the largest Japanese oil and gas exploration and production company and ranks high among global independent upstream companies. It was founded in October 2008 through the business integration of the former INPEX Corporation and Teikoku Oil Co., Ltd. Currently, INPEX is engaged in more than 70 oil and natural gas projects across 28 countries. These include two large-scale LNG projects, Ichthys LNG in Australia and Abadi LNG in Indonesia, which it operates.

INPEX undertakes proactive exploration, development and production activities in order to fulfil its social duty of contributing to a stable and efficient supply of energy. INPEX aims to become a top-class worldwide oil and gas exploration and production company through sustainable growth.

In May 2012, INPEX released the "Medium- to long-term vision of INPEX: Ichthys and our growth beyond" in which the company sets forth its commitment to its shareholders and more broadly its stakeholders for sustainably enhancing its corporate value as a company serving an essential role in the global community.

Three growth targets are defined in the Vision. The first target is to achieve a net production volume of one million boe/d by the early 2020s, pursuing the top-class position among independent upstream companies in the industry.

The second target relates to the establishment of a gas supply chain. INPEX has a trunk pipeline network stretching 1,400km across the Kanto and Koshinetsu regions that surround the greater Tokyo metropolitan area, delivering gas to city gas companies and industrial customers. The Naoetsu LNG regasification terminal located in Joetsu City, Niigata Prefecture was inaugurated in December 2013. By importing through Naoetsu, INPEX integrates LNG from its overseas projects with the gas production from the company's natural gas fields in Japan in order to enhance the capacity and stability of gas supply to the Japanese market.

Thirdly, INPEX pursues reinforcement of its renewable energy initiatives, promoting efforts to commercialise renewable energies and reinforcing R&D activities for the next generation.


▸ INPEX inaugurated the Naoetsu LNG terminal in December 2013.

Petronet LNG developed India's first LNG import terminal at Dahej.

As a new Associate Member of IGU, INPEX will make the best use of this opportunity to share competence and experience with other members.

*For more information, visit www.inpex.co.jp.*

### Petronet LNG

Petronet LNG Limited established India's first LNG import terminal at Dahej in Gujarat. Built with an initial capacity of 5 mtpa and completed in 2003, it was expanded to 10 mtpa in 2009. Dahej LNG is the biggest LNG terminal in south-east Asia.

Of the present 10 mtpa throughput, some 7.5 mtpa is sourced through a long-term contract with RasGas of Qatar. Additional LNG is being sourced through spot/short-term contracts. Dahej LNG meets around 30% of India's total gas requirement and is catering to the needs of the states of Maharashtra, Gujarat, Rajasthan, Delhi, Haryana and Uttar Pradesh. The capacity of the terminal is being further expanded to 15 mtpa. The works include a second jetty to mitigate the risk of receiving large number of cargos at a single jetty. The Dahej terminal is connected to three major trunk pipelines – HBJ, DUPL and GSPL. The expansion of pipeline networks will play a vital role in the development of India's natural gas market.

Petronet LNG's second terminal at Kochi with capacity of 5 mtpa was officially dedicated by Dr Manmohan Singh, Prime Minister of India on January 4, 2014. The terminal had received its commissioning cargo on August 20, 2013 with

Petronet LNG's second terminal at Kochi was officially dedicated in January 2014.

the arrival of the LNG tanker *WilEnergy*. This terminal will cater to the needs of the fertiliser, power, petrochemical, steel, transport, city gas distribution and other ancillary industries using gas in the southern states of Karnataka, Tamil Nadu, Kerala and parts of Maharashtra. Petronet has already tied up 1.44 mtpa of LNG on a long-term basis from ExxonMobil's Gorgon Project in Australia for the Kochi terminal.

The pre-project activities for setting up a third LNG terminal on the eastern coast at Gangavaram, Andhra Pradesh are in progress with a target for operation by 2017. The commissioning of this terminal will help the company to provide gas to the eastern Indian states of Andhra Pradesh, Odisha, West Bengal and the north-eastern states, besides catering to central Indian states like Madhya Pradesh, Chhattisgarh, Jharkhand and Bihar.

Petronet LNG started its commercial operations in 2004 with the entry into service of Dahej LNG and has become a market leader in the LNG industry. Today it is ranked 35th in the elite FE-500 list of India's Finest Companies by *Financial Express* on the basis of the FY2011-12 results for revenue and market capitalisation of the top 750 companies. It has also been ranked at 37th in *Fortune India*'s 500 largest corporations based on the sum total income and total assets for FY2012-13. Adding another feather to its cap, it has been named the top Indian company in the sector of gas processing, transmission and marketing in the Dun & Bradstreet Corporate Awards 2012.

IGU will provide a unique international forum for networking and professional development. It will also provide access to the latest knowledge about technological and regulatory developments in the LNG value chain in different parts of the world, besides establishing a channel for cooperation with other international organisations and institutions.

*For more information, visit www.petronetlng.com.*

## RasGas

One of the world's premier integrated LNG enterprises, RasGas Company Limited (RasGas), has a reputation for being a safe and reliable supplier of LNG that has transformed a regional resource into a key component of the global energy mix.

RasGas is pleased to become an Associate Member of IGU, an organisation which has played a pivotal role in natural gas advocacy and is considered to be the voice of the gas industry worldwide.

In just two decades since its inception, RasGas has grown into a world-class global LNG producer with an annual production capacity of around 37 million tonnes.

RasGas is a Qatari joint stock company with more than 3,000 employees, owned by Qatar Petroleum (70%) and ExxonMobil (30%). The company has seven LNG trains in operation, produces LPG, condensate, liquefied helium, sulphur and sales gas. It also operates and manages the world's largest helium facility, Helium 2, making Qatar the world's largest exporter of high-quality liquid helium supplying 25% of global demand.

RasGas is aware that in order to continue to meet the growing demand for clean energy, suppliers must optimise operational output while working hard to conserve and protect our resources.

▼ By 2015, RasGas will be producing around 11 bcf/d from Qatar's North Field – the RasGas Alpha platform.

RasGas exports LNG to customers around the world – the Q-Flex vessel *Ejnan* at Ras Laffan.

RasGas was the first company in Qatar to implement a five-year flare minimisation programme through its greenhouse gas (GHG) strategy. Under its second five-year flare minimisation programme, RasGas aims to reduce flaring by 90% by 2016 (compared to figures in 2005).

Aligned with the IGU vision to advocate gas as an integral part of a sustainable global energy system, RasGas looks forward to sharing industry best practices and supporting the development of technologies which add to the environmental benefits of gas.

Recently, along with Qatargas and Nakilat, RasGas launched a pilot project using innovative technology to convert a Q-Max vessel to run on LNG. The conversion promotes a cleaner marine fuel, while cutting down the ship's exhaust gas and GHG emissions. The converted Q-Max will be the world's first low-speed marine diesel engine to use LNG as a fuel, allowing it to meet current known and future stated global emissions regulations.

As an IGU member, RasGas looks forward to the opportunity to contribute to promoting gas and LNG as the fuel of choice, emphasising its role as a clean, safe and reliable way to fuel the world's energy demand.

*For more information, visit www.rasgas.com.*

## Transportadora de Gas del Perú

Set up in 2000, Transportadora de Gas del Perú (TgP) has the concession to transport hydrocarbons from the Camisea gas fields in the Cusco region. Camisea production started in 2004 and has made a major contribution to Peru's economic development. In terms of the country's energy matrix, natural gas now accounts for 30% of primary energy consumption (50% of electricity generation) and is also exported as LNG.

The TgP system comprises two parallel pipelines: a natural gas pipeline of 731km to the Lima/Callao metropolitan area and a natural gas liquids pipeline of 557km to a fractionation plant at Pisco.

The pipelines run across the Andes reaching an altitude of 4,900 metres before dropping down to sea level. This brought significant engineering and environmental challenges during the construction phase and it also means that the system is exposed to geohazards during operations. TgP has a policy of sharing its experience and best practices in terms of integrity management, maintenance, community relations and environmental protection and sees IGU membership as a means of sharing information and promoting the development of the gas industry in the region.

*For more information, visit www.tgp.com.pe.*

# Comprehensive Programme for AFG's Gas Conference

By Georges Bouchard

The Gas Conference held on September 11 and 12, 2013 at the Palais des Congrès in Paris was a great opportunity to clarify the strengths and the role of gas in the energy transition to 2030 and beyond. The event is held every two years and is organised by the French Gas Association (AFG).

## The Gas Conference, a networking event

The Gas Conference 2013 welcomed nearly 800 energy professionals from across the gas industry. As well as debating the challenges facing the industry in roundtables and workshops, participants also had the opportunity to meet and network throughout the event.

A line-up of 100 speakers – CEOs, experts, analysts, policymakers and industry stakeholders – took part in a comprehensive programme over the two days which provided a better understanding of the issues facing the gas industry. The major issues discussed during the roundtables and workshops included: Gas market perspectives; Gas and energy transition; Towards the integration of the European market; Decentralised production and local development; and the Strategies of the players.


▼ The Gas Conference 2013 welcomed nearly 800 energy professionals.

The conference was closed by Jérôme Ferrier, President of IGU and the new President of the French Gas Association. He was elected by the AFG Board of Directors when it met during the event, succeeding Hervé Malherbe.

## Parallel events

An international exhibition called Expogaz ran alongside the conference and welcomed more than 3,500 visitors who were able to learn about innovations and new gas technologies with a focus on the downstream market. The exhibition area increased by 17% compared to 2011 and 95 companies were represented, 24 of them based outside France.

For the second time, Expogaz featured a technical day with a series of sessions. For 2013, they were dedicated to discussion of and feedback on new regulations covering the safety and security of distribution networks.

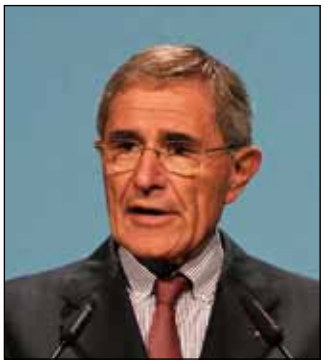
## In the press

The Gas Conference 2013 benefited from substantial press coverage with articles in various national media including *Le Monde, La Croix, Energiesactu.fr, Enerpresse and Pétrole & Gaz Informations*.

*Georges Bouchard is the Managing Director of the French Gas Association (www.afgaz.fr).*

## Important keynote speakers

Jérôme Ferrier, IGU and AFG President.



Gérard Mestrallet, Chairman & CEO, GDF SUEZ.

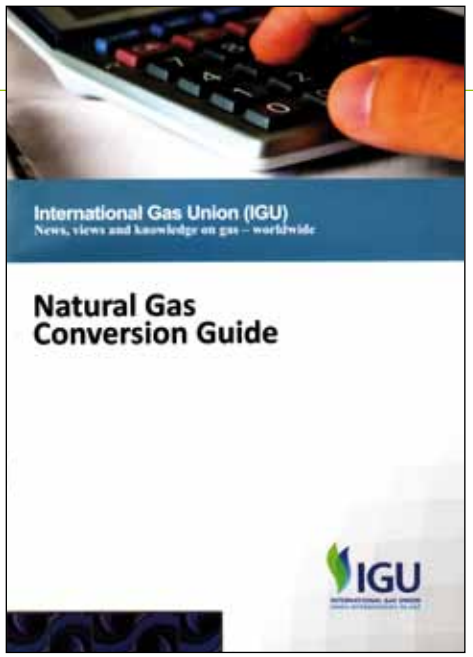
Philippe Sauquet, President Gas & Power, Total.

Philippe de Ladoucette, Chairman, French Regulatory Commission of Energy.

Brendan Devlin, Advisor, Directorate B Internal Energy Market, DG Energy, European Commission.

Bruno Lescoeur, Senior Executive Vice President Gas & Southern Europe, EDF and CIO of Edison.

# 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 to order hard copies (if in stock) from the Secretariat:

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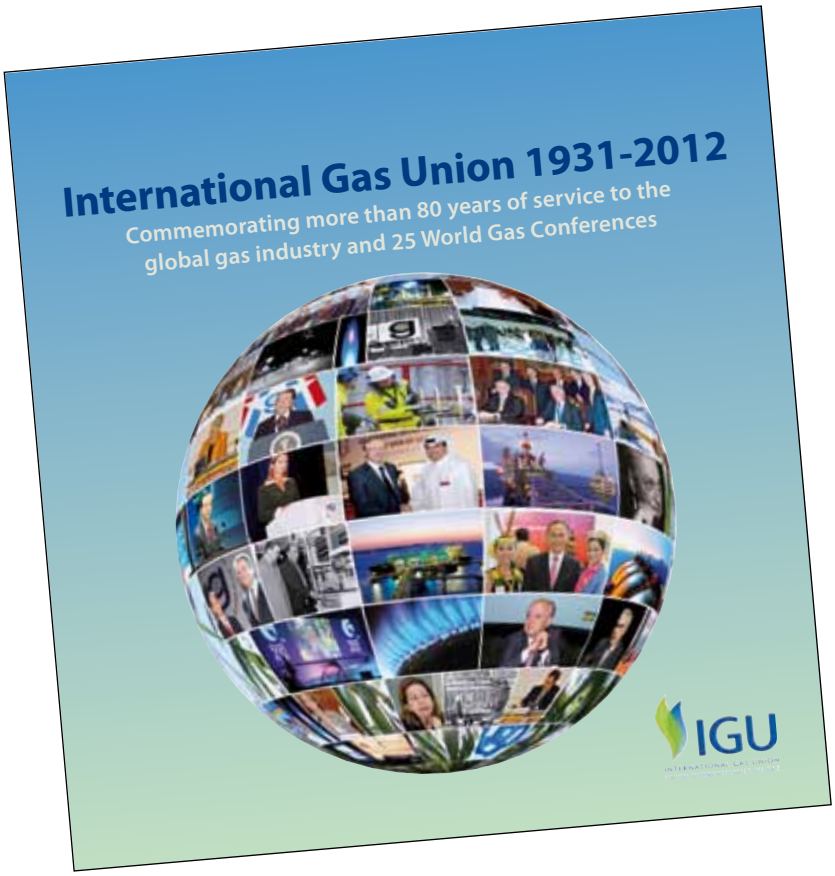



### IGU publications

- IGU Articles of Association
- IGU Annual Report
- IGU Strategic Statement 2013
- IGU General Brochure (revised)
- Triennial Work Programme 2012-2015
- 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 – 2013 edition
- Wholesale Gas Price Formation – A Global Review of Drivers and Regional Trends, 2013 edition
- Global Vision for Gas: The Pathway towards a Sustainable Energy Future
- IGU Natural Gas Conversion Guide
- IGU Natural Gas Conversion Pocketbook
- International Gas Union 1931-2012
- Shale Gas: The Facts about the Environmental Concerns

## Reports for WGC 2012

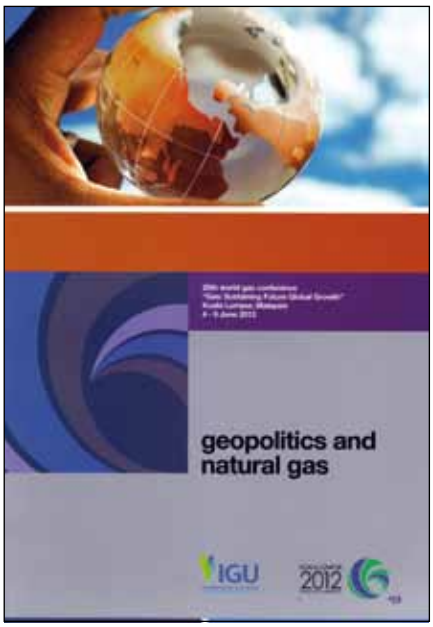
- Final report of the 25th World Gas Conference
- Building Strategic Human Capital
- Everything You Wanted to Know about Gas … but Were Afraid to Ask (Youth publication)
- Geopolitics and Natural Gas
- Natural Gas Industry Study to 2030: An Update on Supply, Demand and Trade
- Nurturing the Future Generations for the Oil and Gas Industry
- Reduction of Greenhouse Gases: A Technology Guide
- Renewable Gas: The Sustainable Energy Solution


## Joint publications with other organisations

- The Role of Natural Gas in a Sustainable Energy Market (with Eurogas)
- Guidebook to Gas Interchangeability and Gas Quality 2011 (with BP)

## Scientific and technical papers and documentation

- Sustainable Development and the Role of Gas (2006)





- Gas to Power Global Outlook, (2006)
- The Art of Regulation, (2006)
- Proceedings of the 23rd World Gas Conference, 2006, (CD-ROM)
- Proceedings of the 22nd World Gas Conference, 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

Please check the IGU website for other (older) publications which are still available from the IGU Secretariat.

# IGU Events and Other Major Gas-related Events 2014-2015

**2014**

**April 1-3**
**IGU Executive Committee**
**Sydney, Australia**

May 5-9
NGV 2014: 14th NGV Global Biennial Conference & Exhibition
Long Beach, USA

May 20-22
World Shale Oil & Gas Europe Summit
Kiev, Ukraine

May 22-23
REGATEC 2014: 1st International Conference on Renewable Energy Gas Technology
Malmö, Sweden

June 15-19
21st World Petroleum Congress
Moscow, Russia

**September 17-19**
**IGU Research Conference**
**IGRC2014**
**Copenhagen, Denmark**

September 24-26
World Shale Oil & Gas Latin America Summit
Buenos Aires, Argentina

October 13-17
IPLOCA 48th Annual Convention
Abu Dhabi, UAE

**October 14-17**
**IGU Council Meeting**
**Berlin, Germany**

November 4-7
5th World Shale Oil & Gas Summit & Exhibition
Dallas, USA

**November 24-25**
**4th IEF-IGU Ministerial Gas Forum**
**Mexico City**

November 18-20
GASEX 2014 Conference & Exhibition
Hong Kong, China

December 1-12
20th Session of the Conference of the Parties to the UNFCCC (COP 20)
Lima, Peru

**2015**

**March 24-26**
**IGU Executive Committee**
**Abu Dhabi, UAE**

**June 1**
**IGU Council Meeting**
**Paris, France**

**June 1-5**
**26th World Gas Conference**
**Paris, France**

# Acknowledgements


**For the IGU Secretariat**
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*Cover:* Royal Dutch Shell (Prelude LNG FPSO), Gazprom (pipeline welding in Siberia), Eni (gas-fired power station in Ferrara, Italy), NIGC (South Pars gas processing facilities).

*Messages:* French Presidency of IGU (10 & 11 upper), CWC (11 lower), IGU (14), Gazprom (15).

*IGU Members and Organisation:* IGU (24), French Presidency of IGU (Jérôme Ferrier & Georges Liens, 25), GTI (David Carroll, 25), Malaysian Gas Association (Datuk Abdul Rahim Hashim, 25), IGU (Mel Ydreos & Torstein Indrebø, 25).

*News from the Secretariat and Presidency:* IGU except World Energy Congress (32 lower), CWC (33 left), Marc-André Boisvert (33 right), Summit Trade Events (34 lower), PISM (37 upper).

*IGU Initiatives Launched at the Council Meeting in China:* China Gas Society.

*The IGU Global Gas Award:* WGC2012.

*News from Organisations Affiliated to IGU:* Geir Mogen/NTNU (50), Lois Lammerhuber/OMV Aktiengesellschaft (51), GTI (54 & 55), IPLOCA (59 & 60), Royal Dutch Shell (62), Galileo (63), Buquebus (64), NGVRUS (65 upper & 68), NGVA Europe (65 lower), Gazprom (67).

*IGRC2014 in Copenhagen Set to Be Biggest IGRC Ever:* Tivoli Congress Center (70), DONG Energy A/S (71).

*Gearing Up for the 26th World Gas Conference:* French Presidency of IGU (74 upper left & right), Jean-Claude Guilloux/Viparis (74/5 lower), CWC (76).

*Progress Report:* French Presidency of IGU (80), China Gas Society (81), Malaysian Gas Association (84, 85, 86, 100 & 101), IGU (90, 93, 94, 96, 98, 99, 102, 104, 106, 109, 110, 112, 114, 116, 118, 119 & 121), NIGC (92).

*Inaugural African Training Seminar Offers Wide Perspective:* Marc-André Boisvert (128, 129, 130, 132, 133 & 134), CWC Group (136 & 137).

*IGU's COP 19 Event Discusses Clean Energies:* PGNiG.

*Women in Engineering Workshop Tackles Big Issues:* UNESCO/P. Chiang-Joo.

*Capacity Remuneration Ensures Security of Power Supply:* Torresol Energy Investments, S.A. (158), Eni (159 & 160).

*In the Pipeline:* Nord Stream AG (162), Gazprom (163 & 164), BP (166).

*India Expands Gas Transmission Grid:* Tractebel Engineering (170), Asian Development Bank (171), Essar (172), GEEC (174).

*Improving UGS Operations:* Gazprom (176 & 179 upper), Adrian Giddings from original supplied by Fabien Favret (179 lower).

*Presenting IGU's New Members:* GEP Events Ltd (182), ADNOC Distribution (183), INPEX Corporation (184), Petronet India Ltd (185), RasGas (186 & 187).

*Comprehensive Programme for AFG's Gas Conference:* AFG/Nathalie Tirot.

北京市燃气集团有限责任公司
BEIJING GAS GROUP CO.,LTD.

# Introduction to Beijing Gas Group

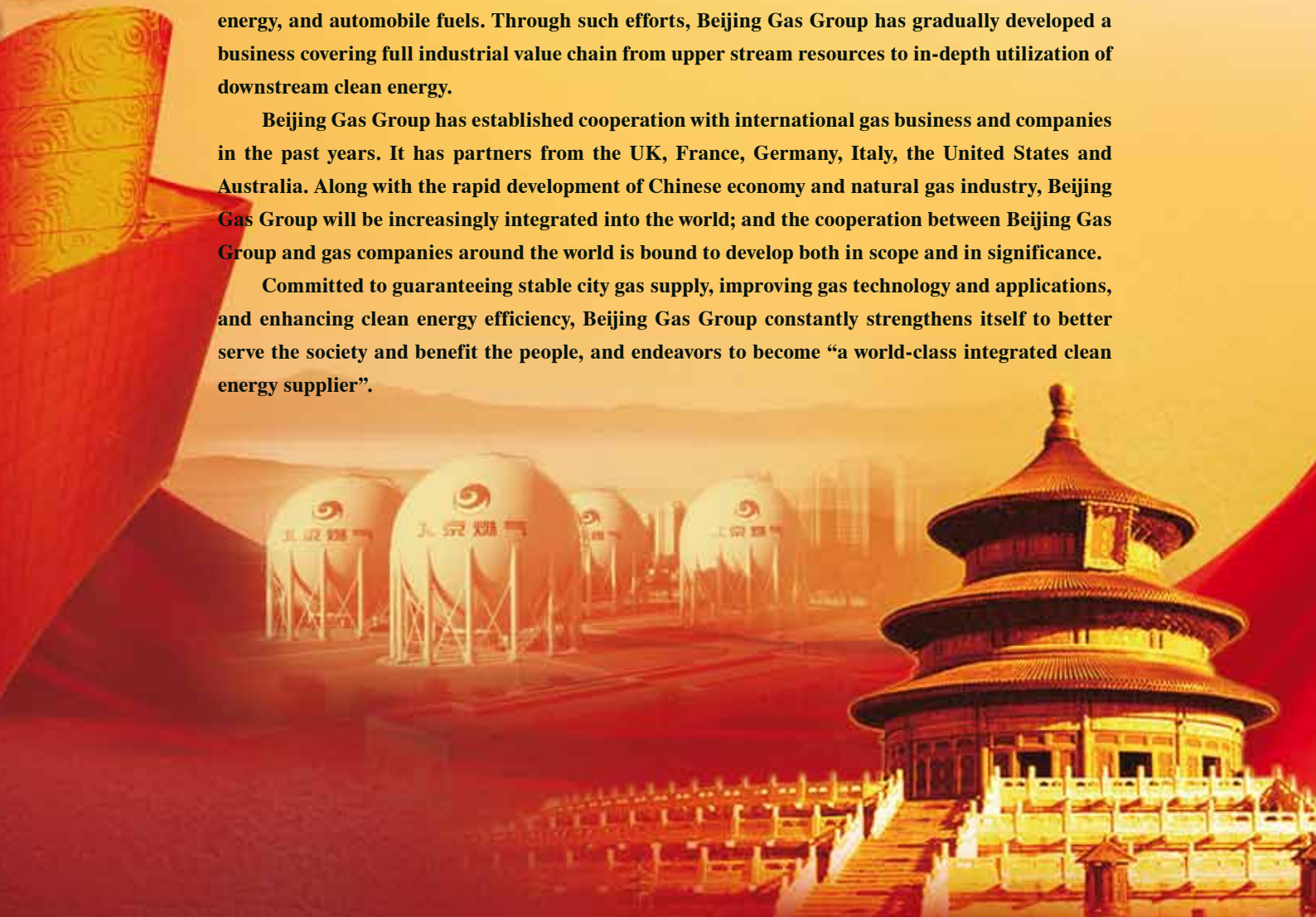
**Founded in 1958, Beijing Gas Group is a clean energy supplier in Mainland China providing integrated natural gas services, with its businesses ranging from natural gas transmission and distribution, sales, research and development to design, construction, gas devices manufacturing and in-depth usage of clean energy. In May 2007, Beijing Gas Group was successfully listed in Hong Kong, becoming the first utility company in Beijing integrated into the international capital market.**

**Beijing Gas Group is now the largest city gas company in terms of operation scale in a single city, enjoying high reputation and major influence in gas industry in China. In 2014, Beijing Gas Group supplies 9.1 billion cubic meters of natural gas to 7.3 million diversified users, with 19,500 kilometers of pipeline networks and 17,000 employees.**

**Following the strategy of "establishing a foothold in Beijing; following a domestic and external approach; putting a firm focus on the gas business and pursuing vertical integration", Beijing Gas Group has established business presence in 14 provinces, cities and regions, forming a comprehensive investment pattern in China. Meanwhile, Beijing Gas Group actively develops non-conventional natural gas and establishes cooperation in this area, and participates in the construction of long distance gas transmission pipelines, underground gas storage reservoirs, LNG gate stations. It also actively promotes the application of natural gas in heating and power generation, CCHP distributed energy, and automobile fuels. Through such efforts, Beijing Gas Group has gradually developed a business covering full industrial value chain from upper stream resources to in-depth utilization of downstream clean energy.**

**Beijing Gas Group has established cooperation with international gas business and companies in the past years. It has partners from the UK, France, Germany, Italy, the United States and Australia. Along with the rapid development of Chinese economy and natural gas industry, Beijing Gas Group will be increasingly integrated into the world; and the cooperation between Beijing Gas Group and gas companies around the world is bound to develop both in scope and in significance.**

**Committed to guaranteeing stable city gas supply, improving gas technology and applications, and enhancing clean energy efficiency, Beijing Gas Group constantly strengthens itself to better serve the society and benefit the people, and endeavors to become "a world-class integrated clean energy supplier".**



*The French Gas Association*

*The professional gas union in France*

*www.afgaz.fr*

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- Promotion of the gas industry in France at national, European and international levels
- Supplier of services in the fields of standardisation and certification
- Exchange of information and expertise between gas players
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