ACCESS TO ENERGY
Gas delivers sustainable economic development
Charting New Growth Areas
PETRONAS FLOATING LNG

As part of our efforts to meet the world’s growing demand for energy, PETRONAS is aggressively expanding into the uncharted waters of Liquefied Natural Gas (LNG) floating vessels to monetise stranded gas in small and scattered conventional fields. The first of its kind in the world, PETRONAS’ FLNG is testimony to our commitment to continuously push performance boundaries, go further and do better.
GE’s SeaSmart Offshore Package™ is a plug-and-play gas turbine solution for mechanical drive or power generation in the most challenging offshore environments. Our latest design provides increased availability and long-term efficiency with reduced installation and commissioning, optimized maintenance and compact, on-skid controls, auxiliaries and diagnostics capabilities. Advanced composite materials eliminate tons and increase corrosion resistance for harsh marine conditions, while the fully integrated package significantly reduces footprint to free up valuable deck space. Continually evolving based on real customer needs in the most demanding operations, every generation is more compact, durable, lighter and smarter than the last.

At GE Oil & Gas, our innovative offshore solutions help power your operations and the world. GE Works.

CONTINUING EVOLUTION THAT’S SMARTER EVERY TIME
Vision, Mission and Objectives

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

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.
every day millions of customers choose eni for natural gas

eni, a leader in natural gas in europe
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
# Contents

October 2013 – March 2014

**Introduction**
- Vision, Mission and Objectives 4
- Message from the President 10
- Message from the Secretary General 14
- Countries Represented in IGU 18
- IGU Organisation 24
- News from the Secretariat 28
- Full Agenda for Seville Meetings 40
  *By Ksenia Gladkova*
- News from Organisations Affiliated to IGU 44
- IGRC2014 in Innovative Copenhagen 62
  *By Peter Hinstrup*
- On Track for the 26th World Gas Conference 66
  *By Daniel Paccoud*

**Progress Report**
- Introduction and Key Developments 72
- Progress Reports from the Committees 76
- Progress Reports from the Task Forces 108

**Features**
- China Hosts the 2013 Council Meeting 120
  *By Mark Blacklock*
- Reports from the Regional Coordinators 134
- LNG 17 Sets New Record 140
  *By Mark Blacklock*
- LNG Financiers Pile In 152
  *By Rod Morrison*
- Is FLNG the Future for Liquefaction? 160
  *By Alex Forbes*
- Unconventional Gas vs LNG – Friend or Foe? 170
  *By Marius Popescu*
- Society for Gas as a Marine Fuel Launched 172
  *By Andrew Clifton*
- Q&A with Bent Svensson, Outgoing Manager of the GGFR Partnership 176
- Sustainable Energy for All 182
  *By Adrian Giddings*
- The Advancement of Key Carbon Capture Technologies 188
  *By Frank Ellingsen*
- Japan Launches CCS Demonstration Project 192
  *By Susumu Nishio*
- Life Cycle Assessment as a Tool for Decision-making in the Gas Industry 196
  *By Anne Prieur Vernat*
- Managing the Diversification of Gas Quality 200
  *By Peter Flosbach and Uwe Klaas*
- Zapolyarnoye Becomes Russia’s Most Productive Field 206
  *By Ekaterina Litvinova*
- IGU Work Recognised in Australia’s Women of Influence Awards 208
  *By Mark Blacklock*
- GTL Gathers Pace as a Gas Monetisation Option 210
  *By Mark Blacklock*
- Publications and Documents Available from IGU 214
- Events and Acknowledgements 216

The opinions and views expressed by the authors in this magazine are not necessarily those of IGU, its members or the publisher. While every care has been taken in the preparation of this magazine, they are not responsible for the authors’ opinions or for any inaccuracies in the articles.

Unless otherwise stated, the dollar ($) values given in this magazine refer to the US dollar.
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.
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.
Message from the President

Dear Colleagues

The 17th International Conference and Exhibition on LNG in April was a great success because LNG is a thriving topic in the energy community. It is gradually becoming of major importance in global gas markets. In 2012, LNG’s share of overall natural gas consumption was 10% but this represented just under a third of internationally traded gas.

LNG 17 was held in Houston at a time when the United States is rediscovering the virtues of natural gas thanks to the development of unconventional gas – particularly shale – which has revolutionised the US energy market over the past five years. North American operators are now investing in liquefaction units so that gas that is surplus to domestic requirements can be exported in liquid form.

IGU is proud to have helped the Gas Technology Institute (GTI) and International Institute of Refrigeration (IIR) organise this conference, which is held every three years. Congratulations to our friends at the American Gas Association and the whole conference and exhibition team for making LNG 17 the gas event of the year. You can read a report on the highlights in this issue. Future LNG conferences will be held in Perth, Australia in 2016 and Beijing, China in 2019, highlighting once again the role that Asia will play in LNG over the coming years.

The next two major international gas community events are the IGU Research Conference (IGRC 2014) and the 26th World Gas Conference (WGC 2015).

Under the French Presidency, the important issues of R&D and innovation have been inte-
IGU developments

IGU’s membership continues to grow steadily and we are attracting new applications from countries that have only recently discovered gas reserves. These applications will be examined during our next Council meeting in Beijing in October. Another important item on the agenda will be a report on IGU strategy to 2020.

The world in which we live is evolving. Energy is an essential part of this world and natural gas is an integral part of the energy system, playing a major role in delivering sustainable development. IGU is growing and adapting in order to address the challenges of the future.

Jérôme Ferrier

Prepared into the technical committee structure by the formation of Programme Committee F. More than 50 experts have signed up and are keen to share their expertise and findings.

The current debates on energy transition in a number of countries will have to take this work into account, in particular on energy efficiency and the most suitable technologies for extracting unconventional gas. PGC F’s responsibilities include preparing the technical programme for IGRC 2014, which will be held in Copenhagen, Denmark, September 17-19, 2014.

The gas industry’s major international triennial event will take place in Paris, France, June 1-5, 2015. The 26th World Gas Conference will provide an opportunity to assess the progress made over the past few years to make natural gas one of our main future sources of energy through conference debates and the associated exhibition.

Preparations for these events are already well underway and the organisers are sure that they will be very successful.
Developing expertise
By combining R&D and technological boldness
To secure the future of energy, Total has identified the following challenges for its R&D operations: to more effectively develop and process resources, to drive faster growth in alternative energies, to optimize the efficiency of the industrial base, to design innovative products, to address environmental issues and to fast-track the introduction of advanced technologies across the business base. We intend to invest €7 billion in R&D over the period 2010-2015. Thanks to recent advances in geological concepts and technology, for example, major oil and gas finds are now possible in places that not so very long ago would have been unexpected or inaccessible.

www.total.com
Message from the Secretary General

Dear Reader

Global market developments
The global gas market grew by more than 2% in 2012 compared with the previous year. Overall we are back on track for sustained expansion of the gas industry, but this simple message obscures some extraordinary shifts in the energy market that underlie recent developments: European gas demand declined while the other regions saw increases, more LNG cargoes were delivered to Asia to make up for reduced nuclear output, and new markets developed downstream for the expanded utilisation of gas. How different sectors and economies develop and uncertainty about the level of future GDP create significant demand-side uncertainty.

There is no doubt, however, that the shale gas revolution in North America continues to be the key supply-side factor in the changing global balance of supply and demand. Enhanced shale gas production has enabled the USA to consolidate its position as the largest gas producing country in the world. Furthermore, the phenomenon of increasing shale gas production is expected by most experts to be able not only to sustain further development and expansion of US downstream gas sectors, but also to allow LNG exports in significant quantities during the next five to 10 years.

Looking further ahead, estimates from the US Energy Information Administration (EIA) published in June suggest that future production of shale gas might develop in other countries around the world, with top shale gas resource holders being China, Argentina and Algeria.

LNG 17 in Houston
The 17th International Conference and Exhibition on LNG took place in April and was an outstanding success. Indeed, the LNG series has become an unmissable meeting place as it is the only global event created by the industry for the industry bringing together the entire LNG value chain. Houston, the energy capital of the USA, proved to be an ideal host city for this prestigious event and there was fantastic commitment from the highest levels within the industry and government. You will find a separate report on this great event in the magazine.

Securing our future
Just like the industry that we support, IGU has to plan for the long term. We have started the internal process to elect the President who will lead us for the triennium starting in 2018, culminating in the World Gas Conference in 2021 for which we must also select the venue. The deadline for Charter Members to make...
their nominations for IGU President and the venue for WGC 2021 is November 30, 2013.

Another key issue for the future organisation and activities of IGU is the choice of the host of the secretariat after the end of the Norwegian term. The deadline for nominations for the new IGU Secretary General and supporting office facilities for the period 2016-2022 is the end of 2013.

The election of the IGU President for 2018-2021, choice of venue for WGC 2021 and election of the Secretary General and host location for 2016-2022 will all take place at the Council meeting in Berlin in October 2014.

**Strategy towards 2020**

IGU strategy towards 2020 was discussed by the Executive Committee in Seville earlier this year as a follow-up of the Ottawa Council meeting in 2012. Realigning our internal and external communication was established as the top priority. This will include further improvements to the IGU global web portal for gas. The strategy will also aim to enhance the image of IGU, and indeed all aspects of the gas business, among stakeholders outside the industry with particular focus on political processes related to energy in international organisations such as the United Nations, European Union and G8/G20 Leaders’ Summits. We have already developed initiatives with UNIDO about transfer of gas competence, and with UNESCO on gender and women in the gas industry.

**IGU Strategic Statement 2013**

The IGU Executive Committee has approved the 2013 Strategic Statement of IGU which I hope will find its way to stakeholders inside and outside the gas industry, and be translated into many languages by our members. Please see page 42 for the complete version of the statement.

**IGU publications**

One aspect of communication that I know is greatly appreciated by IGU members is the publication of up-to-date reviews by our experts in the technical committees. Among the information that you will find published on www.igu.org during 2013 are updates of the *World LNG Report*, *Global Wholesale Gas Price Formation*, *Natural Gas as a Transportation Fuel* and on Shale Gas.

I hope that you enjoy the articles in this issue and find further information on our website on the topics that most interest you.

Enjoy your reading!

Torstein Indrebø
Petrobras is more than an oil company.

And if you think about it, it’s more than an energy

Petrobras is renowned around the world for its technology and leadership in deep and ultra-deepwater exploration and production. It’s also a pioneer in biofuels and invests in alternative energy sources.
company too.

But, more importantly, Petrobras is committed to social and environmental development and fosters good citizenship values, culture and the arts. If the future is a challenge, Petrobras is ready for it.
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  
Ireland  
Israel  
Italy  
Japan  
Kazakhstan  
Korea, Republic of  
Latvia  
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

Countries represented in IGU
81 Charter Members
and 40 Associate Members
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.
### Charter Members

<table>
<thead>
<tr>
<th>Country</th>
<th>Organization/Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>Albanian Energy Regulator (ERE)</td>
</tr>
<tr>
<td>Algeria</td>
<td>Association Algérienne de l’Industrie du Gaz – AIG</td>
</tr>
<tr>
<td>Angola</td>
<td>Sonangol Gás Natural</td>
</tr>
<tr>
<td>Argentina</td>
<td>Instituto Argentino del Petróleo y del Gas</td>
</tr>
<tr>
<td>Australia</td>
<td>Australian Gas Industry Trust</td>
</tr>
<tr>
<td>Austria</td>
<td>Österreichische Vereinigung für das Gas- und Wasserfach (ÖVGW)</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>State Oil Company of the Azerbaijan Republic (SOCAR)</td>
</tr>
<tr>
<td>Belgium</td>
<td>Association Royale des Gaziers Belges</td>
</tr>
<tr>
<td>Bosnia and Herzegovina</td>
<td>Gas Association of Bosnia and Herzegovina</td>
</tr>
<tr>
<td>Brazil</td>
<td>Associação Brasileira das Empresas Distribuidoras de Gás Canalizado (ABEGÁS)</td>
</tr>
<tr>
<td>Brunei</td>
<td>Brunei Energy Association</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Overgas Inc.</td>
</tr>
<tr>
<td>Cameroon</td>
<td>Société Nationale des Hydrocarbures</td>
</tr>
<tr>
<td>Canada</td>
<td>Canadian Gas Association</td>
</tr>
<tr>
<td>China, People’s Republic of China</td>
<td>Gas Authority of India Ltd (GAIL)</td>
</tr>
<tr>
<td>Colombia</td>
<td>Asociación Colombiana de Gas Natural – Naturgas</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>PETROCI Holding – Société Nationale d’Opérations Pétrolières de la Côte d’Ivoire</td>
</tr>
<tr>
<td>Croatia</td>
<td>Croatian Gas Association</td>
</tr>
<tr>
<td>Cyprus</td>
<td>Ministry of Commerce, Industry &amp; Tourism</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Czech Gas Association</td>
</tr>
<tr>
<td>Denmark</td>
<td>Dansk Gas Forening – Danish Gas Association</td>
</tr>
<tr>
<td>Egypt</td>
<td>Egyptian Gas Association</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>Sociedad Nacional de Gas G.E.</td>
</tr>
<tr>
<td>Estonia</td>
<td>Estonian Gas Association</td>
</tr>
<tr>
<td>Finland</td>
<td>Finnish Gas Association</td>
</tr>
<tr>
<td>France</td>
<td>Association Française du Gaz (AFG)</td>
</tr>
<tr>
<td>Germany</td>
<td>Deutsche Vereinigung des Gas- und Wasserfaches e.V. (DVGW)</td>
</tr>
<tr>
<td>Greece</td>
<td>Public Gas Corporation of Greece (DEPA) S.A.</td>
</tr>
<tr>
<td>Hong Kong, China</td>
<td>The Hong Kong &amp; China Gas Co. Ltd</td>
</tr>
<tr>
<td>India</td>
<td>Gas Authority of India Ltd (GAIL)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Indonesian Gas Association (IGA)</td>
</tr>
<tr>
<td>Iran</td>
<td>National Iranian Gas Company (NIGC)</td>
</tr>
<tr>
<td>Italy</td>
<td>Comitato Italiano Gas (CIG)</td>
</tr>
<tr>
<td>Japan</td>
<td>The Japan Gas Association</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>KazTransGas JSC</td>
</tr>
<tr>
<td>Korea, Republic of Gas</td>
<td>Korean Gas Union</td>
</tr>
<tr>
<td>Latvia</td>
<td>JSC Latvijas Gāze</td>
</tr>
<tr>
<td>Libya</td>
<td>National Oil Corporation</td>
</tr>
<tr>
<td>Lithuania</td>
<td>Lithuanian Gas Association</td>
</tr>
<tr>
<td>Macedonia</td>
<td>Macedonian Gas Association</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Malaysian Gas Association</td>
</tr>
<tr>
<td>Mexico</td>
<td>Asociación Mexicana de Gas Natural, A.C.</td>
</tr>
<tr>
<td>Monaco</td>
<td>Société Monégasque de l’Électricité et du Gaz (SMEG)</td>
</tr>
<tr>
<td>Mongolia</td>
<td>Baganuur Joint Stock Company</td>
</tr>
<tr>
<td>Morocco</td>
<td>Fédération de l’Énergie de la Confédération Générale des Entreprises du Maroc (CGEM)</td>
</tr>
<tr>
<td>Mozambique</td>
<td>Empresa Nacional de Hidrocarbonetos, E.P. (ENH)</td>
</tr>
<tr>
<td>Netherlands, The Royal Dutch Gas</td>
<td>The Koninklijke Vereniging van Gasfabrikanten in Nederland (KVGN)</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Nigerian Gas Association</td>
</tr>
<tr>
<td>Norway</td>
<td>Norwegian Petroleum Society (NPF) – Norwegian Gas Association</td>
</tr>
<tr>
<td>Oman, Sultanate of Oman LNG L.L.C.</td>
<td>The Oman LNG Gas Association</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Petroleum Institute of Pakistan</td>
</tr>
<tr>
<td>Peru</td>
<td>Perúpetro S.A.</td>
</tr>
<tr>
<td>Poland</td>
<td>Polskie Zrzeszenie Inżynierów i Techników Sanitarnych (PZITS) – Polish Gas Association</td>
</tr>
<tr>
<td>Qatar</td>
<td>Qatar Liquefied Gas Company Ltd (Qatargas)</td>
</tr>
<tr>
<td>Romania</td>
<td>S.N.G.N. Romgaz S.A.</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>OAO Gazprom</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>Saudi Aramco</td>
</tr>
<tr>
<td>Serbia</td>
<td>Gas Association of Serbia</td>
</tr>
<tr>
<td>Singapore</td>
<td>Power Gas Ltd</td>
</tr>
<tr>
<td>Slovakia</td>
<td>Slovak Gas and Oil Association</td>
</tr>
<tr>
<td>Slovenia</td>
<td>Geoplín d.o.o. Ljubljana</td>
</tr>
<tr>
<td>South Africa</td>
<td>CEF (Pty) Ltd</td>
</tr>
<tr>
<td>Spain</td>
<td>Spanish Gas Association</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Aktiengesellschaft für Erdgas (SWISSGAS)</td>
</tr>
<tr>
<td>Taiwan, China</td>
<td>The Gas Association of the Republic of China, Taipei</td>
</tr>
<tr>
<td>Thailand</td>
<td>PTT Public Company Ltd</td>
</tr>
<tr>
<td>Timor-Leste</td>
<td>Secretariat of State for Natural Resources (Government of the Democratic Republic of Timor-Leste)</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>The National Gas Company of Trinidad and Tobago Ltd</td>
</tr>
<tr>
<td>Tunisia</td>
<td>Association Tunisienne du Pétrole et du Gaz (ATPG) c/o ETAP</td>
</tr>
<tr>
<td>Turkey</td>
<td>BOTAS</td>
</tr>
<tr>
<td>Ukraine</td>
<td>Naftogaz of Ukraine</td>
</tr>
</tbody>
</table>
Every day, the world needs more energy. Oil alone won’t be enough. So we’re investing in the development of abundant, cleaner-burning natural gas. Off the coast of Western Australia, Chevron is leading one of the largest natural gas ventures in the world. Our commitment to projects like these is making the potential of natural gas a reality.

Learn more at chevron.com
### Charter Members (continued)

<table>
<thead>
<tr>
<th>Country</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Arab Emirates</td>
<td>United States of America</td>
</tr>
<tr>
<td>Abu Dhabi Liquefaction Company Ltd (ADGAS)</td>
<td>American Gas Association</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>United States of Uzbekistan</td>
</tr>
<tr>
<td>The Institution of Gas Engineers and Managers</td>
<td>Uzbekneftegaz (UNG)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Associate Members

<table>
<thead>
<tr>
<th>Country</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Arab Emirates</td>
<td>Indian Oil Corporation Ltd (India)</td>
</tr>
<tr>
<td></td>
<td>Instituto Brasileiro de Petróleo, Gás e Biocombustíveis – IBP (Brazil)</td>
</tr>
<tr>
<td></td>
<td>Liander (The Netherlands)</td>
</tr>
<tr>
<td></td>
<td>N.V. Nederlandse Gasunie (The Netherlands)</td>
</tr>
<tr>
<td></td>
<td>OMV Gas &amp; Power (Austria)</td>
</tr>
<tr>
<td></td>
<td>Origin Energy Limited (Australia)</td>
</tr>
<tr>
<td></td>
<td>Petróleo Brasileiro S.A. – Petrobras (Brazil)</td>
</tr>
<tr>
<td></td>
<td>Repsol (Spain)</td>
</tr>
<tr>
<td></td>
<td>Russian Gas Society (Russia)</td>
</tr>
<tr>
<td></td>
<td>RWE Deutschland AG (Germany)</td>
</tr>
<tr>
<td></td>
<td>Shell Gas &amp; Power International B.V. (The Netherlands)</td>
</tr>
<tr>
<td></td>
<td>Société Suisse de l’Industrie du Gaz et des Eaux – SSIGE/SVGW (Switzerland)</td>
</tr>
<tr>
<td></td>
<td>Sonorgás (Portugal)</td>
</tr>
<tr>
<td></td>
<td>Spetsneftegaz NPO JSC (Russia)</td>
</tr>
<tr>
<td></td>
<td>TAQA Arabia (Egypt)</td>
</tr>
<tr>
<td></td>
<td>TBS – Transportadora Brasileira Gasoduto Bolivia-Brasil S/A (Brazil)</td>
</tr>
<tr>
<td></td>
<td>TOTAL S.A. (France)</td>
</tr>
<tr>
<td></td>
<td>Vopak LNG Holding B.V. (The Netherlands)</td>
</tr>
<tr>
<td></td>
<td>Wintershall (Germany)</td>
</tr>
<tr>
<td></td>
<td>Woodside (Australia)</td>
</tr>
</tbody>
</table>

### Organisations Affiliated to IGU

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Delta Institute (EDI)</td>
<td></td>
</tr>
<tr>
<td>Gas Infrastructure Europe (GIE)</td>
<td></td>
</tr>
<tr>
<td>Gas Technology Institute (GTI)</td>
<td></td>
</tr>
<tr>
<td>GERG – Groupe Européen de Recherches Gazières/European Gas Research Group</td>
<td></td>
</tr>
<tr>
<td>GilGNL – Groupe International des Importateurs de Gaz Naturel Liquefié/International Group of LNG Importers</td>
<td></td>
</tr>
<tr>
<td>NGV Global</td>
<td></td>
</tr>
<tr>
<td>NGVA Europe – European Association for Bio/Natural Gas Vehicles</td>
<td></td>
</tr>
<tr>
<td>International Pipe Line &amp; Offshore Contractors Association (IPLOCA)</td>
<td></td>
</tr>
<tr>
<td>MARCOGAZ – Technical Association of the European Natural Gas Industry</td>
<td></td>
</tr>
<tr>
<td>Pipeline Research Council International, Inc. (PRCI)</td>
<td></td>
</tr>
<tr>
<td>Russian National Gas Vehicle Association (NGVRUS)</td>
<td></td>
</tr>
</tbody>
</table>
My adventures at sea have taken me to all four corners of the globe. I have seen the world, but Ameland is the only place I could ever call home. Here, we are aware of how vulnerable nature is. This is why we are always looking for ways to keep the island clean. This means using less energy and generating energy in a smarter way. As a beachcomber, I am doing my bit to keep the island clean.

GasTerra is also doing its bit. As the instigators of the “Sustainable Ameland” project, we show how alternative energy sources can be practically applied in order to speed up the transition to a sustainable society. And time and time again, natural gas has played a key role in this transition. We are therefore part of the solution.

www.iampartofthesolution.nl
This photograph was taken at the Executive Committee (EXC) meeting which was held in Seville, Spain, in April 2013.

From left to right in the front row are:
Lori Traweek (who was substituting for David McCurdy), Antoni Peris Mingot, Chris Gunner, Mel Ydreos, Gertjan Lankhorst, Datuk (Dr) Abdul Rahim Hj Hashim, Jérôme Ferrier, David Carroll, Torstein Indrebø (IGU Secretary General, not a member of the EXC), Jupiter Ramirez, Cheryl Cartwright, Walter Thielen, Lixin Che and Cynthia Silveira.

From left to right in the back row are:
Carolin Oebel (Director, IGU Secretariat, not a member of the EXC), Daniel Paccoud (Chair of the WGC 2015 NOC, not a member of the EXC), Benjamin Guzmán (who was substituting for Jorge Javier Gremes Cordero), Hiroyuki Wada, Jae-Seob Kim, Evgueni Riazantsev, Luis Domenech, Kang Soo Choo, Khaled Abubakr, Marcel Kramer, Runar Tjersland, Philippe Miquel, Georges Liens, Jean Schweitzer and Timothy M. Egan.

Xia Yongjiang and Abdelhamid Zerguine’s substitute, Fethi Arabi missed the photo session; Pavol Janočko could neither attend the EXC nor send a substitute.
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 Committee (France)
Mr Mel Ydreos, Vice Chair of the Coordination Committee (Canada)
Mr Torstein Indrebø, Secretary General

IGU Executive Committee

Mr Abdelhamid Zerguine, Algeria
Mr Jorge Javier Gremes Cordero, Argentina
Ms Cheryl Cartwright, Australia
Mr Luis Domenech, Brazil
Ms Li-xin 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
Mr Philippe Miquel, 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
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.
The IGU Secretariat’s main activities since the last edition of the IGU Magazine (April-September 2013) are detailed below in news items and general information.

**G20 in St Petersburg**
IGU was invited to join the G20 events in St Petersburg, Russia, where the Secretary General, Torstein Indrebø, and Ksenia Gladkova, Senior Advisor, participated in the Conference on Commodity and Energy Markets on July 8 and the Energy Sustainability Working Group meeting (ESWG) on July 9-10.

With the theme “Sustainable energy: Designing policy for the G20”, the conference brought together high-level delegates from G20 governments, international organisations, business and industry, as well as representatives of think-tanks and academia, to summarise the ESWG activities in 2013 and look into the future G20 work in the energy field.

The conference agenda was focused on the prospects for sustainability in energy and commodity markets; policies to promote inclusive green growth and pave the way towards a sustainable energy future; improving the transparency and functionality of commodity markets; and encouraging investment in sustainable energy.

Torstein Indrebø gave a presentation on energy sustainability and the role of gas in the low-carbon energy mix.

The ESWG meeting was convened to discuss the outcomes of the work undertaken in the energy sphere during the Russian G20 Presidency.

Discussions had a specific focus on promoting investment in energy, ensuring sustainable development, fostering innovations in the energy sphere and ways to boost the development of the energy sector. Delegates also discussed the main outcomes of the outreach dialogue meetings held by the ESWG. The Group commented on and finalised its input on energy sustainability to be included in the G20 Leaders’ Communiqué.

IGU participated in the drafting of the G20 Leaders’ Communiqué and a statement on enhancing investments in the power sector. Torstein Indrebø also expressed IGU’s views on the role of gas in green growth during a panel debate.

**IGU contribution to UN initiative “Sustainable Energy for All”**
IGU is working with the UN Industrial Development Organisation (UNIDO) to support the high-level UN initiative “Sustainable Energy for
All” (SE4ALL) through a competence programme focusing on the use of natural gas. An initial seminar will be held with high-level representatives from sub-Saharan Africa, mainly Western Africa, in Abidjan, Côte d’Ivoire, November 4-5. The seminar will also be supported by the Economic Community of West African States (ECOWAS) and the IGU Charter Member for Côte d’Ivoire, Petroci. The seminar will be held two days prior to the Gulf of Guinea Gas Conference which will take place in the same location.

**IGU-UNESCO initiative**
Within the scope of work of Task Force 1 – Human Capital, IGU has approached the UN Educational, Scientific and Cultural Organisation (UNESCO) with a proposal to co-organise a symposium looking at how the representation of women in gas engineering and industrial careers in Africa and the Middle East can be increased. The symposium will be held in Paris on December 10.

**LNG 17 proceedings**
The proceedings of LNG 17 (presentations from the conference sessions, poster sessions and exhibition pavilion seminars) are available with open access at www.gastechnology.org/Training/Pages/LNG17-conference/LNG-17-Conference.aspx. There is also a link to this site via www.igu.org/IGU%20Events/lng/lng17.

**Updated website**
The new design for the IGU website was launched in spring 2013. The content has been reorganised in a more logical way, and some of the old content has been removed. A new section has been created which contains historical information from previous triennia (e.g. Triennial Work Programmes and IGU-related conferences such as the WGC and LNG series).

**Sustainable Energy in Africa**
At the Sustainable Energy in Africa 2013 conference organised by the EU-Africa Chamber of Commerce in Brussels on June 27, the Director of the Secretariat, Carolin Oebel...
Torstein Indreba and Ksenia Gladkova participated in the 11th Russian Petroleum and Gas Congress (RPGC) in Moscow, June 26-28. This is one of the largest industry events in Russia, attracting around 1,000 participants from 40 countries and more than 80 speakers. Supported by the Russian Ministry of Energy, the congress provides a platform for discussions and analysis of Russia’s oil and gas market.

Ksenia Gladkova gave a presentation during the Gas Day, traditionally co-sponsored by Gazprom and IGU. The participants discussed Russian gas industry strategies and prospects, developing technology and improving gas extraction, transportation, storage and processing projects, among other subjects.

Swissgas General Assembly
Torstein Indreba was invited to attend the 2013 General Assembly of Swissgas, the IGU Charter Member for Switzerland, which was held in Bern on June 25. He gave a presentation entitled “Trends and perspectives of the global gas industry” in which he called for robust and sustainable energy policies and highlighted the

Ksenia Gladkova at the 11th RPGC in Moscow.
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?

www.gasnaturalfenosa.com
role of natural gas in the energy mix as a reliable, competitive and environmentally friendly fuel.

Central European Gas Congress
The sixth Central European Gas Congress was organised by the Slovak Gas Association in Bratislava, June 23-24. The Chair of the Coordination Committee, Georges Liens represented IGU and chaired a panel on “Underground gas storage: Continuation or complementation of the E&P value chain in the Vienna Basin region?”. The participants in the panel were from Slovakia, Austria, the Czech Republic and Hungary.

Meeting with Chinese Ambassador to Norway
Torstein Indrebø and Mats Fredriksson, Senior Advisor, visited Ambassador Zhao Jun at the Chinese Embassy in Oslo on June 19. The purpose of the visit was to inform the ambassador about IGU and its activities. The ambassador was also briefed about the growing role of China in IGU, and the election of China as the host of LNG 19 in 2019.

International Student Energy Summit
More than 400 students from 60 countries participated in the third International Student Energy Summit (ISES 2013), which was hosted by the Norwegian Technical University in

News from the Secretariat
Global

To date we have delivered to 21 countries. That’s over 3.7 billion people.

As the largest LNG producer in the world with an annual production capacity of 42 million tonnes per annum (MTA), we work every day to meet our customers’ needs around the world by safely and efficiently operating our world-class facilities in Qatar.

The World’s Premier LNG Company
www.qatargas.com.qa
Advisor to the Secretary General, Khadija Al-Siyabi attended ISES 2013 as a delegate and took the opportunity to inform participants about IGU activities and distribute IGU publications.

**European Gas Conference**
The 17th European Gas Conference was held in Oslo, Norway, June 4-5. With around 200 participants, the conference looked at where future gas supplies will come from, the role of gas in the energy mix and the impact of global market developments on Europe.

The conference was opened by the Chairman of the Norwegian Gas Society, Pål Rasmussen. He was followed by IGU President, Jérôme Ferrier who was the first moderator. Ola Borten Moe, Norwegian Minister of Petroleum and Energy, spoke about gas supply from Norway and current issues related to the Norwegian gas sector. Apart from Jérôme Ferrier, the IGU team included Torstein Indrebø and Khaled Abubakr, Regional Coordinator for Africa and the Middle East, who spoke about the Global Vision for Gas and the North African perspective respectively.

**EGATEC 2013**
The second European Gas Technology Conference (EGATEC) was held in Paris, May 30-31. Organised by Student Energy, the summit covered global energy affairs, and also presented several interesting energy projects and initiatives developed by students as simple solutions to providing energy for all.

Torstein Indrebø participated in the session on unconventional energy. He spoke about the shale gas revolution and its impact on global energy markets and energy policies. The panel debate afterwards examined the implications of unconventional gas for global gas supplies, gas pricing and environmental aspects. The debate also covered the latest developments in heavy oil exploration in North America.
which are organisations affiliated to IGU, and the 2013 edition attracted more than 200 participants. Jérôme Ferrier opened the conference saying that technological innovation in the gas industry plays a leading role in achieving significant progress in the field of energy productivity, which accelerates economic growth and contributes to sustainable development.

**Eurogas/Russian Gas Society conference**

Eurogas and the Russian Gas Society held their 8th international conference in Brussels on May 30 with the theme “Energy dialogue: Russia-EU gas aspect”. Jérôme Ferrier delivered a speech on “Reconciling market trading with long-term partnerships”.

**Vienna Energy Forum**

IGU was invited to the Vienna Energy Forum which was jointly organised by UNIDO, the Federal Ministry for Foreign Affairs of Austria and the International Institute for Applied Systems Analysis (IIASA), May 28-30. Jérôme Ferrier addressed delegates during the second panel “A new action agenda – High Level Group on Sustainable Energy for All”, and informed them about the plans for the joint competence programme of IGU and UNIDO in the context of the Sustainable Energy for All (SE4ALL) initiative. Torstein Indrebø and Carolin Oebel also participated in the forum and attended several meetings with UNIDO and other organisations on the event’s sidelines.

**Baltic Sea Forum**

Carolin Oebel gave the keynote speech on the topic of “Natural gas, LNG and the Baltic Sea” at the Baltic Sea Forum focusing on “Russia and new challenges in the Baltic Sea region” in Turku, Finland, May 24. The event took place at the Turku School of Economics and brought together academia, industry and political representatives.

**Turkmenistan Gas Congress**

Jérôme Ferrier and Ksenia Gladkova took part in the Turkmenistan Gas Congress which was organised by Turkmengas in Ashgabat, Turkmenistan Gas Congress.
May 20-22. The event attracted more than 500 delegates and 50 speakers who discussed international cooperation to develop Turkmenistan’s gas resources. Jérôme Ferrier gave a keynote speech during the plenary session on “Gas market outlook – the global picture and Turkmenistan’s role”.

Uzbekistan International Oil & Gas Conference (OGU)
Torstein Indrebø represented IGU at the 17th OGU with a keynote address entitled “Trends and perspectives of the global gas industry”. The conference focused on developments in the Caspian region in light of the drivers in international energy markets. More than 200 delegates attended the event, which was held in Tashkent, May 14-16. IGU used the opportunity to meet with Shokir Fayzullayev, CEO and Deputy Chairman of Uzbekneftegaz and his management team to discuss areas of mutual interest.

GasNaturally Gas Week
After the successful launch of Gas Week by GasNaturally in 2012, the second edition was held in the European Parliament in Brussels, April 23-25. GasNaturally is a joint advocacy programme of IGU, Eurogas, GERG, GIE, GIIGNL, Marcogaz and OGP –
GDF SUEZ, A GLOBAL PLAYER IN THE NATURAL GAS VALUE CHAIN

An integrated player in the global natural gas industry, GDF SUEZ is present throughout the value chain, from upstream to downstream.

With 344 licences of exploration and/or production, the Group holds an asset portfolio balanced between mature development areas and high-potential exploration zones around the world.

Operator of Europe’s 1st network and 2nd purchaser of natural gas in Europe, the Group manages a diversified gas portfolio of more than 115 bcm annually, including long-term contracts. Its LNG portfolio of 16 million tons per year, the 3rd largest in the world, as well as the new Nord Stream pipeline contribute to the diversification of gas-supply routes.

Our presence along the natural gas value chain, with diversification at each step, guarantees security of supply to our millions of industrial and residential customers all year round, 24/7.
the International Association of Oil and Gas Producers.

The focus of Gas Week 2013 was on how natural gas can help Europe make a clean future real, and it was held in the context of the debates on post-2020 European energy, climate and industrial policy, as well as discussions about new energy technologies in Europe. Jérôme Ferrier and GasNaturally Chairman, François-Régis Mouton, jointly opened a high-level public hearing entitled “Reconciling EU energy policy goals with reality” on the last day of the event. Carolin Oebel, who represents IGU on the GasNaturally Steering Committee, also participated in Gas Week 2013.

**Green growth**

A forum took place on April 4 in Paris with the theme “Towards a sustainable economic paradigm: From labour to resource productivity”. It was organised by the French Development Agency (AFD) with the support of UNIDO and the UN Programme for the Environment (UNEP). Jérôme Ferrier participated in the roundtable on “Green industry for a sustainable economy” alongside the French Minister of Industrial
Renewal, Arnaud Montebourg. In his address, Jérôme Ferrier pointed out that natural gas is the cleanest of the fossil fuels and has an important role to play in a green economy.

**Crans Montana Forum**

Torstein Indrebø and Ksenia Gladkova participated in the 2013 Crans Montana Forum, which was held in Brussels, March 6-9. It was dedicated to Africa and south-south cooperation. The event brought together Heads of State and Government, ministers, international organisations and businesses, in particular from Africa, the Arab world, South America and the Far East.

Torstein Indrebø gave a presentation during the session entitled “The first economic challenge for Africa: How to manage natural resources?”

**Visit to Qatar**

Torstein Indrebø visited Qatargas in March and met CEO Khalid bin Khalifa Al-Thani and COO Alaa Abujbara together with IGU Executive Committee member Jupiter Ramirez. IGU was updated on market developments in the Middle East and the perspectives of Qatar on the global gas market outlook. The future strategic focus of IGU was also discussed. Jupiter Ramirez subsequently joined Torstein Indrebø in meetings with Qatar Petroleum and RasGas.

**Visit to Taiwan**

In February, Torstein Indrebø and Mats Fredriksson met with the Gas Association of Taiwan, China represented by Chairman, Ho-Chia Chen and Secretary General, Hsiang-Tai Hsiung. The IGU delegation shared their views on the Asian gas market and in particular the LNG market which is the main source of gas for Taiwan. The CEO of CPC’s Natural Gas Business Division, C. Y. Chen explained how Taiwan is exposed to high-priced gas indices in its gas contracts, and said Taiwan needed to get access to LNG cargoes without being exposed to oil-indexed or other high-price indices. After this discussion and a photo session the meeting continued with a working lunch. During lunch the IGU delegation described the Union’s organisation and activities, and handed over a printed presentation, IGU history book and some reports.

Natural gas holds great promise for the global energy future, and the American Gas Association is pleased to be working with the IGU in advocating for natural gas as an integral part of a sustainable global energy system.
The Spanish city of Seville welcomed delegates to the April meetings of IGU’s Executive Committee (EXC) and Coordination Committee (CC). The CC meeting was held on Tuesday, April 9 and the EXC meeting on Wednesday, April 10, and there was a combined workshop on the Wednesday afternoon.

With close to 90 participants, this was one of the largest spring meetings in recent years. It was hosted by the Spanish Gas Association (Sedigas) whose excellent organisation of both the professional and social programmes ensured a successful event. After the business sessions, participants were able to enjoy the pleasant atmosphere in Seville and the unique culture of Andalucia.

The EXC meeting’s agenda featured such important items as the schedule for the forthcoming election for the Presidency 2018-2021, IGU strategy – in particular, the Global Voice for Gas communication project – and the 2013 edition of the IGU Strategic Statement.

EXC members were invited to contribute to the strategic discussion and the role IGU is to play in the global gas industry.
Each triennium, IGU reviews and adapts its strategy, structure and activities to ensure that they are in line with the needs and challenges of its members and of the gas industry in general. The 2012-2015 Triennium is no exception. A strategic debate took place during the EXC meeting in Seville including a discussion of the four cornerstones of the IGU strategy towards 2020:

- IGU in the political arena;
- The Global Voice for Gas communication project;
- Further development of IGU’s cooperation with UNIDO and the World Bank on the transfer of gas competence; and
- An increased focus on human resources in cooperation with UNESCO.

The 2013 Strategic Statement (see box at end) covers key issues that IGU wishes to address, and is aimed at both internal and external readers. The concept for the 2013 edition is to have an attractively designed document using simple and concise language to appeal to the largest possible audience.

On the membership front, applications from Lebanon and ADNOC Distribution Company of the UAE were unanimously approved by the EXC and will now go to the Council for final approval.

The workshop entitled “Europe’s energy challenges in a global marketplace” featured internal and external presentations of great interest (see box). It was moderated by the Vice President, David Carroll. Invited speakers and the delegates discussed current and future policies on renewables and nuclear power, the long-term role of gas in power generation in

### Workshop Speakers

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization and Position</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberto Nadal</td>
<td>Secretary of State for Energy, Spanish Ministry of Industry, Energy and Tourism</td>
<td>Opening speech</td>
</tr>
<tr>
<td>László Varró</td>
<td>Head of the Gas, Coal and Power Markets Division, IEA</td>
<td>Global energy perspectives</td>
</tr>
<tr>
<td>Jean-Arnold Vinois</td>
<td>Special Advisor, Directorate General for Energy, European Commission</td>
<td>Combining policies on renewables with competitiveness</td>
</tr>
<tr>
<td>Professor Jürgen-Friedrich Hake</td>
<td>Head of IEK-STE (Institute for Energy and Climate Research), Jülich</td>
<td>The German energy challenge – phasing out nuclear power</td>
</tr>
<tr>
<td>Antoni Peris</td>
<td>President, Sedigas</td>
<td>The role of gas in the energy mix – the Spanish case</td>
</tr>
</tbody>
</table>
There was also a meeting of IGU’s Regional Coordinators, who discussed the role of this function in IGU’s activities and the scope of their work during the current triennium. This was the first time they had got together since the triennium started, and the successful outcome of the meeting paved the way for further meetings alongside the main IGU events.

Finally, there was an interesting technical visit to Torresol Energy’s Gemasolar plant, which has introduced new thermosolar electrical generation technology. Gemasolar is the first commercial-scale plant in the world to apply central tower receiver and molten salt heat storage technology.

The autumn CC and EXC meetings will be held immediately prior to the Council meeting in Beijing in October.

Ksenia Gladkova is Senior Advisor to the Secretary General.

---

**IGU Strategic Statement 2013**

**Gas Delivers Sustainable Economic Development**

As the voice of the gas industry worldwide, IGU will:

- Advocate for the use of gas as an essential part of a sustainable energy future; and
- Promote further gas industry development by wider application of innovative technologies.

This IGU vision recognises the unique role that gas plays in satisfying rising energy demand and in mitigating climate change.

More than 1 billion people have no access to electricity and around 2.5 billion use traditional biomass for cooking and heating. To improve their health and living standards people need access to safe, reliable, affordable and clean energy.

No single fuel or technology can provide a comprehensive solution for this increasing need for energy. The world needs a range of options, and gas has a crucial role to play.

Gas is a foundation fuel for the world’s current and future energy needs. It is, and will remain the perfect partner for renewable energies.

Gas is used to cool and heat living spaces and working environments, as feedstock for industrial processes, to produce electricity, to fuel vehicles and ships, and to cook.

Gas is:

- **Available**
  Resources of gas are enough for more than 250 years of use.
- **Acceptable**
  Gas burns cleanly and efficiently.

Using gas helps protect public health by reducing emissions and improving air quality. Electricity generation based on gas offers minimal impact on the landscape.

- **Accessible**
  Gas can be moved over land through pipelines and can cross the seas when transported as LNG by ships.

- **Adaptable**
  Gas installations can be adapted to technology developments, like combined heat and power, biogas and hydrogen. Gas is storable and serves as a complement for variable renewables.

- **Affordable**
  Gas is a competitive energy option as an affordable fuel choice and because of its efficient end-use applications. New technologies are making gas more competitive every day.
PSI is a Trusted Partner in the Oil & Gas Industry for Complete Process Solutions.

Monitoring and Control  
Transmission  
Gas Management  
Distribution  
Communication  
Pipeline Management  
Simulation  
Leak Detection and Location  
Optimisation  
Operational Planning  
SCADA

Software for Utilities and Industry  
+49 30 2801-1504  
mbuerger@psi.de  
www.psioilandgas.com
News from Organisations Affiliated to IGU

Here we have reports from the Gas Technology Institute (GTI), NGV Global, Marcogaz – Technical Association of the European Natural Gas Industry, Pipeline Research Council International (PRCI), Energy Delta Institute (EDI) and the latest affiliated organisation, NGVA Europe.

GTI Programmes Advance Shale Gas Development in China
By Rod Rinholm
China is being hailed as one of the next big shale gas regions in the world, and Gas Technology Institute (GTI) is leveraging its legacy of North American unconventional gas successes to help establish many new training programmes there.

Notes David Carroll, GTI President and CEO and Vice President of IGU, “GTI has developed an enormous wealth of knowledge and experience from its active involvement in the development, application, deployment and promotion of unconventional gas technologies and solutions in North America and beyond. We are working to expand the body of scientific knowledge, promote the exchange of leading best practices and transfer technology. We can bring together the right parties for international collaboration that will help the energy industry achieve greater success, both in China and other regions worldwide.”

In early January, the United States Trade and Development Agency awarded a contract to GTI for programme management services for a US-China Gas Training Programme in 2013-2014. Four workshops, each lasting two days, are being held in China to help introduce Chinese energy sector officials and project sponsors to US shale gas best practices, policies and technologies.

Workshop 1 was hosted April 22-23 in Chengdu, and focused on reservoir characterisation and assessment. It included training, panel discussions, product and service presentations from US companies, one-on-one meetings and exhibits. Workshop 2, held in Beijing, July 25-26, covered best practices for shale gas environment, health and safety. Workshop 3 will take place September 26-27 in Xi’an on Shale Gas Exploration & Development Technologies, and will be co-located with the Oil and Gas Industry Forum (OGiF). Early 2014 will be the timeframe for the last workshop, delivered in Beijing on optimising field development and operations. More details about these upcoming events will be available on the GTI website.

In November 2012, GTI signed a Framework Cooperation Agreement with SPT Energy Group
GTI has been host for the Global Unconventional Gas (GUG) Summit for the past three years. The intention of the Global Unconventional Gas Summit is to create important opportunities for learning, networking, and dialogue about the technical and non-technical challenges to overcome for these resources to reach their full potential. It provides an effective forum for discussions between international players to explore valuable collaboration opportunities in pursuit of best practices, evolution of existing technologies, innovation of new technologies, effective business models, environmental stewardship, clarity around legal and regulatory frameworks, and investment in infrastructure.

Given the importance of China to global shale gas development, the conference was hosted in Beijing for the past two years, and...
Non-Traditional Markets Opening to Natural Gas

By Alicia Milner

There is an interesting and important phenomenon underway that leverages the abundance, affordability and sustainability of the global supply of natural gas. Whereas, in the past, each part of the natural gas value chain focused primarily on its distinct role (i.e. production, transmission or distribution), what is now happening is greater engagement and involvement by companies in the natural gas value chain to stimulate new demand for natural gas in non-traditional markets. In doing so, benefits are being generated for the companies who are making the changes as well as in terms of creating a “warmer” policy context as policy makers see industry investing in order to use a cleaner, more affordable fuel in their own operations.

For example, there has been a series of announcements made over the past two years related to greater use of natural gas in the oil and gas exploration and production sector. A common first step that is being taken is to switch over operations of fleet vehicles to natural gas. Major natural gas producers such as Encana and Apache have made considerable progress over the past few years in transitioning their corporate fleets to natural gas operation. Encana now operates 28% of its fleet of 1,300 vehicles on natural gas. Apache has more than 400 vehicles operating on natural gas and aims to switch 80% of its fleet of 1,300 vehicles on natural gas by the end of 2015. Both companies have invested in refuelling stations to refuel their own fleets as well as to supply other local fleets interested in natural gas use. Apache is currently assessing the potential to broaden its corporate compressed natural gas (CNG) fleet programme to other countries in which it operates including Argentina, Egypt and Canada.

In addition to “walking the talk” and demonstrating corporate leadership, these companies...
Delivering the Good News of Good Energy

Spectra Energy is in the business of delivering energy – natural gas, liquids and crude oil to premium North American markets.

We also deliver the good news story of energy. The products we bring to market create jobs, fuel economic growth, advance energy independence and reduce greenhouse gas emissions.

Our energy assets are situated in the midst of prolific supply basins and connected to growing demand markets. That means we’re able to serve producers, power generators, refineries, and those working to export liquefied natural gas to international markets.

Good energy reliably delivered to doorsteps across North America – by a company dedicated to growth, service and operational excellence. The good news just keeps getting better.

www.spectraenergy.com

unlocking the global potential of natural gas

GAS TECHNOLOGY INSTITUTE
GTI is developing new technologies, technical insight, and training to solve global energy challenges and enable a clean, sustainable future.
www.gastechology.org
are reducing their annual fuel costs and lessening the environmental impact of their operations. In some cases, companies are making a significant and focused effort to encourage employees to drive natural gas vehicles (NGVs). In the United States, Apache has an employee incentive programme that provides: (a) free CNG for the first $5,000 of fuel purchased at public CNG stations; and (b) reimbursement of half of the incremental cost of an NGV. Apache is also currently assessing whether to bring this programme to other regions in which it operates.

In addition to encouraging fleet use of natural gas, a strategy that local gas distribution companies have also long embraced, another area in which non-traditional demand is being encouraged is with respect to drilling rig operation. In June, Canadian natural gas distribution company, SaskEnergy working with CanGas Solutions, commissioned Canada’s first commercial CNG station purpose-built to supply CNG for drilling rigs operated by CanElsion Drilling. The new station and bulk CNG supply services provide an option for rig operators to...
reduce the environmental impact of operations as well as to lower fuel costs. CanElsom is in the process of converting existing diesel drilling rig engines so that they can operate on a dual-fuel basis using a mixture of natural gas and diesel fuel. CanGas Solutions will provide the CNG supply by means of its fleet of 30 CNG bulk tankers. The company also offers services to capture, transport and monetise flared gas.

There have also been several announcements over the past few years regarding the use of LNG as a fuel both for drilling rig operation as well as for pressure pumping services for hydraulic fracturing. In early 2011, Noble Energy launched a pilot project involving dual-fuel LNG-diesel engines for drilling rig operation in the United States. With an average of 2,500 US gallons (9,250 litres) of fuel used per day of rig operation, the company reduced its fuel costs by $1.3 million in the first year which more than paid off the upfront capital cost of $1 million to modify the drilling rig. Similarly, in November 2012, Ferus LNG announced their first North American project involving the use of LNG for hydraulic fracturing in Texas. Encana, has also conducted its own LNG pilot and found that they could reduce fuel costs by 47% using dual-fuel drilling rig engine technology. Encana now has 22 out of 39 drilling rigs that are capable of operating on natural gas and, based on transitioning fleet vehicles and drilling rigs to natural gas, the company estimated $16 million in fuel cost savings in 2012.

While these announcements and initiatives are important, beyond the vehicle-specific items are these developments relevant at all to the global natural gas vehicle industry? What, if any, are the linkages between these projects and the broader growth in demand for natural gas vehicles that is underway around the world?

While not directly apparent, there are actually five major ways in which the increasing engagement by the global natural gas industry in growing demand in non-traditional markets matters to the global NGV industry.

**Investment synergies**

The first important connection point is with respect to investment synergies. Investments may not always be anchored on the transport-
Human skills and knowledge base
The third connection point is in the area of human skills and knowledge base. For natural gas to become a mainstream fuel choice, it is important that adequate human capacity is in place. An increased use of both CNG and LNG for non-transportation applications will contribute to the industry’s knowledge base as well as enhancing the pool of available workers with the appropriate skills and training.

Infrastructure
The fourth connection point is with respect to investments in infrastructure. Bulk transfer CNG stations that are purpose-built to serve off-grid industrial customers or drilling rigs, can also provide for fuel dispensing to vehicles. Private corporate fleet stations that are opened up to other local fleets similarly provide important new infrastructure that can be leveraged. LNG production facilities can supply a range of markets including heavy duty trucks and the marine sector. Infrastructure build-out is fundamental to supporting a long-term, sustainable market share for natural gas in non-traditional markets.

Policymakers
Finally, the most important connection point of all is enhancing the positioning of natural gas with policymakers. Industry investments to increase the use of natural gas underscore the value proposition for natural gas as well as increasing awareness among policymakers regarding the opportunity to use natural gas in a broader range of markets. Nothing speaks quite so powerfully as industry acting on its own recommendations and actively working to transform the market and stimulate demand for natural gas as an affordable, lower emission energy choice. It is with these actions that the entire market, including the transportation market, benefits and advances.

Alicia Milner, President of the Canadian NGV Alliance, is NGV Global Chairperson (www.ngvglobal.com).
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.
EGATEC 2013 Reviews Innovative Future for Gas

By Daniel Hec

The second EGATEC event, which is the main European conference on the gas technologies of the future, was held in Paris on 30 and 31 May. It was attended by over 200 people, including industry professionals, university staff, researchers and political leaders, who reviewed the way in which gas could become one of the most competitive and innovative energy options on the market in a fast-changing European landscape.

In 2011, EGATEC, the first European gas technology conference, gathered the leading industry professionals in Copenhagen, Denmark. The second event was held in the Salons Hoche in Paris, and was organised by GDF SUEZ Research and Innovation Division with the support of the French Gas Association, under the auspices of Marcogaz – Technical Association of the European Gas Industry and GERG – European Gas Research Group.

EGATEC 2013 provided an opportunity to touch on a wide array of topics that are of key interest for the European gas industry, including “traditional” topics such as gas quality, smart metering or the safety of gas installations. In addition, to reflect the challenge set by this second EGATEC event, i.e. to “Imagine Gas Innovation”, the main issues addressed were breakthrough issues, like smart gas, biomethane, the “power to gas” revolution, and new applications for gas (micro-generation, hybrid solutions, etc.).

Around 40 experts addressed the conference in order to present the results of studies and pilot projects, and the new products and services that have recently been launched on the market, all of which are opportunities to develop gas networks and applications. Participants particularly valued the presentations given by Jérôme Ferrier, the President of IGU, Dr Fatih Birol, the Chief Economist at the International Energy Agency, Satoshi Yoshida, Chair of IGU’s Programme Committee A – Sustainability, and David Carroll, Chairman and CEO of the Gas Technology Institute and Vice President of IGU.

These speakers underscored three major points: first, the fundamental changes in the global energy landscape, due to the combined effects of new technologies and of natural and environmental disasters; second, the advantage of gas in this context due to the “3E+S” concept, which shows the economic and environmental benefits of natural gas, which promote energy efficiency and security of supply; lastly,
the impact of developing renewable energies on a large scale and their strong link with natural gas. Both days of the conference were organised by Marc Florette, who had combined his role as President of Marcogaz with that of Chairman of EGATEC 2013’s Steering Committee.

**New from Organisations Affiliated to IGU**

5th GERG Academic Network prizes
Around 20 European doctoral students and researchers, whose work was subject to a prior selection process, were given the opportunity to present a summary of their research in poster form at the event. They were able to compare their results with the opinions of the industry professionals and consultants who attended the debates. The four prize-winning posters dealt with:

◆ The operational security of the natural gas network (F. Ortloff, Germany);
◆ The optimisation of an electro-chemical sensor to measure the quality of natural gas (L. Rojo, Spain);
◆ Measuring gas quality in networks that include biogas (C. Fiebig, Germany); and
◆ Producing second generation biomethane via catalytic methanisation (A. Khodakhov, France).

**Site visits and roundtable**
In addition to the discussions, three site visits were offered to participants: a GNVert CNG vehicle filling station, a co-generation unit of the Paris District Heating Company and CRIGEN, the GDF SUEZ research centre.

A roundtable entitled “Gas innovation for energy mix transformation” highlighted the challenges of transforming the European energy mix and the role that gas can play in that transformation. The views of Sophie Auconie of the European Parliament, Tudor Constantinescu of the EC Directorate General for Energy, Pierre Louis François, Chairman and CEO of Atlantic, Torben Brabo of network operator Energinet.dk and Dr Hartmut Krause, Chief Executive of DBI (a German research institute) gave rise to fruitful discussions, which were led by the Chairman of GasNaturally, François-Régis Mouton. Here are a few key ideas generated by those discussions:

◆ As a fossil fuel, gas may be viewed negatively by political institutions: the key is to publicise its environmental and economic advantages, and its advantages in terms of reliability;
◆ The capacity of natural gas to combine effectively with renewable energy, especially wind power and biogas; and
◆ The economic and environmental efficiency of natural gas or hybrid products and applications.

These points directly reflected the position recently adopted by eight European companies in the energy sector, at GDF SUEZ’s initiative. All the companies want to draw EU leaders’ attention to the gravity of the situation (increasing scarcity of investments, etc.), and to the difficulties encountered by the European energy sector (lack of visibility on energy policies, uncertainty regarding regulations, etc.).

**Daniel Hec is the Secretary General of Marcogaz (www.marcogaz.org). Please visit www.egatec.2013.com in order to view the event presentations and photos.**
Working Towards Zero
By Cliff Johnson
I joined Pipeline Research Council International (PRCI) in 2010 and over the last three years, as people learned that I work with the oil and gas industry, I have received a number of questions about the industry. The most commonly asked question is: “Are pipelines still the safest mode of transportation for the oil and gas industry?”

First, I am surprised by the number of people who have an opinion about the pipeline industry. Most of the time, the pipeline network is out-of-sight, therefore out of mind to the general public and therefore not a key concern. However, the industry has recently experienced a number of unfortunate failures so the issue of safety has risen in everyone’s mind. A key point is that a failure anywhere has an impact on the perception of the public on overall safety. It is important that the industry engages the public and regulators in a discussion about the safety of the systems and any needs for improvement.

While every mode of transportation has its challenges, with the tanker train accident in Canada in July highlighting that rail is not without risks, pipelines remain statistically the safest. This does not mean the pipeline industry should not strive to further ensure the safety and integrity of this critical infrastructure. The industry has announced in North America that the goal is to have zero failures. This is an important goal and one the industry should work to achieve. We have to be constantly improving and raising the bar on safety. A key tool in reaching this goal is research.

As part of this effort for improvement, the members of PRCI are developing the R&D roadmap for the pipeline industry. This is a document that will help to focus industry and government on the areas that need to be addressed to continue increasing safety and reducing incidents globally. A number of key areas have been identified and we have begun work to fill the gaps. These areas include:
◆ Improvements in in-line inspection (ILI) capabilities and re-inspection intervals;
◆ Unpiggyable/difficult to inspect pipelines;
◆ Electric resistance welding (ERW)/longitudinal seam welds;
◆ Leak detection;
◆ Data integration and decision-making processes/tools;
◆ Stress corrosion cracking (SCC) and cracking – welds and pipe body;
◆ Anomaly assessment;
◆ Mechanical damage and damage prevention;
◆ Facility integrity; and
◆ Risk assessment.

For each of these areas, PRCI has developed a number of research programmes and projects that address the key challenges. Details about each of these can be found on our website (www.prci.org). It is vital that the pipeline industry continues to move the needle on pipeline safety and integrity; and it is doing so by investing in key research projects.

Cliff Johnson is the President of Pipeline Research Council International (www.prci.org).
Our people thrive on your technical challenges.

Scientific curiosity and technical innovation have been part of the Schlumberger culture for more than 80 years. We recruit the best students and talented professionals from around the world and advance their technical knowledge and skills through national and international experience. With 65 research and technology centers located in 15 countries, our goal is to continually deliver new technology to solve customers’ complex reservoir challenges.

Find out more at slb.com
Natural Gas, Soviet Prototypes and the Future of Aviation

By Jacob Huber and Santiago Katz

On April 15, 1988, test pilot Captain Vladimir A. Sevankayev taxied a Tupolev Tu-154B with tail number CCCP – 85035 onto an active runway servicing the Zhukovsky Air Base on the outskirts of Moscow. Moments later, when he rotated the aircraft’s nose, somewhere around 140 knots, he lifted off into aviation history. While he would eventually be granted the title Hero of the Russian Federation, his Tu-154B, which would set 14 world records, eventually spent over two decades parked, ignominiously, in a scrap heap of aviation history. The Tu-154B Captain Sevankayev flew from 1988 to 1990 was the first aircraft ever to be fitted with an engine capable of running on cryogenic fuels. Later renamed the Tu-155, the aircraft was designated “LL,” which stands for flying laboratory, and served as a testing platform for both LNG and hydrogen fuels for aviation.

The push for this innovative technical development was part of a concerted strategy by Soviet policymakers that came about partly as a result of the energy crises of the 1970s. These crises had decidedly positive externalities for the Soviet Union: they created conditions in which global markets placed a premium on non-OPEC oil, and the Soviet Union benefited tremendously by increasing its production levels. Yet along with increased production and growing exports came the realisation that resources, particularly fuels, are subject to constraints, both physical and commercial. Additionally, conventional fuels were both expensive and a relatively prominent source of pollution. As a result, the USSR Academy of Sciences was given the mandate to explore the use alternative fuels in agriculture and in industry in general. In the aviation industry, this involved collaboration with individual design bureaus, such as Tupolev, and the project was named “Холод,” or “Cold,” in reference to the cryogenic fuel technologies that would later be implemented.

Alternative aviation fuels are primarily cryogenic, and therefore variants of the standard Tu-154 required modified engines. On the Tu-155, Tupolev replaced one of the three standard NK-8-2U engines with an experimental NK-88 engine. Designed by the Kuznetsov scientific-technical complex in Samara, Russia, this could be modified to use either LNG or liquid hydrogen. The flying laboratory eventually operated more than 100 flights, of which 95 were powered with LNG, the first of which took place on January 19, 1989. These flights provided an incredible learning experience to the industry, and made possible further advances in the use of LNG as an alternative aviation fuel. The Tupolev design bureau followed up with a series of successive “cryogenic” variations including the Tu-156, Tu-206 and Tu-136. With the collapse of the Soviet Union, these projects
faced inevitable setbacks, but the progress made and the motivations for the projects continue to remain relevant. Today, Tupolev continues to pursue LNG as an aviation fuel, and this can be seen in the design of aircraft such as the Tu-330, and in variants such as the Tu-334k.

Today, LNG as aviation fuel is no longer limited to Russian design bureaus, and for good reason. LNG is cheaper than jet fuel and although it has an energy density of only around 64% that of gasoline, on a mass-basis it actually contains more energy than jet fuel. This is important because in aviation, weight is of greater concern then volume. Because LNG is relatively cheap and widely available, and is expected to remain so in the future, Western design bureaus, such as Boeing, expect LNG to become a viable civil aviation fuel in the 2040-2050 timeframe.

Boeing’s Subsonic Ultra Green Aircraft Research concept, or “SUGAR Freeze” uses LNG as a fuel for just these reasons: high availability, relatively low cost and low emissions. This is essentially a continuation of concepts explored in the 787 Dreamliner such as ultra-lightweight materials and low drag, taking these concepts to an extreme in order to achieve an efficiency 63% greater than the current 737-800 generation. The fuel would be burned in unducted hybrid engines hooked to a fuel cell and powering a rear-mounted thruster to reduce drag. This construction further contributes to drastically increased efficiency and lowers operating and maintenance costs as well as, importantly, emissions.

In a less radical departure from the current paradigm, Qatar Petroleum, Qatar Airways and Shell have introduced synthetic jet fuel products produced from natural gas in the Pearl gas-to-liquids (GTL) project. This synthetic jet fuel is a mixture of synthetic paraffinic kerosene and jet fuel designed to meet ASTM-D-7566 specifications, yet weighs less per unit of energy and has very low sulphur and particulate emissions. The first commercial cargo of this product was exported in June, and it has been in use since January for several flights departing Qatar’s Doha International Airport. Qatar’s prodigious natural gas reserves will ensure that this improved jet fuel will be available for years to come.

Finally, natural gas as a fuel for general aviation has also been gaining ground. At the Oshkosh Airshow in Wisconsin Aviat Aircraft introduced a CNG-fuelled Husky aircraft conversion. This aircraft can be switched from avgas to CNG at the flick of a switch to take advantage of the fuel as a cheaper and cleaner alternative. Many light aircraft still run on aviation fuel containing lead and in addition to eliminating this pollutant, CNG-fuelled engines burn cleaner and require less maintenance. However, CNG in aviation is still at a very early

---

**Energy Delta Institute | Energy Business School**

Energy Delta Institute (EDI) is an international energy business school founded in 2002 by N.V. Nederlandse Gasunie, GasTerra B.V., O.A.O. Gazprom and the University of Groningen, later joined by Shell and many other international business and knowledge partners. EDI’s ambition is to prepare energy professionals for the challenges that lie ahead in a continuously changing world, by offering them different perspectives on energy-related topics through a diverse range of learning methods. In achieving this ambition, EDI works closely with international partners to jointly develop high-quality programmes tailored to the needs of its clients.

For more information please contact Energy Delta Institute at info@energydelta.nl or +31 (88) 1166800.
stage and there are severe limitations on refuelling infrastructure. Nevertheless, with a price differential of around $5/gallon equivalent, there are very strong financial motivations for CNG aircraft as well as CNG conversions.

While natural gas has yet to make a significant penetration in the market for aviation fuels, the future looks bright. A combination of economics and increasing environmental regulation points to renewed interest in cleaner, cheaper and more efficient alternative fuels for the aviation industry. It may not be long before many aircraft, civil as well as military, begin transitioning towards natural gas based fuels. In fact, you may have already, unknowingly, travelled in a plane with a component of synthetic natural gas fuels from Pearl GTL.

Jacob Huber and Santiago Katz are Energy Analysts at the Energy Delta Institute (www.energydelta.org).

NGVA Europe – IGU’s Latest Affiliated Organisation

By Matthias Maedge

NGVA Europe is the European Association for Bio/Natural Gas Vehicles and was set up in 2008. Its mission is to support the European NGV industry from vehicle and equipment manufacturers to biomethane producers, gas distributors and, in particular, the final customer who appreciates the fuel economy and environmental friendliness of NGVs.

The Association brings together more than 150 members from some 40 countries all over Europe including companies, research centres, associations and individuals. It is the major EU stakeholder representing all parties interested in the future growth of the NGV market, with 18 members represented on the Board of Directors and offices in Madrid and Brussels.

NGVA Europe is a platform for all parties involved in the European NGV business to work jointly and optimise the available market opportunities. It also collects, reviews and disseminates new information on technological innovations, environmental demands and proposed legislation as well as reliable statistics on the development of the NGV market.

A major goal of the Association is to develop a common European policy to promote biomethane as a low-emission automotive fuel. This involves developing common standards for allowing the injection of biomethane into the gas grid, work which is being carried out by the European Committee for Standardisation (CEN) group TC 408.

NGVA Europe also closely follows other factors that are affecting the market in order to evaluate the costs/benefits of promoting one alternative fuel over another. These factors include the reflection of infrastructure investment costs in the revision of the energy taxation directive, and the comparison of EU investments in different fuel technologies. The expected result is to demonstrate that the use of natural gas/biomethane (as CNG or LNG) is the only real alternative to reduce oil dependency in transport.

NGVA Europe’s main activities

Political action

The main objective of our Brussels office is to seek support for the use of NGVs by convincing European politicians of their benefits. Our political advocacy covers NGV-related topics such as energy taxation, fuel labelling, fuel infrastructure and fuel quality. This involves liaising with EU institutions, permanent representatives and other stakeholders.

Activities include the follow-up of public consultations and participation in stakeholder meetings and public hearings organised by the European institutions. NGVA Europe also gets involved in European movements such as the Covenant of Mayors, which brings together local and regional authorities committed to increasing energy efficiency and the use of renewable energy sources in their regions.
Among the issues worked on in Brussels during the last year, it is important to highlight:

- Energy taxation for gas used as a transport fuel;
- CO₂ emission reductions from cars and vans;
- Energy Efficiency Directive adopted in the EU Parliament;
- Adoption by the European Parliament and Council of an amended directive on sulphur content in marine fuels – the new rules clearly promote the use of LNG in shipping;
- Indirect land use change;
- Clean Power for Transport Package, a new legislative proposal related to alternative fuel infrastructure for transport in the EU;
- New guidelines on fiscal incentives for clean and energy efficient vehicles;
- Trans-European Transport Network (TEN-T) days supporting the programme to finance European transport infrastructure projects in all transport modes – air, rail, road and maritime/inland waterways – plus logistics and intelligent transport systems, and in all EU Member States.

Ongoing key advocacy activities for NGVA Europe include important dossiers such as the Directive on Mass and Dimensions, the Renewable Energy Directive and the Fuel Quality Directive.

In addition, collaboration with IGU has been a most important activity for NGVA Europe since the Association’s foundation. NGVs represent an important segment of the downstream end of the natural gas value chain and are covered by Study Group 5.3 of Working Committee 5 – Utilisation, in which NGVA Europe participates actively.

Technical activities

NGVA Europe has deep involvement in the work of key entities like the European Commission, UN Economic Commission for Europe, CEN, and, in some cases, ISO technical committees. The main purpose is to serve as the technical voice of our members, offering them the possibility to have their own interests represented during the development of future requirements affecting the NGV industry. This work is coordinated by NGVA Europe’s Technical Committee.

Continuing with the clear objective of representing the interests of its members, NGVA Europe has been involved in a variety of technical discussions during the past year. Major topics addressed include natural gas/biomethane fuel specifications, emissions approval for heavy duty dual-fuel engines and safety requirements for LNG vehicle fuel systems. The Association keeps members up to date by distributing relevant information and experiences in the form of position papers, case studies and technical communications. These are all accessible through the members’ page of the website.

Participation in European projects

The LNG Blue Corridors project aims to establish LNG as a real alternative for medium- and long-distance transport – first as a complementary fuel and later as an adequate substitute for...
diesel. A roadmap has been defined of LNG refuelling points along four corridors: Atlantic, Mediterranean, North-South and East-West. In order to implement a sustainable transport network for Europe, the project has set the goal to build approximately 14 new LNG or L-CNG stations, both permanent and mobile, on critical locations along the Blue Corridors whilst building up a fleet of approximately 100 heavy duty vehicles powered by LNG. The consortium comprises 27 companies, all members of NGVA Europe.

The Green Gas Grids project supports the upgrading of biogas to biomethane for injection into the natural gas grid. Biomethane can be used in the same efficient and versatile manner as natural gas: for transportation, heat and electricity.

BioWALK4Biofuels is a project financed by the European Commission to produce biofuel from algae cultivation in order to develop second generation biofuels. This project aims to develop an alternative and innovative system for the treatment of biowaste and use of greenhouse emissions to produce biofuels, using macroalgae as a catalyst, in a multidisciplinary approach.

Events organisation
NGV Europe organises events to promote NGV technologies and to highlight and discuss relevant matters with policymakers and stakeholders. These events also allow our members to show their latest developments in NGV technology.

Events over the past year include the 1st NGVA Europe international LNG workshop for trucks and ships in Amsterdam in September 2012; presence at the TEN-T days in Brussels in November 2012, where LNG/CNG vehicles were shown; a presentation on NGV Blue Corridors in Brussels in March; promotion of the Clean Transport Package in different European countries in collaboration with DG Move; and the launch of the LNG Blue Corridors project in Brussels in May, where the keynote speech was given by Olivier Onidi, Director of DG Move.

A big recent event was the 4th NGVA Europe International Show & Workshops, which took place in Gothenburg, Sweden, June 11-13. NGV 2013 Gothenburg featured a series of interesting workshops, a wide-ranging exhibition, enlightening technical visits, high-level networking activities and meetings of associations.

Developing the NGV market
NGVA Europe looks forward to growing and developing the NGV market for the benefit of its members and the whole industry.

Matthias Maedge is NGVA Europe’s EU Affairs Manager and Head of the Brussels office. For any questions about the Association’s activities, please contact info@ngvaeurope.eu or visit www.ngvaeurope.eu.
Global KOGAS Growing Together, with Customers

As a bowl of rice gives energy to a starved one, and children's laughter gives energy to their parents, energy brings us hopes and strength. KOGAS is continuously challenging itself with passion to enrich Korean energy industry.
IGRC2014 in Innovative Copenhagen

IGU’s next world-leading R&D event – IGRC2014 – takes place in Copenhagen, September 17-19, 2014. All members of the IGU family and guests are cordially invited to join us for three days focusing on Gas Innovations Inspiring Clean Energy. The conference is hosted by the Danish Gas Technology Centre (DGC) and will be held in the state-of-the-art Tivoli Congress Center in central Copenhagen.

Technical programme
The technical programme is being prepared by IGU’s Programme Committee F for Research, Development and Innovation, which is chaired by Jack Lewnard of the Gas Technology Institute, USA. Presentations on the latest gas technology issues covering the entire gas chain and cross-cutting issues will be scheduled over 2.5 days. More than 300 papers will be presented in oral and poster sessions.

The Call for Papers will be issued on November 1, 2013. At the same time registration will open. The deadline for the receipt of abstracts is January 6, 2014, authors will be notified by April 1, 2014 and papers are due by July 1, 2014.

Make sure you receive our newsletters and Call for Papers by signing up at www.igrc2014.com.

Exhibition
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 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.

If you are interested in being an exhibitor you can find more information at www.igrc2014.com.

IGR first: Innovation and Student Forum
As a new feature of the IGU Research Conference series, IGRC2014 will include an Innovation and Student Forum. This special exhibition forum is intended for small start-up companies, educational organisations, HR departments, etc., which have a particular interest in communicating with students, entrepreneurs and organisations/individuals dedicated to R&D.

Students will be encouraged to visit both the exhibition and the Innovation and Student Forum and special admission rates will be offered to this group of delegates.

To apply for a meeting point in the Innovation and Student Forum, please find more information at www.igrc2014.com.

IGU committee meetings at IGRC2014
Several IGU committees and task forces are already planning to hold one of their meetings of the 2012-2015 Triennium in conjunction with IGRC2014 to create both professional and logistical synergy. This is something we encourage and welcome very much. We will be happy to assist with all practical issues such as...
meeting rooms, accommodation, etc. Please contact me at pih@igrc2014.com.

**Technical tours**

IGRC2014 offers three alternative technical tours to places of interest in the Copenhagen area:

- Avedøre Power Station – one of the top combined heat and power plants in the world;
- Kløvermarken Gasworks which supplies Copenhagen – 30% of the city’s supply is CO₂-neutral biogas;
- The future heating system – a gas-fired heating pump combined with a solar water heater and a gas boiler.

All three tours will take place on Tuesday, September 16, 2014 in the afternoon. Visit www.igrc2014.com for more information.

**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.

If you are considering joining the prestigious group of sponsors, please find more information at www.igrc2014.com, where you may also download the Sponsor Prospectus.

I look forward to seeing you in Copenhagen, September 17-19, 2014.

Peter I. Hinstrup, President of DGC and Honorary Member of IGU, is the IGRC2014 Conference Director.

Enjoy Copenhagen with your accompanying person

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. In recent years Copenhagen has been praised for “being one of Europe’s coolest, greenest cities” and “having the best restaurant in the world”, while Denmark has been awarded for “having the happiest people in the world”. Take the opportunity to combine IGRC2014 with a few days off in Wonderful Copenhagen with your accompanying person.

During the conference we will offer accompanying persons two special sessions with interesting presentations as well as tours of Copenhagen’s sights. Find more information about the accompanying persons programme under Copenhagen at www.igrc2014.com.
IndianOil: The Energy of India

IndianOil is India’s flagship national oil company with business interests straddling the entire hydrocarbon value chain – from refining, pipeline transportation and marketing of petroleum products to exploration & production of crude oil and gas, marketing of natural gas and petrochemicals. IndianOil is the leading Indian corporate in the Fortune “Global 500” listing, ranked 88th in 2013. With a workforce of over 34,000 people, IndianOil has been helping to meet India’s energy demands for over half a century. With a corporate vision to be the “Energy of India”, IndianOil closed the year 2012-13 with turnover of $76.20 billion and Profit After Tax of $919 million.

At IndianOil, operations are strategically structured along business verticals – refineries, pipelines, marketing, R&D and business development – E&P, petrochemicals and natural gas. To achieve the next level of growth, IndianOil is currently forging ahead on a well laid-out road map through vertical integration – upstream into oil and gas E&P and downstream into petrochemicals – and diversification into natural gas marketing and alternative energy, besides globalisation of its downstream operations. Having set up subsidiaries in Sri Lanka, Mauritius and the UAE, IndianOil is simultaneously scouting for new business opportunities in the energy markets of Asia and Africa.

Reach and Network
IndianOil and its subsidiaries account for over 49% of the petroleum products market, 31% of refining capacity and 71% of downstream sector pipelines capacity in India. The IndianOil Group of companies owns and operates 10 of India’s 22 refineries with a combined refining capacity of 65.7 MMTPA. Indian Oil Corporation Ltd operates an 11,163 km network of crude oil, petroleum product and gas pipelines with a capacity of 77.258 million metric tonnes per annum of oil and 10 million standard cubic metres per day of gas, the largest in the country.

Investment
With a steady aim of maintaining its position as a market leader and providing the best quality products and services, IndianOil is currently investing approximately $8 billion in a range of major projects to augment its refining and pipeline capacities, set up an LNG import terminal, expand marketing infrastructure and upgrade product quality.

Redefining the horizon
Over the years, natural gas has emerged as the “fuel of choice” across the world. Natural gas marketing is a thrust area for IndianOil with special focus on city gas distribution and gas transportation. The Corporation has entered into franchise agreements with other players to market CNG through its retail outlets.

During 2012-13, gas sales grew by 9% to 3.16 million tonnes from 2.90 million tonnes in the previous year. IndianOil is setting up a 5 MMTPA LNG import, storage & regasification terminal at Ennore. This terminal would be the first of its kind on the east coast of India. Green Gas Ltd, IndianOil’s JV, is already operational in Agra and Lucknow in the state of Uttar Pradesh and is further expanding to cater to the increased demand in various sectors. Furthermore, IndianOil along with GSPL, BPCL and HPCL have formed a joint venture to develop three cross country gas pipelines projects extending to more than 4,200 km. This network would create connectivity from the Krishna-Godavari fields to Gujarat, central and north India.

IndianOil has the capabilities to supply regassified LNG to customers presently located in the northern and western regions of India. The “LNG at Doorstep” initiative involves making LNG available to customers not connected by gas pipeline. Gas is transported through a cryogenic system, stored in a cryogenic holding tank at the target location and re-gassified on-site through vapourisers for use as a fuel.

“Natural gas has garnered a major position in the energy basket and has evolved as the primary source of energy. In times to come, the future of the hydrocarbon sector will continue to be highly dynamic, challenging and competitive.”

Mr R. S. Butola, Chairman, IndianOil
LNG for Long Term & Affordable Energy

It’s a Greener Alternative for Success

In a developing country like India, promotion of natural gas is vital in building a sustainable future.

With a vision to become “Energy of India”, IndianOil is committed to increase its presence in Natural Gas industry by implementing 5 MMTPA LNG Import Terminal on the east coast, which is targeted for completion during 2016-17.

IndianOil is also taking the initiative in partnership with other national energy players to develop India’s gas infrastructure by involving itself in a number of projects related to cross-country natural gas pipelines & City Gas Distribution. IndianOil has also played the role of leading India towards one of the innovative methods of supply of natural gas by “LNG by Road” to its customers who are not located on gas pipelines. With this, IndianOil looks forward towards a future that will have enough to satisfy the energy needs of India.

Leading India towards sustainable development
On Track for the 26th World Gas Conference

By Daniel Paccoud

The triennial World Gas Conference is the most significant event in the gas calendar. This is the second of a series of updates on preparations for WGCPARIS2015 from the Chair of the National Organising Committee (NOC).

Marketing for the 26th World Gas Conference, which will be held in Paris, June 1-5, 2015, is gathering force with international media already partnering with the event, an extensive online and social media campaign being launched and with the team present at major gas events. The global marketing campaign will ensure that WGCPARIS2015 will attract unprecedented interest from all over the world, making the event truly global.

This year so far we have had stands at LNG 17 in Houston in April and Expogaz in Paris in September. Next up is the 22nd World Energy Congress, which takes place in Daegu, Korea, October 13-17, while in 2014 we will be at Gasteck in Seoul and the 21st World Petroleum Congress in Moscow.

Attending these events allows us to meet people in the gas industry and tell them personally about the top gas event of 2015. To reinforce the message between events and reach out to an even wider audience we have set up a LinkedIn group, which has nearly 600 members, and are on Twitter (@WGCPARIS2015).

WGCPARIS2015 offers an unparalleled forum for the gas community to meet and debate the issues facing the industry as it works to expand the role of abundant, available and environmentally acceptable natural gas in the global energy mix.

The venue will be the Porte de Versailles Convention Centre which includes one of the biggest arenas in Paris, the Palais des Sports.

During the conference, the work of IGU’s 11 Technical Committees and three Task Forces will be presented in committee sessions and strategic panels; while plenary sessions will feature leading figures in the gas industry and policy-
will be launched on June 1, 2014. The NOC has appointed the Elephant Group as conference organiser and the CWC Group to handle marketing and communications.

Exhibition and sponsorship
The exhibition for WGCPARIS2015 has been fully integrated with the conference. The entire exhibition will be accommodated in one hall, which delegates will pass through to reach the conference and luncheon sessions. Already

Key dates to remember
The Call for Papers will be launched on February 1, 2014 with a deadline for abstract submission of September 1, 2014. Conference registration will open on April 1, 2014 and there will be an earlybird discount. The conference programme
Welcome to Paris
We are preparing an exciting and stimulating programme for WGCPARIS2015. Your first port of call for information and the latest news is our website, www.wgc2015.org, but please do not hesitate to contact the NOC if you have any questions. The whole French team looks forward to welcoming you to Paris.

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

Social programme and technical visits
The WGC golf tournament will be held on May 31, 2015, while city tours of Paris will be offered throughout the week. There will also be excursions to Versailles, a cruise on the River Seine, a visit to Montmartre and some surprise tours of places not normally open to the public.

The technical visits will take place on June 6 and delegates will have the opportunity to be shown around a number of interesting sites. We will give you more information about the programme of social and technical visits as soon as details are finalised.

Contacts and Key Dates
NOC Chair
Daniel Paccoud
dpaccoud@wgc2015.org

NOC Secretary
Annie Louys, alouys@wgc2015.org

Exhibition sales
Robby Clark, Exhibitions & Trade Fairs, rclark@etf.com.au

Call for Papers February 1, 2014
Abstract submission September 1, 2014
Registration opens April 1, 2014
Programme launches June 1, 2014
Bringing our energy together

- 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
- Develop and provide training courses with our Gas Techniques Training Centre, CAFG

AFG supports the National Organisation Committee of World Gas Conference Paris 2015

www.wgc2015.org
We all need electricity. Whether it’s to light up the local football match or warm the half time drink – it’s an essential part of powering our lives. Shell is helping to deliver natural gas to more countries than any other energy company. When used to generate electricity, this natural gas emits around half the CO2 of coal. It’s one of the most abundant sources of energy available today and, with our continued innovation, it could provide us with cleaner energy for around the next 250 years. And it’s one of a number of different sources of energy we’re investing in to power and sustain our lives today and into the future. Let’s broaden the world’s energy mix.

Search: Shell Let’s Go
To explore interactive stories on innovation in energy on your iPad, scan the code or search ‘INSIDE ENERGY’ in the App Store.
Coordination Committee Progress Report

**Introduction and Key Developments** 72

**Progress Reports from the Committees** 76
- Working Committee 1 – Exploration and Production 76
- Working Committee 2 – Storage 80
- Working Committee 3 – Transmission 84
- Working Committee 4 – Distribution 86
- Working Committee 5 – Utilisation 90
- Programme Committee A – Sustainability 92
- Programme Committee B – Strategy 95
- Programme Committee C – Gas Markets 96
- Programme Committee D – LNG 98
- Programme Committee E – Marketing and Communication 101
- Programme Committee F – R&D and Innovation 104

**Progress Reports from the Task Forces** 108
- Task Force 1 – Human Capital 108
- Task Force 2 – Gas Advocacy 109
- Task Force 3 – Geopolitics 111
Introduction and Key Developments

By Georges Liens and Yves Tournié

One year into the French Presidency, the Working Committees, Programme Committees and Task Forces are working hard on the 2012-2015 Triennial Work Programme, which has been developed under the theme “Growing together towards a friendly planet”. We have visited all 14 working groups at least once between autumn 2012 and spring 2013, to attend their first or second meetings.

Nearly 1,000 people (see table) have joined the groups and participation levels are very high with more than 50% of members attending the first two meetings. All groups are using the “Growing Together” extranet collaboration platform, which helps members to discuss ideas, exchange documents and share best practices.

Throughout the triennium, the working groups will exchange information on the four transversal themes (pillars):

- Natural gas for a sustainable development (the green pillar which is led by PGC A);
- Combination with renewables and electricity (yellow, PGC F);
- Natural gas available everywhere (red, PGC C); and
- Human resources for the future (blue, TF 1).

In order to enhance pillar/theme interaction, some of the groups have organised joint meetings, e.g. WOC 1 and PGC A (Sapporo, Japan in September 2012 and Rio de Janeiro, Brazil in February); and PGC B and PGC C (Oran, Algeria in November 2012 and Jeju Island, Korea in March).

Workshops

The Coordination Committee (CC), which is composed of all 14 working group chairs, is organising workshops on each pillar. There will also be a workshop on advocacy and communications.

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 following presentations were made:

- Smart Energy Network (SEN) of today in Japan (Satoshi Yoshida, Chair of PGC A);
- Adequate combination of gas with renewables and electricity (Dr Gerald Linke, PGC F);
- Smart energy communities start with integration (Michael Harcourt, CEO of QUEST);
- Opportunities for synergy between natural gas and renewables in electricity, power and transportation (Douglas J. Arent, Executive Director of the Joint Institute for Strategic Energy Analysis); and
- The role of natural gas in integrating renewable systems into power grids (Robert M. Lesnick, World Bank).

The second workshop (blue pillar – human resources for the future) was held in April in Seville, Spain to coincide with the Executive Committee meeting. It began with presentations by Agnès Grimont (Chair TF 1), Alfredo Ingelmo (Chair PGC E) and Fredrik Johnsson, Senior Advisor of Creative HotHouse. Afterwards brainstorming sessions were organised on the “Voice of Gas” and the “Image of Gas”.

The next workshop (red pillar – natural gas available everywhere) will be held in October to coincide with the Council meeting in Beijing, China.

In 2014, an advocacy and communications workshop will be held during the Executive Committee meeting in Brisbane, 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.
Pushing for a paperless WGC 2015
As a keen supporter of sustainable development, the 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.

Our current initiatives include the “Growing Together” collaboration platform and the use of multimedia materials by applicants responding to the Call for Abstracts.

During the conference interactive maps will be provided through the WGC 2015 mobile app, flash codes will be used for business cards and social media (Twitter and LinkedIn) will be used to facilitate networking and contact delegates via “push” notifications. There will also be interactive session access and video streaming.

Georges Liens is the Chair and Yves Tournié is the Secretary of the Coordination Committee.
We meet the world energy challenge through our projects

For close to fifty years, Technip has been a leader in providing conceptual design, engineering and construction services to the gas industry.

We are a leader in gas field production facilities, pipelines and gas pre-treatment units. Then, based on the latest technologies, our process designs provide energy-efficient and cost-optimized solutions for gas monetization including:

**Liquefied Natural Gas (LNG)**
We pioneered base-load LNG plant construction through the first-ever facility in Arzew, Algeria. Some 50 years later, we have built around a third of world LNG capacity.

**Floating Liquefied Natural Gas (FLNG)**
FLNG requires the integration of technologies from several core activities: LNG, offshore and subsea infrastructure. Major FLNG contracts with Shell and Petronas confirm our leadership position in this buoyant market.

**Gas to Liquids (GTL)**
We built Qatar's first GTL plant for the QP/Sasol joint venture (Oryx), with the highest reactor capacity to-date. We have an alliance with Sasol that includes FEED's for their future GTL projects and the co-development of Sasol Fischer Tropsch reactor technology.

**Natural Gas Liquids (NGL) recovery**
We have designed and built numerous plants for the recovery of natural gas liquids. We offer our Cryomax® suite of processes and access to other gas treatment technologies.

Our references cover grassroots gas facilities, ranging from small individual units to gigantic complexes, in every sort of environment, as well as upgrades of existing installations.
At Technip, we are building the future through today’s most ambitious energy infrastructure projects

In May 2011, Shell gave notice to the Technip-Samsung Consortium (TSC) to proceed with the construction of the first FLNG facility in the world, at its Prelude gas field off the northwest coast of Australia. TSC combines the strengths of each company to enable the delivery of an integrated FLNG facility: Technip provides the engineering, procurement and installation for the FLNG facility, and Samsung takes care of the construction.

Technip is a key partner of a visionary customer pushing back together the limits of technology. The Shell Prelude FLNG facility will be the largest floating offshore facility in the world. This great project is a real breakthrough for the energy industry and a true revolution for offshore natural gas developments.

www.technip.com
Delegates were welcomed to the opening joint plenary session by the chairs of WOC 1 and PGC A. Business began with a series of short presentations by top representatives of the local gas industry, including the Chief Gas and Energy Officer of Petrobras, Alcides Santoro, and the President of the Brazilian Charter Member ABEGÁS, Luis Domenech, who is IGU’s Regional Coordinator for North and South America. There was also a presentation by Bent Svensson, then Programme Manager of the World Bank-led Global Gas Flaring Reduction (GGFR) partnership, an initiative which is closely related to the work of both WOC 1 and PGC A.

Participants then divided into their committees and study groups to discuss the progress of work (see below). The day was rounded off with a visit to Sugarloaf Mountain and dinner in a traditional restaurant in the Santa Teresa district.

The next day participants continued their study group discussions in the morning and in the afternoon visited the new R&D facilities of Petrobras. Here they watched a 3D presentation on the submarine facilities and platforms of the Campos Basin at the Visualisation and Collaboration Nucleus (NVC). They also attended an R&D workshop, whose content was designed to contribute to the work programmes of WOC 1 and PGC A.

On the last day, there was a technical visit to the Guanabara Bay LNG terminal, where participants boarded the floating storage and regasification unit (FSRU) Exquisite for a tour and presentation. The facility can regasify 20 mcm/d, which is enough to produce 3.7 GW of electric power. This is about one third of the

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

**Working Committee 1 – Exploration and Production**

WOC 1 is chaired by Denis Krambeck Dinelli (Petrobras, Brazil) and has 72 members organised in three study groups. The committee’s second meeting of the 2012-2015 Triennium took place at the Windsor Atlantica Hotel in Rio de Janeiro, February 18-21. It was a joint meeting with PGC A and the event was hosted by Petrobras.

A total of 48 IGU delegates were present of which 22 were from WOC 1, 24 from PGC A, one from WOC 3 and one from the Coordination Committee. In addition, 17 external speakers and 11 guests were invited, giving a total of 76 participants from 19 countries. It was the second largest IGU meeting ever held in Brazil, and an all-time record for WOC 1.
average production of Itaipu, the largest power plant in the country. The organisers would like to thank Excelerate Energy and the crew commanded by Captain Jean Pol Wigny for their warm welcome to the IGU delegates.

**SG 1.1 Technological advances in gas exploration and production**

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

This study group is the largest in the committee. Adif Zulkifli began the session in Rio by recapping the approach proposed and the expectations for the work programme, following which there were a number of presentations.

Ekaterina Litvinova (Gazprom, Russia) looked at the Zapolyarnoye field in northern Russia and an edited version of her presentation is published in this issue of the IGU magazine (see pages 206-207). This is an excellent example of how state-of-the-art technology can be applied to the production of gas and condensate in extreme conditions. Although discovered in 1965, Zapolyarnoye could not be developed then as the remoteness and harsh conditions in the area required specialised technology which was not available. With the advent of new technology the giant field is now being monetised. Its production of 130 bcm/year makes it Russia’s largest. Other fields in the area are expected to be developed next.

Mariano Garcia (Halliburton) was invited to contribute to the triennial work programme of this study group. His presentation in Rio explored a number of technologies that are relevant to the production of shale and tight gas, including pinpoint completions, which allow perforations to be made at precise points in the reservoirs that need to be fractured, microseismic, management of clay sensitivity (to ensure that no clay swelling causes clogging of fractures or pores), new methods for water management in unconventional fields and improvements in equipment for reservoir stimulation.

Yassine Mestiri (ETAP, Tunisia) highlighted the possibility of using renewable energy to fuel gas fields, saving on gas that is traditionally used at the end of their joint meeting delegates of WOC 1 and PGC A made a technical visit to the FSRU Exquisite in Rio’s Guanabara Bay.
used for this purpose. A discussion ensued on how stranded gas could be developed, and one of the solutions would be related to the development of mini-LPG plants on skids, to be used on small gas fields. These can be moved elsewhere once the gas is depleted, spreading the cost of development over many fields.

Further technologies to explore, develop and produce gas will be suggested by members from PetroChina, PTTEP and KOGAS. Discussion continued by email after the Rio meeting, and the list of technologies to be showcased was due to be presented at the next meeting.

SG 1.2 Assessment of global gas reserves and resources

Leader: Dr Mohammed Kaced
(Sonatrach, Algeria)

Said Chelbeb (Sonatrach) presented an analysis of shale gas reserves and resources, around the world and in Algeria. Some definitions are problematic, so it is important to exercise care when comparing data from different sources.

Dr Mohammed Kaced defined the structure of the triennial report with the other members of this study group. It will have four main sections, exploring (1) the global potential for conventional gas, (2) for unconventional gas, (3) a gas flaring assessment and (4) an analysis of E&P trends, new frontiers and exploratory areas. These will be led by Fernando Bado (Tenaris, Argentina), Mohammed Kaced, Bent Svensson and Denis Krambeck Dinelli, respectively.

For the next meeting in Malaysia the group is refining the report structure with analyses of the different methods available to estimate reserves and resources, and will decide on the best data to be outsourced.

SG 1.3 Gas rent and mineral property rights

Leader (and WOC 1 Secretary): Dr Marcos de Freitas Sugaya (Petrobras)

Adauto Carneiro Pereira (Petrobras) gave a presentation on the granting of documents for upstream contracts. Governments and companies have different goals that must be reconciled, and this is not an easy task. In addition to the more usual division of production sharing, concession and service contracts, he briefly described the Iranian buy-back system and the transfer of rights system recently introduced in Brazil for Petrobras. He disagrees with Daniel Johnston, who sees a tendency towards growing use of production sharing contracts.

The Brazilian fiscal instruments for oil and gas were explored by Demetrius Casteloes Abdala (Petrobras). In addition to the direct taxation of income and profits, a number of indirect taxes are levied on goods and services, which have an important impact on capex and opex costs. To compensate for that, a special regime was developed to facilitate the entrance of equipment for the exploration and production of gas in the country, entitled Repetro.

Professor Edmar de Almeida (Federal University of Rio de Janeiro) compared the fiscal systems adopted by a number of countries in Latin America for the exploration and production of oil and gas. In recent years, a number of countries have moved from concession to service contracts, and in a few cases the fiscal terms for the production of natural gas are worse than for oil. Another important challenge to be faced by the gas industry is the control of domestic prices, which affects production and investment in upstream activities.

Dr Ik Hyun Park (KOGAS, Korea) analysed the fiscal regimes of Mozambique, Tanzania and Kenya, aiming at the production of gas from deepwater fields. Tanzania released its first natural gas policy draft in November 2012, with guidelines for public-private partnerships and security of supply provisions to the domestic market. Kenya has been using production sharing contracts since 1982, but conditions are more attractive in Mozambique, where even smaller reservoirs can be exploited at higher rates of return.

Dr Marcos de Freitas Sugaya gave a presentation on the Angolan production sharing
Powering Possibilities

In the 1970s, Saudi Arabia recognized the merits of gas as a valuable clean energy resource. This led the country to take an economic and environmental step forward with the creation of the Master Gas System (MGS). Today the MGS, constructed and managed by Saudi Aramco, includes massive gas plants that can handle daily gas production capacity of more than 12 billion standard cubic feet (SCF). As the backbone of the country’s industrial network, plans are in place that will increase daily capacity to more than 15 billion SCF.

As Saudi Aramco expands its gas exploration and production activities, we are always looking for talented professionals. For more information on career opportunities with Saudi Aramco, visit www.jobsataramco.com
regime for deep waters, which is relatively complex, but very stable. He used the same case study presented at the previous meeting in Sapporo for Norway and the UK, which was developed by Decio Barbosa.

Pawel Jagosiak (PGNiG, Poland) could not attend this meeting, but kindly prepared an analysis of the fiscal regimes applicable to the Norwegian Continental Shelf, to be shared among WOC 1 members.

As many IGU members remained unaware of the creation of this study group, a formal letter was dispatched to announce its purposes and content, encouraging the nomination of delegates. A small questionnaire was attached to investigate the opinions of IGU members concerning bidding processes and fiscal instruments for the production of oil and gas, and partial results are already available. These indicate that IGU members are satisfied with the fiscal systems available in their countries, which are considered attractive for investors.

Next meeting
At press time, the third meeting of WOC 1 – also a joint meeting with PGC A – was due to take place at the Shangri-La Tanjung Aru Resort in Kota Kinabalu, Malaysia, September 3-6. It will be covered in the next progress report.

Working Committee 2 – Storage
The second meeting of WOC 2, which is chaired by Ladislav Goryl (NAFTA, Slovakia) was hosted by Gazprom in St Petersburg, Russia, May 28-31. Forty-five delegates from 15 countries attended the meeting, including Sergey Khan, Head of Gazprom’s Underground Gas Storage (UGS) Directorate. In line with WOC 2’s tradition, a workshop was held during the meeting entitled “Enhancing the performance and
We guarantee energy security across the country’s regions and communities. And we maintain our commitment to investment and technology in order to be tomorrow’s network today. We aim to become the core hub for Europe, with a strong focus on development. Snam. The future’s network in our present. www.snam.it
efficiency of storage facilities”. There was also a technical visit to the Portovaya compressor station near Vyborg, the starting point for gas supplies via the Nord Stream gas pipeline to Germany.

SG 2.1 UGS database
Leader: Vladimir Lorenc (NAFTA, Slovakia)
Vladimír Lorenc was appointed as the new study group leader. The final concept of a new web application to update the UGS database was approved by SG 2.1’s members and has been introduced. The main features of the online database are:
◆ Online data collection via application software using a MySQL database server;
◆ Online access to the database via the IGU website – at least this is the goal; and
◆ The database is linked to geo-referenced visualisation.

The application was launched to collect data from contributors in September. The scope of data analysis has to be defined by spring 2014.

SG 2.2 Techniques and new opportunities
Leader: Fabien Favret (EDF, France)
Under the co-leadership of EDF and Edison, the work programme on the improvement of the performance and energy efficiency of storage facilities has been finalised. Topics of interest in the fields of subsurface, wells, above ground facilities, operation and optimisation were defined during the meeting in St Petersburg. Contributions are expected from Nafta, Storengy, Edison, EDF, Gazprom, VNG, RWE-Transgas, E.ON, OMV and Enagás, and final subjects will be selected by the autumn. SG 2.2 is also aiming to publish an article in the IGU magazine in April 2014. A dedicated workshop will be organised either in France or in Italy by spring 2014 in order to have final presentations (for the WGC) ready by summer 2014.

In the field of energy storage, synergy and the contribution of UGS to green energy deployment will be addressed in cooperation with PGC F. Presentations on making energy storage profitable, based on existing and future technology and con-
SOCAR, the State Oil Company of the Republic of Azerbaijan, is one of the world’s leading energy companies. Founded in September 1992 on the basis of the industry structures operating during the Former Soviet Union from the middle of the 20th century, the company’s activities comprise the complete value chain from exploration of oil and gas fields, through production, processing, storage, transportation, to marketing and supply of oil, gas, petroleum and petrochemical products to domestic and international markets.

SOCAR is represented in about 15 countries, including Singapore, Switzerland and the United Kingdom. The company has reached an agreement in principal for the acquisition of a 66% stake in Greece’s natural gas transmission system operator DESFA. I am pleased to inform you that the company’s decision to buy into DESFA proves the high level of bilateral relations between Azerbaijan and Greece and their leading energy companies.

Gas markets and strategy
Azerbaijan’s gas strategy, based on the principles of diversification, stability and security of supplies, has shown itself to be the right course in recent years.

Currently Azerbaijan exports natural gas to Georgia, Greece, Turkey and Russia. Azerbaijan supports Europe in its strategic goal of securing further gas supplies and meeting growing energy needs. The Southern Gas Corridor will constitute one of the most complex gas value chains ever developed, consisting of multiple separate energy projects with a total investment of approximately $45 billion.

A series of measures implemented by the European Commission, energy companies and above all by Baku and Ankara, have resulted over the last several months in the adoption of a new approach to the Southern Gas Corridor. This became possible after Azerbaijan and Turkey successfully overcame a political impasse and reached agreements on the transit and the supply of Azerbaijani gas to Turkey. These efforts implemented by SOCAR, prove that Azerbaijan will protect the security of natural gas supply to Europe.

The Route to the Southern Gas Corridor
The race between Nabucco West and Trans-Adriatic Pipeline (TAP) for the final selection of the route for the Southern Gas Corridor has finished:

• Technically and commercially the most effective route to deliver Azerbaijan natural gas to Greece, Albania and Italy TAP will also diversify and provide security of supply to fresh markets in the Western Balkans where new gas supplies are in high demand.
• TAP connects the border of Greece and Turkey into the Italian energy network through a single integrated 867 km pipeline system connected directly to TANAP
• The scope for the initial phase to deliver gas from Shah Deniz 2 is 10 bcm per year and the designed capacity can be easily expanded up to 20 bcm per year, depending on supply and demand.

The Southern Gas Corridor is seen as part of the ‘New Silk Road’ of transport and energy links between Europe and the Caspian region aimed at improving security of supply.

Gas industry
Azerbaijan’s proven natural gas reserves are estimated to be about 2.55 tcm. Annual production is around 27 bcm and it is expected that this figure will rise to 50 bcm by around 2025. Shah Deniz Stage 2 is a giant project of more than $25 billion that will add a further 16 bcm per year of gas production. Development of other Azerbaijani prospective structures Absheron, Umud, Nakhchivan and Shafaq-Asiman is planned in the near future.

Alongside future export potential and new transportation project developments to bring Azerbaijani gas to the world market there is also an open opportunity for the country to be a transit route for gas produced elsewhere in the Caspian region.

Environment and safety
Energy safety, combating climate change and minimising environmental contamination are of great importance to SOCAR. Working to improve the efficiency and safety of natural gas production, transportation and utilisation, SOCAR and its associates follow an environmental policy that includes the elimination of inherited problems, the application of rules and standards in all spheres of work and support for projects with high environmental and socio-economic outcomes.
sidering probable gaps in technology, have to be defined by next summer for a workshop on the subject in conjunction with the IGU Research Conference in Copenhagen in September 2014.

As regards the comparison of worldwide UGS regulatory frameworks, while there is extensive information for Western, Central and Eastern Europe, sponsors still need to be found for Asia and the US.

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

*Leader:* Nikita Barsuk (Gazprom, Russia)

Members of SG 2.3 agreed to divide their work programme into three parts. The first task is an analysis of the gender, demographic and skill characteristics of people working in the UGS sector. This will be carried out by means of a special survey, possibly in cooperation with TF 1 (the decision is still pending). A list of appropriate questions, potential donors and invitations to take part in the survey was presented during the meeting.

Secondly, a competition will be run in honour of the 100th anniversary of UGS. There will be separate categories for students and young employees of storage companies who will be invited to enter theses on storage topics linked to the green (sustainability) and yellow (renewables) transversal themes of the triennium. The submission period will be from this October to June 2014, and the best papers in each category will be presented in SG 2.3’s session during WGC 2015 in Paris. We expect the travel and accommodation costs for young employees to be borne by their companies, while the costs for students could be met by sponsorship or by IGU (subject to IGU’s consent).

The aim of the third part of the programme is to create multimedia tools such as a popular science film or cartoon to improve the image of the gas industry and the UGS sector in particular, and introduce UGS operations to students and young specialists. A draft screenplay and cost estimate are under development and will be presented for discussion at the third WOC 2 meeting which will be held in Tehran, Iran, October 1-4.

**Working Committee 3 – Transmission**

WOC 3 is chaired by Benjamín Guzmán (TGS, Argentina) and has 101 members from 38 countries. New members are still more than welcome to join.

The committee analyses, monitors and gathers information about all the aspects related to transmission systems which include pipelines, compressor stations and treatment plants. We cover aspects such as the development of new technologies, economic solutions and new legislation for the construction of new installations and maintenance of pipeline systems. In order to focus on these items, WOC 3 has three study groups:

**SG 3.1 New transmission projects**

*Leader:* Peter Toth (Eustream, Slovakia);

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

*Leader:* Abderrahmane Taberkokt (GRTG, Algeria); and

**SG 3.3 Public acceptance and new technologies**

*Leader:* Alessandro Moretti (Snam Rete Gas, Italy).

At the end of the triennium we will present the leading practices in the management of gas pipeline systems and compressor plants.

**First meeting**

WOC 3’s first meeting of the triennium was held in Mar del Plata, Argentina, October 24-26, 2012. The meeting started with an introduction by the hosting company (Transportadora de Gas del Sur) and its Vice President and our Chair, Benjamín Guzmán. The main goals of the first meeting were to:

- Inform participants about the rules of work in IGU and the WOCs;

---

84 Progress Reports from the Committees
◆ Confirm the study group leaders and deputies and form the groups from among the participants in the meeting;
◆ Present the programme for each study group and develop the work programme, schedules and deliverables;
◆ Assign tasks to study group members;
◆ Discuss if the inclusion of experts’ presentations in the meetings instead of technical visits would help achieve the study group goals; and
◆ Have preliminary discussions on the dates, venues and format of future meetings.

▲ Delegates to WOC 3’s first meeting pose for their group photo.

▲ Delegates to SG 3.2’s meeting in Copenhagen brave a cold day.
Second meeting
The second meeting of study groups was split for practical reasons. SG 3.1 and SG 3.3 met in Bratislava, Slovakia from March 25 to 27, and SG 3.2 met in Copenhagen, Denmark from March 20 to 21. Then SG 3.2 had another meeting in Paris, France from June 25 to 26 to comply with the schedule of the first stage. The main aim of the meetings was to discuss questionnaires which are being formulated to find out how changes in the gas industry affect pipeline transportation systems. There were also technical presentations.

In Bratislava, participants discussed the creation of questionnaires about:
♦ Compressor stations;
♦ Emissions;
♦ Electric drive;
♦ Public acceptance;
♦ Safety distances;
♦ New sources; and
♦ New gas transmission projects.

In the Copenhagen and Paris meetings the group discussed the creation of questionnaires about:
♦ Ageing pipelines;
♦ Third party damage;
♦ PIMS; and
♦ New developments to reduce gaps in integrity threats.

Next meetings
WOC 3’s third meeting will be hosted by Chevron in Houston, USA, October 1-3. The 2014 meetings will be held in Italy and the Czech Republic; more details will be announced in due course.

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 (TPA) 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...
Opportunities and growth with the power of natural gas

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 environmentally-friendly energy solution.

www.depa.gr
Progress Reports from the Committees

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 4.2 has contributed an article to this issue of the IGU magazine (see pages 200-204).

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;

Members of WOC 4 at work during their second meeting in São Paulo.
Eustream is the main entry gate and the biggest highway for Russian gas in the European Union. Our basic mission is to transport natural gas in Slovakia and through Slovakia to the European markets. To this end, we operate a large-scale high-pressure gas transmission system in the territory of the Slovak Republic which represents an important energy link between Russia and EU.

The A.Hak companies offer total solutions for the transport and distribution of (natural) gas. We’re active in the engineering, construction, commissioning, management, inspection, maintenance, and decommissioning of pipelines. Above and below ground, on- and offshore. Group activities also include drilling, dewatering and coating of pipes. This broad range of services enables A.Hak to deliver turnkey projects.

We join our forces to your advantage
◆ 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**

Chaired by Eugene Pronin (Gazprom Export LLC, Russia), WOC 5 monitors existing and promising technologies and techniques of using of gas to build up energy efficiency and fuel security and improve our customers’ quality of life. Customer testimonials, best practices, promising technologies and future potentials relating to gas use will be researched and the findings distributed worldwide for the benefit of end-users.

WOC 5 is divided into three study groups and two topic teams, which have the common aim of advocating broader use of gas as well as individual tasks.

**SG 5.1 Industrial utilisation**

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

During the triennium, SG 5.1 will prepare a report on trends in industrial gas usage, gather information on natural gas technologies, compare international energy efficiency initiatives, explore combining natural gas with renewables, study gas-to-power technologies and techniques and investigate the role of energy services in industry.

**SG 5.2 Domestic and commercial utilisation**

*Leader:* Martin Seifert (SVGW, Switzerland)

SG 5.2 will prepare a report on new gas appliances, monitor the promotion of gas heat pumps and micro-CHP units, research gas appliances with condensing and modulating properties for use in combination with other appliances such as electric heat pumps (hybrid systems), monitor adsorption heat pumps, study “smart” micro-CHP features and check and research business models for new technologies and associated services.

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

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

SG 5.3 will promote the use of natural gas as a transportation fuel to create cleaner, safer and cheaper mobility solutions. Its tasks include preparing the Global 2012-2015 NGV Report, proposing an action plan for NGVs in Europe (5% market share in 2020/2025) and researching CNG/LNG/biomethane technologies, economics, local policies and incentives. SG 5.3 will cooperate with NGV Global.

**TT 5.1 Renewable energy, CO₂ emissions, hydrogen**

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

TT 5.1 will gather information about global production and use of “green gases” in association with natural gas, investigate how
HONEYWELL RMG GAS METERING MANAGEMENT SYSTEM IMPROVES ACCURACY AND RELIABILITY OF GAS MEASUREMENTS

Tailored Solution enables Remote Monitoring of Gas Pipeline Metering Stations, Analysis of Operational Data and the Ability to Conduct Remote Maintenance

The new RMG Gas Metering Management software and service solution of RMG by Honeywell enables natural gas and measuring station operators to monitor operations on-site or remotely, provide data analysis and facilitate remote maintenance. The solution reduces operational costs and improves the accuracy and reliability of measurements.

The RMG Gas Metering Management system supports both RMG by Honeywell and third-party measurement devices, allowing users to accurately determine the technical condition of all gas measurement devices in a metering station using a single software package. In addition, the ability to remotely access measuring devices simplifies planning and organisation, and reduces costs as it keeps station visits to a minimum.

“One of our goals in developing this new solution was to give customers the freedom and flexibility to choose the best combination of measuring devices to meet their unique needs, regardless of the manufacturer,” said Frank Michels, general manager, RMG Gas Metering. “The RMG Gas Metering Management solution works seamlessly with both RMG and third-party measuring devices, so customers all over the world can create highly tailored solutions, but still monitor everything through one central, reliable system.”

Honeywell has already tested the system with prospective customers including Schwaben Netz GmbH in Germany, producing positive results.

“We’re satisfied with our beta test of the Gas Metering Terminal module of the software,” said Michael Stoeckle, director of Gas Network Control, Schwaben Netz GmbH. “We’ve found it to be intuitive for our operators to use, as well as robust and stable. We plan on extending our use of the solution in our service department for quick and easy remote diagnosis, and expect a quick return on investment.”

The system employs a framework of gas metering management, analysis and terminal modules that can be installed without the need for customised code changes and are easily configured. Dynamic system displays allow for detailed schematic diagrams of the monitored station, and enable technical and accounting personnel to access and act upon current flow, pressure and temperature data and alarms in real-time.

The Honeywell RMG Gas Metering Management software is initially available in English and German. For further information please visit www.rmg.com/gmm-en or www.honeywellprocess.com.

RMG by Honeywell, a division of Honeywell Process Solutions and based in Germany, is a trusted global partner wherever gas needs to be moved, measured or stored. RMG by Honeywell has unmatched experience and expertise in the design and manufacture of natural gas control, measurement and analysis equipment, including flow metering technology, regulating products and safety devices for the most demanding applications. RMG products and solutions are used for compressor and transfer stations, gas-power and combined heat & power stations, and natural gas storage facilities. RMG by Honeywell has specialised in gas products and solutions for more than 150 years.

▲ RMG Gas Metering Monitor: for the schematic representation of the station.

◄ RMG Gas Metering Terminal: for the simple configuration, parameterisation and maintenance of measuring devices from RMG and third-party suppliers.
renewables can be incorporated into the natural gas grid, look at hydrogen/methane production from renewable power, study electrolysis technologies and look at technologies to convert CO₂ + water to methane. It will also prepare a global overview of ongoing projects for the integration of renewable gas into the local natural gas grid – including a status check on technology upgrades.

TT 5.2 Gas quality

Special Adviser: François Cagnon (GDF SUEZ, France)

TT 5.2 will gather information on worldwide gas quality issues, collect data on new regulations or initiatives to standardise gas quality, study the impact of gas quality variations on existing appliances and new technologies, and review the effects of adding hydrogen or new gases to the grid.

Transversal issues

WOC 5’s work on spreading the benefits of gas relates to the transversal theme of gas everywhere (the red pillar) and it will cooperate with PGCs C and E. As regards combining with renewables and electricity (the yellow pillar), WOC 5 will cooperate with PGC F on securing synergy of natural gas with biomethane, hydrogen and renewables. Work on sustainable development issues (the green pillar) such as investing in infrastructure and improving technologies will involve liaison with PGCs A, D, E and F and GERG. Finally, on human resource issues (the blue pillar) WOC 5 will cooperate with TFs 1 and 2.

Meetings

WOC 5’s second meeting was hosted by Westport in Toronto, Canada, April 22-24. At press time, the third meeting was due to be hosted by Dourogas in Vidago, Portugal, September 16-18.

Programme Committee A – Sustainability

PGC A works closely with WOC 1 and the two committees are holding joint meetings during this triennium. The joint sessions of the meeting held in Rio de Janeiro, February 18-21 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 strategic panels and four committee sessions during WGC 2015; one of the strategic panels will be a joint one with WOC 1 on unconventional gas.

SG A.1 Carbon capture and storage

Leader: Hiromichi Kameyama (Tokyo Gas, Japan)
The study group’s session in Rio began with a guest presentation by Rodolfo Dino of Petrobras on the Brazilian NOC’s use of CO₂ for enhanced
Members then discussed the work programme for the triennium. SG A.1 is preparing a CCS road map report for WGC 2015 and is collecting information on:

- **Technology** – the latest developments of ongoing CCS projects;
- **Cost (feasibility)** – the benefits or co-benefits of enhanced oil recovery;
- **Public acceptance** – overcoming NIMBY problems.

Two workshops will be organised and SG A.1 will collaborate with WOC 3 in the field of CO₂ pipelines. The study group has also prepared an article for this issue of the IGU magazine (see pages 192-194).

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

**Leader:** Elbert Huijzer (Liander, The Netherlands)

After a short introduction and presentations on wind energy and biogas from swine manure in Brazil by Elbia Melo (Brazilian Wind Energy Association) and Antônio Machado (SCGAS, Brazil), participants gave briefings on renewable gases in their countries. Reports were also received in advance from France and Algeria (including several other Maghreb and Arab countries). These country reports are for use within the study group and will ultimately lead to addenda to the final report.

For the next meeting, country reports from the members from Germany, Iran, Japan, Serbia and Sweden have been requested, while the Netherlands Development Organisation (SNV) will be contacted for help on information about biogas in countries without a well-developed gas grid. Additional information about the biogas potential in France will also be prepared.

The group discussed and agreed a rough structure of the final report which will be entitled “Sustainability of renewable gases”. The message is that renewable gases are a useful new supply for the natural gas market. There are sources, there is a market and renewable gases are generally produced and utilised locally.

The economics are a difficult point for renewable gases and it is up to IGU to publicise the good examples. However, there is a lot of variety between countries, making comparisons difficult. Where one might expect decreasing costs due to better and wider spread technologies, it is observed that in the leading country, Germany, costs have actually increased. The reason for this is most likely that the feed-in tariffs are so high that there is no incentive to reduce the cost level.

One improvement for the renewable gas market could be trading of renewable energy certificates. At the moment this is not possible between countries because the underlying financial systems are too different from each other. This issue will be looked into more detail in the next meeting.

As regards life cycle assessment (LCA), both the European Committee for Standardisation...
was also agreed that all reference documents would be archived on the IGU website.

SG A.3 has contributed an article to this issue of the IGU magazine (see pages 196-199).

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

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

After a short introduction, participants agreed the wording of the statement of objectives for SG A.4, which “will seek to improve public acceptance of unconventional gas by providing a balanced approach to the discussion about its environmental impacts based on science, fact, technological innovation and management best practices”.

The group then agreed a rough structure of the final report, listed the contents and planned the work programme going forward. The title of the report and the WGC 2015 committee session SG A.4 is organising will be “Seeking common ground”. There were also preliminary discussions about the WGC 2015 strategic panel entitled “Innovative technology as a means of minimising environmental impact and maximising performance of unconventional gas”, which SG A.4 is organising jointly with WOC 1.

It was agreed that the Growing Together collaboration platform would be used to enhance the level of communication, at least with WOC 1, WOC 3 and TF 1, and also to create a Google group for email communication among group members.

Mauro Soares will follow up with the PGC A and WOC 1 chairs to set up a strategy to attract new members to this group.

**Next meeting**

At press time, the next joint meeting of PGC A and WOC 1 was due to take place at the Shangri-La Tanjung Aru Resort in Kota Kinabalu, September 3-6. IGU’s Immediate Past President, Datuk Abdul Rahim Hashim, and the former CC
Chair, Ho Sook Wah were due to attend, with business set to include discussions about PGC A’s sessions at WGC 2015. There will be a report on this meeting in the next progress report.

**Programme Committee B – Strategy**

PGC B, chaired by Fethi Arabi (Sonatrach, Algeria), held its second meeting in Jeju Island, Korea, March 19-21. It was hosted by the Korea Gas Union and KOGAS. Like the first meeting, this was a joint meeting with PGC C.

There were 71 senior gas representatives, of which 28 were from PGC B, who participated in the working sessions and debates with high-level global experts from various fields.

Before the main committee meetings, there was a joint plenary session. This allowed experts to share their insights on unconventional gas resources in Australia and China, the 2012 IGU Survey of Wholesale Gas Price Formation, the natural gas industry in Korea and the role of KOGAS.

The methodology of the 2050 Natural Gas Prospective Study, which is exploring the main developments that will shape gas markets by 2050, was presented and discussed.

The core objectives of the second meeting were to examine and share the outputs of the three study groups and continue the progress from the previous meeting. The study groups held individual sessions led by their respective group leader.

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

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

There were presentations on supply, demand and trade for Europe, North America, Middle East, Latin America and India along with a focus on global trade.

These detailed analyses were debated by experts responsible for different parts of the world, along with a high-level discussion on the scenario, methodology and approach of the report. The decisive role of regional focus points and a bottom-up approach was agreed.

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

*Leader: Mike Fulwood (Nexant, UK)*

There were presentations on market liquidity concepts and the pricing of natural gas in some African countries, while Mike Fulwood presented in-depth analyses on gas market pricing. There was excellent discussion and new responsibilities were assigned to some members of the group.
SG B.3 Strategy and regulation

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

A conference call was organised between the study leader and experts from PGC B in the field of strategy and regulation to explore the ways and means to prepare the materials for the next meeting.

In June the members shared topics, contents, a brief description and deadlines to organise the tasks within the study group during the triennium.

A short questionnaire has also been distributed among the group members to cover the globe. The questionnaire is set-up to make a first inventory possible in the field of infrastructure regulation. A second questionnaire related to energy poverty has been circulated among the members.

Programme Committee C – Gas Markets

PGC C, chaired by Dr Gi Chul Jung (KOGAS, Korea), held its second meeting jointly with PGC B in Jeju Island, Korea, March 19-21. The meeting, co-hosted by KOGAS and Korea Gas Union, was attended by 15 of PGC C’s 56 members and three observers. Participants came from 10 countries, namely Algeria, Australia, France, Indonesia, Iran, Japan, Korea, Norway, Poland and Russia. The observers were Rajesh Vasandani (Santos), Gavin Thompson (Wood Mackenzie) and Jeong Wook Kang (KOGAS).

During the plenary session, CC Chair Georges Liens updated members on the status of the Coordination Committee’s activities. Then five speakers addressed various gas topics from around the world. Kun Ho Lee, PGC C member from KOGAS, presented an overview of KOGAS and its recent activities. Jeanet van Dellen, PGC B member from Gasunie, gave a briefing on the 2050 Natural Gas Prospective Study of PGC B. She asked all participants to fill out a questionnaire which is needed for the study. Rajesh Vasandani from Santos and Gavin Thompson from Wood Mackenzie looked at unconventional gas developments, respectively the recent activities of Santos in Australia and in China. Mike Fulwood from Nexant, one of the PGC B study group leaders, presented the results of the 2012 survey of wholesale gas price formation.

In the wrap-up session, Graeme Bethune (Energy Quest, Australia) presented the details of the next PGC C meeting, which will be held in Brisbane, Australia, October 1-3. This will be
EUROPE NEEDS GAS AND FLUXYS BRIDGES THE MARKETS

- Gas backbone connecting markets and trading places between the UK and Italy
- Crossroads for North/South and East/West gas flows
- Excellent upstream interconnection
  - tied in to all pipe gas resources available to the European market
  - capacity to accommodate Nord Stream gas flows through NEL pipeline
  - worldwide LNG supply through the Zeebrugge LNG terminal
- Optimum destination flexibility for pipe gas and LNG
- Zeebrugge area key landing point in Western Europe
- Development of the Zeebrugge LNG terminal as a hub for small-scale LNG

Gas and gas infrastructure will continue to feature prominently in tomorrow’s low-carbon energy landscape. As a gas infrastructure company for Europe, Fluxys seeks to build bridges between markets so that suppliers and producers can bring gas from any border to their customers and move it between trading places in all flexibility.

www.fluxys.com
hosted by Santos and he encouraged all the committee members to attend.

SG C.1 The role of natural gas in the electricity generation mix
Leader: Alexey Biteryakov (Gazprom, Russia)
Study group members gave presentations on the gas-to-electricity markets of the Czech Republic, Korea, North Africa, Russia and UK. The main trends, features and challenges in those markets were discussed and identified. Alexey Biteryakov gave a presentation on what the natural gas industry (mainly the producers) could offer to the European Commission, local governments and the transmission system operators (TSOs) to increase the reliability of the electricity system in environments with a high share of renewable energy sources (RES). Study group members agreed to choose a problem-oriented approach when developing market analysis case studies. The presentation Dragos Talvescu (Sund Energy, Norway) gave on the UK market was recommended as an example.

SG C.2 Implications of developing unconventional gas
Leader: Shigeki Sakamoto (JX Nippon, Japan)
During the SG C.2 meeting Shigeki Sakamoto, Magdalena Radziwonczyk (PGNiG, Poland), Mikhail Uchkin (Gazprom) and Natalia Kaminskaya (Gazprom) reported on the status of shale gas developments and government policies in Europe, Indonesia and North America. Magdalena Radziwonczyk kindly agreed to present updates on the Polish gas market in the next PGC C meeting, focusing particularly on shale gas development and the LNG import project. Members of the study group also agreed on the basic structure of their final report. It will consist of three parts. Part one covers an introduction of regional shale gas developments with a specific focus on the historical background of selected countries. Part two elaborates the factors, driving forces and challenges which will impact the future of unconventional gas development. Part three concludes with the implications of unconventional gas development in the regional gas markets and relevant policy options and recommendations.

Programme Committee D – LNG
PGC D’s second meeting was hosted by Chevron in Houston, USA, April 14-16, coinciding with LNG 17. It was held in the JW Marriott Hotel and attended by 46 members.

The Chair, Dirk van Slooten (Vopak, The Netherlands) welcomed participants at the opening plenary session and gave a review of PGC D’s contribution to the strategic objectives of the triennium before outlining the work schedule and the committee’s deliverables. PGC D’s five study groups then held individual meetings to discuss their work and summaries were presented in the closing plenary session.

SG D.1 Remote LNG
Leader: Jean-Yves Capelle (Total, France)
In general terms, the implementation of remote LNG production facilities 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, fabrication, logistics/transport, construction and operations. SG D.1 is evaluating the challenges and will make recommendations for future developments.
CREATING WEALTH AND VALUE

VISION
We will play a key role in the LNG and Natural gas industry, creating wealth and value, implementing the National Energy Strategy and serving our valued customers and community in a socially responsible manner.

MISSION
- Achieve company vision through the safe and efficient production, sale and delivery of LNG, LPG and natural gases, paraffinic naphtha and sulphur; building on our ADGAS history, solid partnership and human capital.
- We will strive to sustain our recognized international reputation for reliability, integrity and efficiency and to continually improve HSE and business performance.
- We will attract, develop and retain competent and dedicated staff.

INTEGRATED GAS DEVELOPMENT

Abu Dhabi Gas Liquefaction Ltd. PO Box 3650 Abu Dhabi, United Arab Emirates
Tel: +971 2 606 1111 Fax: +971 2 606 5500

www.adgas.com
In Houston, members identified the need to classify remoteness using a set of pre-established criteria and discussed the possibility of using a unique “Remoteness Indicator” (copyright by Dr Heinz Bauer). They shared ideas on what is remote and what is not. The table of contents for the study group’s final report was reviewed, broken down and assigned to individuals in the team who will act as content owners. They planned the work schedule up to the next meeting in October and work is underway on the content texts.

**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 may offer modest to substantial cost savings and a reduced environmental footprint.

In Houston, members reviewed the progress of research and planned the work schedule for the forthcoming six months with a focus on the chapters on fuel options, end-user assessment and expectations, LNG distribution and the value proposition. Three teleconferences have been planned and arranged before the next meeting.

**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 Houston, members reviewed the progress of work and planned the work schedule going forward. The regional sub-groups will carry on collecting data with a focus on the missing areas (Japan, Russia, South America, southern Europe), and analyse the data collected in terms of drivers, business model, players and regulations. The definition/technology sub-
group will analyse the data in terms of the value chain and expand the technology matrix.

**SG D.4 LNG life cycle assessment**  
*Leader: Ted Williams (American Gas Association, USA)*  
SG D.4 is developing a detailed framework for conducting LCA studies of the LNG chain. The framework and scope of the study group work has been divided into modules covering upstream, liquefaction, shipping/transportation, regasification and end use. A draft template for analysis has been developed based on the upstream module. This will look 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. SG D.4 is collaborating with SG A.3.

In Houston, members developed the final report outline and assigned the various report sections and tasks. They also had initial discussions on data sources, targets, LCA tools and other deliverables. Plans for the next meeting in October include a workshop involving the LNG industry and various stakeholders concerned with life-cycle emissions associated with LNG.

**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 responsible for producing reports for 2012, 2013 and 2014 during the current triennium and is working with consultants PFC Energy.

The 2013 edition covers 2012 and the first quarter of 2013, and features an attractive new design. The draft report was ready for review at the end of March, while the final report was ready in June and published in July. It includes new sections on LNG re-exports and reloading terminals, capacity and utilisation rates, project capex, small-scale LNG, as well as two special reports “North America LNG prospects and challenges” and “LNG as fuel for transportation”.

**Next meeting**  
PGC D’s next meeting will be hosted by Enagás in Barcelona, Spain, October 8-10.

**Programme Committee E – Marketing and Communication**  
Chaired by Alfredo Ingelmo Torres (Sedigas, Spain), PGC E has a two-fold objective. On the one hand it will identify and develop ideas, tools and products to successfully promote and sell 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 increase (with recent recruits from Australia, Canada, Qatar and Russia) and there are now 61 nominated members.

PGC E’s second meeting was hosted by GDF SUEZ and GrDF in Paris, France, March 25-27. It was attended by 27 members.

**SG E.1 Marketing natural gas and promoting new usages**  
*Leader: Luis Pinto (Shell, The Netherlands)*  
During the Paris meeting, SG E.1 discussed its work programme going forward. Members have decided to conduct a survey among IGU members to find out about each country’s advances in finding alternative uses for natural gas. Once the survey is completed a full report will be prepared for IGU members to use as a guide with best practices, trends (global/regional) and ways to expand each country’s use of natural gas.

**SG E.2 Competing and coordinating with other energies**  
*Leader: Barbara Jinks (Gas industry advisor, Australia)*  
SG E.2 is working on four main tasks:

1. A survey has been sent to PGC E members
The message from the study group is that communication is key: our hardware has to come with soft skills.

Hansch Van der Velden moderated a session of the 17th European Gas Conference in Oslo in June, where public acceptance was a major theme. Dimitri Schildmeijer gave a speech on public acceptance at the Sedigas Annual Meeting in Madrid in May. The group also published an article in the *Natural Gas & Electricity Journal* entitled “Golden Age of Gas? Not in My Backyard” (NGEJ, November 2012 on http://db.tt/npoEil3t).

During the next meeting in the US, SG E.4 will continue work on its final WGC report. Shell will then host a visit to its shale gas production facilities near Pittsburgh and show the group how it builds local support.

**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.
Promigas: committed to energy and progress.

Providing communities with a better quality of life. Taking care of the environment where we live, work and grow. Generating business opportunities in Colombia and Latin America.
Meetings
The next meeting will be held in Washington DC, USA, October 7-9. It will be hosted by the American Gas Association and Energy Solutions Center.

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, either directly through CNG or LNG, or indirectly via gas-to-liquids processes. Safety continues to be a focus area for the gas industry, for both existing infrastructure and the rapidly expanding transmission and distribution systems in growing economies.

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 held its second meeting from April 26-27 in Amsterdam, hosted by the Royal Dutch Gas Association (KVGN). The next meeting will be hosted by Tokyo Gas in Tokyo, Japan, October 8-9.

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.
Leadership in technology.

The world is growing. Every day, more people, vehicles, homes and factories are driving an ever-increasing demand for energy.

That’s why ExxonMobil is investing more than $1 billion annually in research, development and technology application—part of our commitment to developing the breakthrough technologies required to meet the world’s rapidly growing energy needs.

Whether it’s investing in research and development, 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
**SG F.1 Technical Programme for the IGU Research Conference (IGRC2014)**

The primary deliverable for PGC F is the 2014 IGU Research Conference, IGRC2014, scheduled to be held September 17-19, 2014 in Copenhagen, Denmark. For more than 30 years, IGRC conferences have provided a unique forum highlighting the latest advances in the gas industry. IGU has actively supported recent conferences, and under the current triennium, the IGRC conferences are now formally incorporated into IGU.

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 is 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 from the expertise of the entire PGC F committee as well as external experts to define programme structure and compelling, high-interest topics. The conference “call-for-papers” is scheduled to be released later this year, and include topics related to both technical and business aspects of innovation in the gas industry.

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

Over the last decade there has been a decline in R&D investment by the gas industry, particularly in gas utilisation. The goal of this study group is to review, identify and assess means for the effective promotion of R&D within the gas industry. The first task is developing an inventory of global R&D programmes and facilities to establish a baseline level. The 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 such as solar, wind and wave power. In addition, the gas grid has enormous potential to provide energy storage for the electric grid by converting the energy from “excess electrons” into gaseous fuel components. 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.
Unconventional Resource Exploration

by Aaron Gatt Floridia, President, Reservoir Characterization Group, Schlumberger

In the coming years, gas demand is expected to grow in all geographies, particularly in Asia, driven by growth in the emerging countries and increased use of gas for power generation in the OECD countries. North America, the former Soviet Union, China and the Pacific region will account for the majority of the supply increase.

While gas demand continues to increase as it represents a low-cost, low-carbon energy source, conventional sources of gas supply are currently in decline. On the other hand, gas from unconventional sources, such as shale reservoirs, are in abundant supply and have helped the United States, for example, overcome import dependencies and supply limitations. Even though the international potential of unconventional gas sources is expected to take longer to develop, E&P companies have embarked on a global land grab for prospective exploration acreage—from Argentina to Poland to China—in an attempt to replicate the success of North America.

It is unlikely that the global unconventional gas development model will be a carbon copy of the North American one. Operators are recognizing the need for a different operational model; one that includes more science in the form of reservoir-centric workflows to help define reservoir and completion quality, refine the identification of reservoir sweet spots, and optimize well drilling and completions. Essentially, an integrated, flexible and inclusive business model is required that ensures both commercial and environmental sustainability.

Integrated Methodology
Schlumberger has developed an integrated methodology that is applicable throughout the life of the unconventional asset including evaluation, drilling, completions and production phases. This approach considers “producing more with less” where fit-for-purpose technology is applied at each step of the asset development process to decrease project risk and optimize production and ultimate recovery.

Within the wellbore, the Litho Scanner* high-definition spectroscopy service directly measures total organic carbon across the zone of interest, which helps to identify the sections with the greatest production potential. Workflows, such as the Shale Gas Advisor, help to integrate all measurements to clearly identify which zones should be stimulated and how best to do that. And finally advanced microseismic measurements, both downhole and from surface, help to identify the location and geometrical progression of the fractures ultimately helping operators to optimize their programs.

Technology is expected to enable future unconventional resource development, particularly in well performance prediction before drilling, proppant transport improvement and ultimate recovery optimization. Also, technologies for the detection and elimination of fugitive gas and reduction of surface and carbon footprints could positively impact the environment.

Finally, the capital and infrastructure requirements for unconventional resource development are high, and the industry’s social license-to-operate requirements are increasing. Notwithstanding this, the abundant shale gas resource is spurring investment around the world; the demand fundamentals, the growing complexity of finding and developing new reserves, and the challenges of maintaining production from an aging production base will require additional growth in E&P spend. In this scenario, technology will continue driving performance improvements and play an increasing role in environmental sustainability.

Mineralogy determined from Litho Scanner elemental weight fractions is confirmed by core mineralogy.

An Ant Track cube reveals features likely to be faults.

Recent advances in reservoir evaluation techniques are helping operators further reduce uncertainties. One example is the use of seismic data analysis together with the Ant Tracking technique for sweet spot determination. Petroleum systems modeling of reservoir charge and seal, based on well-centric information from logs and cores and geomechanical modeling, enables a fuller picture of the reservoir and the completion quality available in any given play. This leads to improved drilling location decisions and optimized completion designs.

Find out more at slb.com/ug
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 second meeting was hosted by the Malaysian Gas Association in Kuala Lumpur, February 26-28. Two study groups have been set up to fulfil the Task Force’s objectives.

Report on best practices in attracting talent (with a focus on young people and women)
This study group is led by TF 1’s Vice Chair, Abdulaziz Mohammed Al-Mannai (Qatargas) and Marius George Popescu (Energy Brains Consulting, Romania). The situation of youth and female workers in the industry will be analysed to share and highlight best practices in the area of human capital development.

A survey has been launched which will be complemented by interviews with industry experts, reviews of HR best practices, youth dialogues and university workshops. The survey focuses on: (1) investigating the commonalities, specificities and key issues impacting the industry’s human resources across different regions and industry segments; (2) understanding the best practices developed by companies to attract young talents and make the industry more female friendly; and (3) assessing the most efficient policies implemented by companies to develop and retain their talented staff.

Once the research has been completed the results will be analysed between March and August 2014, following which work on writing the report will start.

Delegates to TF 1’s second meeting in Kuala Lumpur had their group photograph taken in the bridge linking the Petronas twin towers.
Education and communication

TF 1’s Chair, Agnès Grimont (GDF SUEZ, France) is leading this study group which has two sub-groups responsible for: (1) a youth campaign together with a youth programme at WGC 2015; and (2) a female campaign. Work on these issues will be coordinated with TF 2.

TF 1 is carrying out an educational campaign to engage young people and involve them with the industry using the website set up in the 2009-2012 Triennium www.itsnotmagicitsscience.com and social media. It will also set up a Youth Pavilion covering some 1,300m² and organise a Youth Programme with a target of 200 participants during WGC 2015 following the very successful event at WGC 2012.

During the meeting in Kuala Lumpur, there was a series of workshops to discuss the content of the website, how to structure the WGC 2015 Youth Programme and who should be invited to the WGC. The workshops produced a wide range of ideas and the programme is now being refined.

TF 1’s work will contribute to developing tools to consolidate the female workforce and make the industry more female friendly. To this end, a roundtable on women in engineering concentrating on the regions of Africa and the Arab states will be organised with members of UNESCO at the next meeting in Paris. The objective of the roundtable is to formulate a report which will outline the socio-economic, cultural and educational constraints for women in engineering in Africa and the Arab states, as well as the opportunities for their inclusion in the engineering workforce in these regions.

Working with TF 2 (Gas Advocacy), TF 1 will contribute to the development of a promotional campaign advertising the success stories of female workers in the gas industry. The task forces are also working together on youth issues. Ieda Gomes (Energix Strategy, UK) is in charge of cooperation between TF 1 and TF 2. During the last meeting she presented the main issues:

◆ Find a sponsor to fund participation of a young professional in TF 2 – or someone from TF 1’s members;
◆ Use TF 2 materials to promote the image of gas with young people;
◆ Capture the views of young people about the themes being discussed by TF 2;
◆ Encourage young people to submit abstract/posters to the WGC; and
◆ A contest for young people.

The next meeting will be held in Paris, France, December 9-11.

Task Force 2 – Gas Advocacy

Chaired by Michele Pizzolato (Eni, Italy), TF 2 aims to demonstrate and endorse the essential role of natural gas in the forthcoming transformation of the energy system.

In the first year of the triennium TF 2 has concentrated on planning its work and identifying the main gas advocacy issues to be covered, aided by a survey circulated to IGU members. The task force has been established to be the IGU “voice” of natural gas – producing documents and position papers for advocacy messages, and participating directly through the chairing team and experts in IGU lobbying activities in institutional and regulatory forums of interest. TF 2 aims to work in conjunction with regional associations to complement their arguments with a global view, coordinating support and promotion of its position among all stakeholders.
In order to play this role, TF 2 has released a public document on Capacity Remuneration Mechanisms and finalised two documents to endorse the papers prepared for WGC 2012: “Shale Gas: The Facts about the Environmental Concerns” and “Natural Gas Utilisation and GHG Reduction”.

During the second meeting of the triennium, which was hosted by Gazprom in St Petersburg, Russia on May 16-17, TF 2 analysed the ongoing situation and fixed the priorities for the next two years. TF 2 intends to stimulate debate on a range of issues.

**Role of natural gas in the fuel mix**
Natural gas is widely well known for its positive characteristics: it is clean, affordable, reliable, efficient, abundant, and for these reasons it is an energy source fundamental in addressing security of supply issues at a reasonable price. Natural gas, due in particular to its environmental sustainability, is also identified as a fundamental energy source in those countries where decarbonisation issues are included as priorities in the energy policy agenda. In these areas natural gas is recognised as the best partner of renewables.

In line with these points, TF 2 has prepared the IGU response to the European Commission’s consultation on the Green Paper “A 2030 framework for climate and energy policies”.

**The image of natural gas**
The perception of the gas industry and of the fuel itself is crucial nowadays. TF 2 will analyse how natural gas is perceived by EU institutions and will work together with TF 1 and PGC B to help improve the perception of the gas industry by young professionals, current consumers and the next generation of consumers.

**Natural gas in Asian markets**
TF 2 intends to start a focus on Asian markets in order to highlight the important issues for natural gas in all sectors of the industry. The second step of this work will ideally be an analysis of the best practices that can be put in place in the different Asian markets.

**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. Also the potential offered by the use of gas in 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 contribute to reducing CO₂ and SOₓ emissions.

TF 2’s next meeting will be in early 2014, although the date and the location have yet to be confirmed.

**Task Force 3 – Geopolitics**

Though natural gas may be abundantly available worldwide, not every region is equally endowed with this resource. Getting the gas from the regions where it is produced to where it is consumed can prove to be a challenge. The actions taken by nation states and/or international organisations to influence international gas flows to their benefit can be understood as geopolitical actions. TF 3’s aim is to better understand these actions and to identify key developments worldwide that define the geopolitical setting, the so-called game changers.

Chaired by Geert Greving (GasTerra, The Netherlands), TF 3 will continue the work of the previous triennium with a few notable changes in scope:

- It will not focus on politics exclusively, but also on economic issues. So not only geopolitics, but also geo-economics;
- Its coverage will expand to the Far East, the Americas and Africa, with a special focus on south-south interaction and developments in the Pacific region; and
- Cooperation along the value chain (upstream to downstream) between NOCs and IOCs will be studied.

TF 3 also aims to finish the global round of debates by including the regions that were not covered in the previous triennium and where possible to strengthen the ties of IGU with regional authorities. The debates will take place in high-level meetings between experts, governmental representatives, local authorities and industry representatives. Traditionally, IGU has been focused on the industry – although the gas advocacy initiative is changing this – and the debates are a way of connecting all stakeholders to our project. The conclusions of each meeting will be presented in a regional discussion paper, prepared by the local moderator, which will be published in the IGU magazine. In addition to these regional discussion papers, a major study of natural gas and geopolitics will be carried out by the French think-tank IFRI (Institut Français des Relations Internationales) and the Dutch think-tank CIEP (Clingendael International Energy Programme). Together these reports will make up a final report to be presented at the 26th WGC in Paris in 2015.

Delegate to TF 3’s meeting in Paris pose for their group photo.
The first meeting of TF 3 was held on February 14 in Paris. Together with 12 of our members and our experts from CIEP and IFRI, we discussed the geopolitical issues we seek to address in the current triennium. A paper prepared by CIEP and IFRI that featured a “shopping list” of such issues was distributed beforehand in order to provide some terms of reference. There was a good discussion on the issues and a final version of this paper (which includes the outcome of the discussion), called “The New Geopolitics of Gas”, can be found on the TF 3 pages of the collaboration platform.

In June we organised our first regional roundtable in Washington DC during which the geopolitical impact of the North American gas revolution was addressed. With 35 representatives of government, industry and think-tanks and the lively debate that evolved between them, this was a successful meeting.

For more information on this meeting see the following report.

Also, on May 6, we launched our first online battle. With these battles we seek to engage students and young professionals with our project and with IGU. This initiative addresses the transversal theme of human resources (the blue pillar). In the battles we ask students and young professionals to write down their views on a pre-determined topic in a paper. The first battle is on Arctic drilling. We have challenged the students and young professionals to present their views on whether drilling in the Arctic is desirable or not. The three best contestants will get an opportunity to attend our meeting on Arctic drilling in November in Amsterdam.

TF 3 has secured sponsors who will support our project in this triennium and we are happy to welcome Gazprom, Chevron, Eni, TAQA Arabia, the Royal Dutch Gas Association (KVGN) and GasTerra.

Geopolitics and Natural Gas Roundtable in Washington DC
By Rik Komduur, Lori Traweek and Mel Ydreos
On June 20, IGU’s Task Force on Geopolitics had its first regional roundtable in Washington DC, organised in cooperation with the American Gas Association and the Canadian Gas Association. Academics and representatives from government and industry participated in an active discussion on the geopolitical implications of the North American gas revolution. With
shale gas generally regarded as the prime game changer in the international gas market of the last decade, and Washington well-used to being the centre of any geopolitical discussion, it was the perfect place to discuss the potential global impact of so much new North American supply.

To foster discussion, a paper was prepared by Eurasia Group, a New York based consultancy actively tracking politics and energy1. The paper focused on three main subjects: the geo-economic effect of the North American gas revolution, the winners and losers of North American LNG exports, and the impact these exports might have on international gas prices and pricing mechanisms.

It is clear that the largest impact of the North American gas revolution has been on the US economy itself. The very affordable supplies of natural gas have triggered something of a revival in industrial activity and consequent boost to economic growth. But they also have significant implications for the economies of Canada (where significant new resource basins have been tapped) and Mexico, and have triggered a remodelling of the gas trade flows within and amongst all three of the North American countries.

For the US, apart from the domestic economic boost of affordable energy, there has emerged the idea of the US as a major LNG exporter. This is something that as little as five years ago was unthinkable when there was only a small export plant in Alaska. Signals are increasingly positive that Americans are accepting that role: overcoming an instinctive reaction against it fed by fears of the economic impacts of price volatility, and the threats to energy security and independence.

Mexico has seen its gas exports to the US decrease to almost zero, but is on the other hand greatly benefiting from low-priced US gas imports. In the border region with the US a new industrial hub has emerged that is largely fuelled by these exports (feedstock, chemicals etc.). Mexican imports from the US are set to triple in the coming years if the new planned pipeline capacity (35 bcm/year) materialises.

For Canada it is a different story. Canada’s longstanding export relationship with the US is changing quickly as US production increases, and Canadian suppliers are looking for new buyers for their natural gas – to Asia as LNG rather than the US via pipeline. However, whereas in the US the obstacles to LNG exports are largely political, Canada faces mainly commercial barriers. The Pacific-facing province of British Columbia is the site of most of the proposed export projects. These are all greenfield opportunities and remotely located, meaning costs are significant. Not surprisingly, developers of these fields are keen to secure long-term oil-indexed contracts to cover the investments needed. According to Eurasia Group analysis, Canadian LNG exporters are under pressure by Asian buyers – who can choose to contract gas in Australia, the US or Canada – to link their price to Henry Hub, given their own linkage to US markets and the precedent set by US Henry Hub-based LNG export contracts. This makes the prospective margins on exports much less, and the economics of projects tougher to support.

With the North American picture explained, the roundtable proceeded with a robust debate on its global implications: who wins and who loses in a market with North American gas in the mix? The discussion paper assessed the outlook for existing and future LNG exporting countries in a scenario where US LNG exports hit 60-80 bcm/year by 2020. Many participants felt that North American LNG exports were more likely to trigger change and innovation across the globe than to divide countries into winners and losers. What was acknowledged was that new entrants in the LNG market, especially projects high on the cost supply

---

1 The discussion paper, which incorporates feedback received during the roundtable discussion, is available for download at the TF 3 pages on the Growing Together website (CC members’ pages).
curve, would find it difficult to capitalise on their LNG export potential. It was also noted that the entry of North American LNG exports in the world market would decrease the share of exports from countries in the Gas Exporting Countries Forum (GECF), likely lessening their influence over global gas markets. All agreed that the impact on the GECF should be examined in a broader context, as it wasn’t the focus of this forum.

One particularly significant attribute of US LNG export contracts is the fact that the export price of the gas is a domestic one, rather than being based on its value in the international market. To what extent this pricing structure will contribute to break up oil indexed pricing around the world will depend on a number of other issues, like natural gas production growth around the world, or the future of oil prices (a lower oil price would reduce the incentive of the buyers to demand indexed prices). A second important development is the contract type chosen by US exporters who have licences thus far. They are using tolling contracts for liquefaction capacity rather than take or pay volume-based contracts, a model that is clearly preferred by the parties involved. Combined, these two factors have created a kind of “sweet spot”: gas is likely to be exported from the US where there is domestic market over-supply and prices are low, and trade will decline where prices run higher, preventing run-ups of the Henry Hub price. The additional $5-6/MMBtu needed to transport the gas to a liquefaction terminal on the US east coast, liquefy it and ship it to Asian markets ($1 less when shipped to Europe), is a transparent rider that acts as a modulator on price.

The discussion then turned to how the US positions its emerging gas presence as a geopolitical tool. There was general agreement that there is far more noise (both in the mass media and in the US Congress) about a political agenda around gas exports than there is any actual agenda, apart from the need to lift the current FTA restriction, which the US government appears willing to do. One participant even called it a non-issue outside of the Washington bubble. Within that bubble, where interests in favour of and opposed to export licences tend to be loudest, the real issues in respect to granting permits – admittedly a slow and costly process for proponents – involve (1) demonstrating regulatory compliance and (2) demonstrating a customer base for the product.

So what can we expect from North American LNG exports? Three exporting licences had been granted in Canada and two in the US (Sabine Pass and Freeport) as of the date of the workshop, with a combined capacity of approximately 84 bcm/year (48 bcm/year in Canada plus 36 bcm/year in the US). Two other projects were expected to receive a permit in the US in the very near future (Freeport second phase and Cameron), which would add up to a total US capacity close to 70 bcm/year by 2020. With all projects though, concerns remain high that time delays and cost over-runs will lead to less rapid development than some might hope. Given the very positive post 2020 outlook for LNG, this need not be very problematic, if it weren’t for the fact that this outlook is conditioned by many uncertainties. As some participants noted, the possibility of shale gas development in other regions – for instance China – within the next decade, may well mean an increasingly competitive market for sellers of LNG, reducing the possible market share for North American players. These threats to possible market development are clearly a priority concern for Canadian players, operating in an environment that is much less concerned about threats to domestic supply, and more concerned about how to quickly seize a share of a global opportunity.

Rik Komduur of GasTerra is the Secretary of Task Force 3, Lori Traweek is Senior Vice President and COO of the American Gas Association and Mel Ydreos of Energy Vantage is the Vice Chair of the Coordination Committee.
THE FUTURE OF ENERGY

Industry leading exploration, commercial agility, market insight and one of the world’s largest LNG shipping fleets.

Core strengths designed to meet future global energy needs.

See more of the future of energy today.

bg-group.com
@BGGroup
youtube.com/BGGroup

A world leader in natural gas

BG GROUP
Odebrecht is an organization of thousands of people of knowledge, able to satisfy its customers through innovative solutions that contribute to a better world.

25 years in Argentina

www.odebrecht.com.ar

Av. Leandro N. Alem 855, piso 32
Buenos Aires, Argentina

ODEBRECHT
Features

This issue's features section starts with an overview of the gas industry in China, which is hosting the 2013 Council meeting in Beijing, followed by reports from the Regional Coordinators.

Next up are a review of LNG 17, of which IGU was one of the sponsoring organisations, reports on LNG project finance and floating LNG, and articles on the impact of unconventional gas on the LNG market and the launch of the Society for Gas as a Marine Fuel.

Then we have a Q&A with Bent Svensson, outgoing manager of the Global Gas Flaring Reduction partnership, articles on the Sustainable Energy for All initiative, Norway’s CO₂ Technology Centre, a carbon capture and storage project in Japan, life cycle assessment, managing the diversification of gas quality and Russia's most productive gas field. These are followed by a report on how work for IGU has been recognised in an Australian award and an update on GTL developments.

We round up with a description of the publications and documents available from the Secretariat and the events calendar.
China Gas Society (CGS) is the non-beneficial institute and the sub-academic organisation of the China Civil Engineering Society.

CGS's many experts, professors and technicians in the gas field work on a wide range of academic activities in order to promote the urban gas business and foster technological growth.

CGS champions the technical and economic progress of the Chinese gas industry through its members and works to improve the competitiveness of gas by promoting the development and application of new technologies and best practices.

Contact us:
Email: cgs@cemi.com.cn
Tel: +86 22 2354 5122
FAX: +86 22 2354 5362
Add: Floor 2, Building C, No.99, Qi Xiangtai Road, Hexi District, Tianjin, China 300074

The gas business and industry have been a part of Beijing life since the 1950s. For nearly 15 of the last 55 years it's development has been lead by the largest gas supplier in a single city, the Beijing Gas Group which was established in 1999. The scope of its business interests includes gas transmission and distribution, sales, science and research, design, construction and gas equipment manufacture. It is at the top of the list in China in terms of the size of its pipeline network, the number of gas users, annual gas consumption and annual sales income, with natural gas purchases of 8.41 bcm, 4.7 million customers, and over 15,000 km of pipeline in operation in 2012. Today, natural gas is used in many fields such as cooking, industry, heating, cooling, power generation, gas-powered vehicles and distributed energy. After half a century's hard work and a decade's efforts, Beijing Gas Group is accelerating towards a beautiful vision of the future.
From its beginnings in 1865 the gas business in Shanghai has continually grown. With supplies from western China, LNG imports, and the West-East Gas Pipeline successively coming to the city, a complete natural gas pipeline network is expected to be realised by the end of the 12th five-year plan (2015). Shanghai Gas Group Co., Ltd was established in December 2003. Its business covers the investment, construction, operation and sales of natural gas via its pipeline network; the production and sale of man-made gas and LPG. The group occupies over 90% of the local market, with both user scale, storage and transportation capacity ranking number one nationwide.

By the end of 2012, the Group had a 19,000 km pipeline network of high, middle and low pressure pipelines, total assets of 15.07 billion RMB and an annual sales output of 18.3 billion RMB. Its nearly 9,000 employees provide 6.08 million gas users with an annual supply of 6.26 bcm of natural gas, 830 mcm of man-made coal gas, and 105,000 tonnes of LPG. The Group upholds the concept of “Shanghai gas makes the sky more blue” to accelerate the development of the natural gas industry. And the Group also goes all out to promote the economic and social development of Shanghai, as well as to improve the quality of the urban environment and to raise living standards.

Shenzhen Gas Group Co., Ltd was founded in 1982 with 30 years of pipeline gas franchise rights in Shenzhen and now additionally controls 30 city successful gas projects outside Shenzhen. Listed on the Shanghai Stock Exchange on 25 December, 2005, the Group’s business encompasses urban pipeline gas supply, LPG wholesale, retail of LPG cylinders and gas industry investment. The Group had total assets of nearly 10 billion RMB in 2012 and annual sales revenue of nearly 9 billion RMB. In the future, the Group will expand its natural gas business and fully participate in competition in the energy market. Meanwhile, the Group will advocate building a new urban living style which is more comfortable, beautiful, environmentally friendly and civilized. The Group will also develop into a sustainable enterprise with advanced technology and management and finally become the top clean energy company in Southern China.

During the four decades since its foundation in 1973, Chongqing Gas Group has built up a reputation for safeguarding the supply of clean energy to Chongqing, the youngest municipality directly under the central government. The Group’s natural gas supply network covers all 24 districts and counties of the city serving 3,150,000 customers in total. The Group’s business encompasses storage, transmission, distribution and sales of urban gas, gas engineering design, installation and construction, as well as compressed natural gas and distributed energy. Based on the three characteristics of urban gas supply infrastructure, services and public safety the Group aims to build upon the safe supply system of natural gas in Chongqing by means of abundant gas sources, a safe and reasonable gas transmission and distribution network, sufficient gas peaking facilities and highly automated scheduling means, perfect rescue and emergency mechanisms, and finally, with comprehensive customer service.
When the IGU Council last convened in China in 2005, the country’s primary energy consumption was 1,554 mtoe. In 2012, it was 2,735 mtoe – testimony to sustained economic growth. Indeed, China overtook the USA as the world’s largest consumer of energy in 2010. Coal provides 68% of the country’s primary energy but the share of gas is increasing – from 2.7% in 2005 to 4.7% in 2012 – and under China’s 12th Five-Year Plan (2011-2015) the natural gas industry is an important focus of investment.

As CNPC’s Chairman, Zhou Jiping declared at the 25th World Gas Conference in June 2012, “prioritising the development of gas resources is a strategic choice for China’s energy evolution”. Zhou Jiping is also Chairman and President of CNPC’s major subsidiary PetroChina.

The Ministry of Land and Resources assesses China’s technically recoverable conventional gas resources at 32 tcm and unconventional gas resources at 48 tcm. The main producing areas are in Xinjiang and Qinghai Provinces in northwest China (Tarim, Junggar and Qaidam Basins), Shanxi Province in the north (Ordos and Songliao Basins) and Sichuan Province in central China (Sichuan Basin), with offshore production from the Bohai (Yellow Sea) and Pearl River Mouth (South China Sea) Basins.

CNPC/PetroChina is the major gas producer with three-quarters of production followed by Sinopec, CNOOC and Chinese independents. International companies including Chevron, Shell and Total have production sharing contracts.

The gas transmission system currently totals some 50,000km and is being steadily expanded. A major project has been the development of the West-East Gas Pipelines (WEGP) by PetroChina.

The first WEGP connecting the gas fields of the Tarim and Ordos Basins with cities on the east coast was completed in 2004 with an initial capacity of 12 bcm/year (since increased to 17 bcm by boosting compressor capacity). It runs 4,000km from Lunnan to Shanghai.

**China’s Growing Gas Industry**

<table>
<thead>
<tr>
<th>Year of primary energy consumption</th>
<th>2005</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas consumption mainland China</td>
<td>46.8 bcm / 2.7%</td>
<td>143.8 bcm / 4.7%</td>
</tr>
<tr>
<td>Gas consumption Hong Kong</td>
<td>2.7</td>
<td>2.8</td>
</tr>
<tr>
<td>Gas production</td>
<td>49.3 bcm</td>
<td>107.2 bcm</td>
</tr>
<tr>
<td>LNG imports</td>
<td>0</td>
<td>20 bcm</td>
</tr>
<tr>
<td>Pipeline imports</td>
<td>0</td>
<td>21.4 bcm</td>
</tr>
</tbody>
</table>

WEGP 2 was completed in 2012 and runs from Horgos on the border with Kazakhstan, where it connects with the Central Asia-China gas pipeline, to Guangzhou and the Shenzhen/Hong Kong border. The trunk line is nearly 5,000km long and has eight branches for a total length of 8,700km. Capacity is 30 bcm/year.

Work started on WEGP 3 in October 2012 and is due to be completed in 2015. The trunk line will run 5,200km from Horgos to Fuzhou and eight branches will give a total length just under 7,400km with a capacity of 30 bcm/year.

Feasibility studies for two more WEGPs are underway, each with a capacity of 45 bcm/year.

China’s natural gas production has doubled since 2005 while consumption has tripled (see table). Developing new domestic resources – particularly unconventional gas – will help meet growing demand, although more imports will also be needed.

Indeed, Chinese companies are increasing their investments in overseas projects to give greater import security. CNOOC’s purchase of Nexen and CNPC’s entry into Mozambique’s offshore Area 4 are recent examples.

LNG imports started in 2006 through Guangdong terminal on the Dapeng Peninsula and reached 20 bcm in 2012, with Qatar and Australia providing 58% of supplies. Pipeline imports started in 2009 and reached 21.4 bcm last year with the bulk coming from Turkmenistan. Overall, imports accounted for 29% of gas consumption in 2012.

However, domestic price regulation means that imports are effectively cross-subsidised – PetroChina lost $6.7 billion on gas imports in 2012 – and domestic prices will need to move more in line with import costs to underpin the future development of the gas business. This is the aim of a gradual pricing reform by the National Development and Reform Commission (NDRC). A pilot started in Guangdong and Guangxi in December 2011 and a nationwide increase in prices for non-residential users took effect in July.
The Growing Importance of China in the Global Gas Industry

By Kang Soo Choo

With the development of the national economy and improvement in urban life, demand for natural gas in China has grown strongly and is expected to continue growing at a rapid rate in the coming years. There are many investment opportunities throughout the natural gas chain in China, from exploration and production, through trade to equipment manufacture.

According to the International Energy Agency’s “Golden Age of Gas” scenario, China’s gas demand could increase to as much as 635 bcm by 2035, matching that of the entire EU. A higher consumption forecast is reflected in China’s 12th Five-Year Plan, which identifies that gas demand will account for up to 8.3% of the country’s total energy demand by 2015 as it continues to increase its share of the energy mix.

As the IGU Regional Coordinator for Asia and Asia-Pacific, I consider China to be one of the most dynamic markets in the world. With the anticipated growth in domestic gas consumption, together with steadily growing gas production, China has a high potential for the development of the gas industry through investment in technologies and infrastructures.

The share of natural gas will further improve in China’s energy mix with the increased supply of imported and unconventional natural gas to the market. Natural gas is going to play a significant role in contributing towards China’s future energy needs, making China one of the most important players in the world gas industry.

Kang Soo Choo, Honorary Chairman of Korea Gas Union, is the Regional Coordinator for Asia and Asia-Pacific.

LNG

China introduced LNG in 2000 with a peak-shaving plant in Shanghai and has built up a network of small- and mid-scale liquefaction plants. The first investment in overseas LNG projects was made in 2003, when CNOOC bought a stake in Australia’s North West Shelf venture, and China now has interests in all stages of the LNG supply chain. As noted above, the first import terminal opened in 2006, while the first of a fleet of home-built LNG carriers entered service in 2008 on the run from the North West Shelf venture to Guangdong Dapeng. The Dapeng Sun with a capacity of 147,000m³ was built at the Hudong Zhonghua yard in Shanghai with a membrane containment system under licence from GTT. The yard is now building carriers with a capacity of 174,000m³ to serve the Australia-Pacific LNG project.

China has six LNG import terminals with a seventh due to open in the last quarter of 2013. Guangdong Dapeng LNG is a joint venture of CNOOC, BP and smaller Chinese gas companies. CNOOC also controls terminals in Fujian, Ningbo and Shanghai, while PetroChina operates terminals in Dalian and Rudong. The country’s first floating storage and regasification unit (FSRU) will start operations in Tianjin in the last quarter of 2013. CNOOC has teamed up with Tianjin Port and Tianjin Gas to charter the Cape Ann, a GDF SUEZ vessel operated by Höegh LNG.

There are plans to add an onshore terminal in Tianjin and expand the terminals in Dalian, Dapeng, Fujian, Rudong and Shanghai, while
Find & Deliver
More natural gas for a cleaner future
seven new ones are under construction. These are in Beihai and Qingdao, (controlled by Sinopec), Diefu, Jieyang, Hainan and Zhuhai (CNOOC) and Tangshan (PetroChina). CNOOC also has plans to commission two more FSRUs in Yantai and Yancheng, and Sinopec has applied to build a terminal in Lianyungang. By the end of the decade, total LNG import capacity is likely to be around 100 bcm/year.

China’s growing role in the LNG business was recognised in April when the country was selected as the host of LNG 19, which will be held in Beijing in 2019. The bid to host the event was put forward by Professor An-Zhong Gu, Secretary General of the China LNG Association.

**International pipelines**

China’s imports of gas by pipeline have also been backed up by upstream investments. CNPC has a production sharing contract with Turkmengaz for the Bagtyyarlyk field from which imports began in December 2009 when the Central-Asia-China pipeline was inaugurated. CNPC is also part of the consortium developing the Galkynysh field in Turkmenistan which is expected to start production by the end of 2013.

A second line was added to the Central-Asia-China pipeline in 2010, while imports from Uzbekistan began in August 2012 via a branch connection. A third line is now being built which will boost overall capacity to 55 bcm/year in 2015, and a Kazakhstan branch will open in 2014 to supply gas from the Karachaganak, Tengiz and Kashagan fields.

In the south-west, a new pipeline between Ramree Island in Myanmar and Kunming in Yunnan Province was completed in June. It has a capacity of 12 bcm/year.

To the north, gas pipeline connections between Russia and China (there is already an oil pipeline) have been proposed for many years but negotiations have foundered on price. In March, during the state visit of China’s President, Xi Jinping to Moscow, Zhou Jiping signed a Memorandum of Understanding with his Gazprom counterpart, Alexey Miller, covering the supply of 38 bcm/year from East Siberia.
the largest producing field is CNPC’s Sulige. CNPC is also working with Shell and Total to produce tight gas from the Changbei and South Sulige fields.

China’s coal-bed methane (CBM) development is concentrated in the Qinshui Basin of Shanxi Province and in the east of the Ordos Basin, with technically recoverable resources put at 10.9 tcm. The first company to start pure CBM production was China United Coal Bed Methane in 2005 and a number of other

Subject to a final agreement at the end of 2013, supplies would start in 2018 via spurs off the pipeline being built to supply the Vladivostok LNG project. The two companies are also evaluating a project (dubbed Altai) for a pipeline running from the West Siberia region to Xinjiang region. The pipeline would connect to the WEGP network and have a capacity of 30 bcm/year.

**Unconventional gas**

China continues to develop its conventional gas resources. Indeed, production from the Liwan project in the South China Sea is due to start by the end of 2013 and the development includes Asia’s biggest offshore platform. However, it is the unconventional sector which has been attracting a lot of attention recently.

Unconventional gas currently accounts for about 20% of production with the bulk being tight gas from the Ordos Basin. CNPC started commercial tight gas production in 2006 and technically recoverable resources are estimated by the Ministry of Land and Resources at 12 tcm. Production reached 20 bcm in 2011 and
The biggest unconventional prospect is shale. Technically recoverable resources are estimated at 25.1 tcm, with some 70% in acreages already controlled by the NOCs. The first auction of new shale gas blocks was held in June 2011 and a second in October 2012. There were hopes that shale gas production would reach 6.5 bcm in 2015. However, CNPC cautions that developing volume production will not be easy. Compared to the US, the top shale gas producer, China’s shale resources are less brittle and therefore more difficult to fracture, and they are deep and in mountainous terrain making access more difficult. Moreover, obtaining water in areas of scarcity is a problem. And a support industry needs to be developed.

CNPC launched shale gas pilot projects in 2010 at two blocks in Weiyuan-Changning in Sichuan Province and Zhaotong in Yunnan Province. The first vertical shale gas appraisal well Wei-201 was completed in the south of the Sichuan Basin. Commercial gas flows were obtained from two series of shale strata of the Cambrian and Silurian systems after fracturing.

Chinese and foreign companies are working in the sector. The latest figure for pure CBM production is for 2010 when it was 1.57 bcm. China also has a programme to use the coal-mine methane extracted from working coal mines, which is generally used for local power and heat generation and is not fed into the normal gas transmission and distribution system.
150 years ago, The Hong Kong and China Gas Company Limited (“HKCG”) supplied gas to 500 street lamps and a few buildings in Hong Kong through a network that was only 24 km long. Today, HKCG operates close to 170 piped city-gas and new eco-energy projects in over 20 provincial-level regions in China, in tandem with the nation’s rapid social and economic development.

Looking to the future, HKCG will continue to provide our customers with a safe, reliable supply of energy and the caring, competent and efficient service they expect, while working to preserve, protect and improve our environment.

www.towngas.com
Other developments

China is active in coal gasification and is working on a number of projects in areas with rich coal reserves. Concurrently, support for carbon capture, utilisation and storage has been increased. Most projects involve the coal sector but pilot CO₂ capture projects are being developed for gas-fired power plants.

China’s NGV sector is growing rapidly with a 40% surge in the country’s fleet of NGVs to 1.577 million in 2012. The network of 2,784 filling stations dispensed 12.6 bcm, representing nearly 9% of total gas consumption.

The bulk of NGVs run on CNG but the 71,000-strong LNG-fuelled fleet is set to grow as there has been increased emphasis on the production of LNG-fuelled vehicles recently.

Chinese government policy supports greater use of NGVs. The three NOCs are expanding their networks of CNG and LNG filling stations,

In 2011, CNPC drilled four vertical wells and four horizontal ones, and fractured five of them. Well Wei 201-H1 was completed and fractured, maintaining a daily output of 11,500-13,400 m³. In 150 days of gas testing, it produced 1.77 mcm, and became the first completed horizontal well to produce shale gas. Sinopec and Yanchang Petroleum have also obtained gas from appraisal wells.

Chinese NOCs are working with international companies to develop shale resources, both by buying into overseas projects to gain experience and through joint study agreements for projects in China. Companies that have agreed joint shale studies in China include BP, Chevron, ConocoPhillips, Eni, ExxonMobil and Total. Meanwhile, CNPC signed the first shale gas production sharing contract with Shell in 2012 for the Fushun-Yongchuan block in the Sichuan Basin.
intuitive • independent

To know more about our RMG Gas Metering Management solution, please contact us at www.rmg.com/gmm/contact or visit us at www.rmg.com and www.honeywellprocess.com

© 2013 Honeywell International Inc. All rights reserved

RMG Gas Metering Terminal
The all new RMG Gas Metering Management Software offers complete control for all Gas Station measuring devices. Local or Remote supervision, regardless of the device manufacturer allows simple and efficient Configuration, Parameterization and Maintenance.

by Honeywell
China Gas Society

The IGU Charter Member for China is the China Gas Society (CGS), which is a professional body of the China Civil Engineering Society (CCES). CGS is a non-profit organisation which carries out various academic activities in the field of urban gas under the authorisation and leadership of CCES.

Originally known as the China City Gas Society, CGS was founded in Dalian, Liaoning Province in April 1979. Authorised by the Ministry of Construction, it joined IGU as a Charter Member in 1986. CGS brings together experts, researchers and technicians who work to promote the technical progress of the Chinese gas industry.

CGS is organised into 10 professional committees: Gas Sources, Transmission and Distribution, Utilisation, LPG, LNG, CNG, Gas Heat Supply, Statistics Compilation, Information Technology and Management; and members have made significant contributions to the development of the Chinese gas industry. Their work covers technical standards, training, the accreditation of qualifications, technical consultation, data collection and a comprehensive publications programme of academic journals and reference books. CGS also makes suggestions for gas development, recommends scientific talents and serves as a communication channel between the industry and government.

Internationally, CGS takes an active part in IGU activities and Chinese members serve on the following technical committees: WOC 1 – Exploration and Production; WOC 2 – Storage; PGC B – Strategy; and PGC F – R&D and Innovation.

CGS promotes communication, exchanges and cooperation between China and the rest of the world, introducing new products and technologies into China and paving the way for Chinese companies to integrate smoothly into the global gas industry.

Foton’s range of NGVs includes this LNG-fuelled tractor unit.

while independents are also active in the market. CBM producer Green Dragon Gas, for example, is building a network in Shanxi and Henan provinces. Municipal bus operators are offered subsidies to switch to NGVs and the automotive industry has developed manufacturing capacity for gas engines and components, compressor and cryogenic equipment, high-pressure vessels and cryogenic tanks. The leading manufacturer of commercial vehicles, Foton has joint ventures with Cummins and Daimler and produces buses, dump trucks and tractor units. Other companies manufacturing NGVs include Higer (buses), XCMG, which
offers a 25-tonne wheeled crane running on LNG, and Volkswagen China (cars).

In the marine sector LNG bunkering is being developed to support pilot projects for river vessels. Next in line are deep-sea shipping and railway engines.

Delegates to the Council meeting will be able to catch up on the latest developments in China’s rapidly growing gas industry during a special presentation. The agenda will also include a workshop on unconventional gas and a technical visit.

Mark Blacklock is the Editor-in-Chief of International Systems and Communications. The author would like to thank Lingzi Wang, Secretary of the China Gas Society, and Eugene Pronin, Chair of Working Committee 5 – Utilisation, for their help in preparing this article.

Beijing Gas Group

As the co-host of the IGU Council Meeting in 2013, Beijing Gas Group looks forward to welcoming delegates to Beijing.

Beijing Gas Group was established in 1999 when the city’s gas supply operation was corporatised. It is China’s largest local gas company with activities including distribution, sales, R&D and the manufacture of gas appliances. The Group has a network of over 15,000km of pipelines and in 2012 supplied 8.41 bcm of gas to 4.7 million users.

In line with the policy of reducing air pollution and increasing the use of clean-burning natural gas, the Group has steadily widened its customer base. Today, gas is used for cooking, heating, cooling, industrial purposes, transportation, power generation and distributed energy.

Beijing Gas Group has a strong business and the future prospects are excellent as the share of gas in Beijing’s energy mix continues to rise.
The role of gas in powering Asia to feature at SIEW 2013

Singapore’s first LNG terminal began operations in May. The city-state, which has so far been relying on imports from Malaysia and Indonesia, will now be able to access natural gas from global sources including the US, Australia and Russia.

The LNG terminal is part of the Singapore government’s strategy to diversify and secure its sources of energy, as 80% of Singapore’s electricity is produced by gas. The terminal is Southeast Asia’s third LNG import facility, and is an example of how policymakers in the region are acting to tap the world’s expanding supplies of natural gas.

The International Energy Agency (IEA) has predicted that over 70% of global LNG trade will go to Asian markets by 2017.

“LNG will play an essential role in meeting additional demand. The good news for Asian customers is that most of it will come from the Pacific basin, particularly Australia, Papua New Guinea and Indonesia,” said Ms Maria van der Hoeven, Executive Director of the IEA in her keynote address at the Singapore International Energy Week (SIEW) 2012.

While gas is a relatively cleaner source of fuel to power Asia’s fast-growing demand, it also brings with it a set of challenges. Gas prices in Asia continue to be the highest in the world, due to the long-term gas contracts and the high costs of liquefaction.

In a report released in March, the IEA said that the city-state is an ideal site for natural gas trading in Asia. The report noted that a gas-trading hub in the region would allow countries to negotiate shorter-term – or spot contracts with prices that reflect the fundamentals of supply and demand, instead of high, long-term prices linked to those of oil. This would also encourage investments in gas infrastructure in the region.

But despite the benefits of gas, the region cannot ignore the need for energy efficiency and renewable energy sources. The Director-General of the International Renewable Energy Agency (IRENA), Mr Adnan Z. Amin, noted at SIEW 2012 that while each country would have to determine the most suitable policies to meet its priorities, renewable energy was crucial to ensure sustainable growth in the long-term and to bring modern energy sources to rural populations.

Mr Adnan will return to SIEW 2013 as one of its key speakers, along with Mr Charif Souki, CEO & President of Cheniere Energy; Mr Arthur Hanna, the Global Energy Industry Managing Director at Accenture; and Mr Jose Maria Figueres, President of the Carbon War Room and Former President of Costa Rica.

The theme of SIEW 2013 is New Horizons in Energy and registration is open at www.siew.sg. SIEW 2013 will be held at the Sands Expo and Convention Centre, Marina Bay Sands, Singapore, from 28 October to 1 November 2013. The event is organised by the Singapore Energy Market Authority (EMA), a statutory board under the Ministry of Trade & Industry.
Join the Influencers of the Energy Industry

Jose Maria Figueres
Former President of Costa Rica and President of Carbon War Room

YB Datuk Seri Dr. Maximus Ongkili
Minister of Energy, Green Technology and Water Malaysia

Adnan Z. Amin
Director-General
International Renewable Energy Agency

Dr Fatih Birol
Chief Economist
International Energy Agency

ONE WEEK - ONE LOCATION
28 October - 1 November 2013
Sands Expo and Convention Centre, Marina Bay Sands

Register now at WWW.SIEW.SG
Following contributions from IGU’s Regional Coordinators for Asia and Asia-Pacific and Europe to the last issue, here we have reports from the Regional Coordinators for Africa and the Middle East, North and South America and the Russia-Black Sea-Caspian area.

Africa and the Middle East
A Q&A with Khaled Abubakr
What do you see as the major challenges facing the gas industry in your region?
We cannot deny the political unrest in some of the North African countries due to the calls in these countries for a better democratic system to be introduced. However, Africa has an R/P (reserves/production) ratio of almost 70 years, and the Middle East still holds the largest reserves with an R/P ratio of over 150 years. Whilst it is evident that the countries of the Middle East and North Africa (MENA) and sub-Saharan Africa hold almost 40-50% of the world’s proven reserves, with much additional potential for the discovery of more conventional and unconventional resources, a deeper understanding of the political economy of these gas resource-rich countries is necessary in order to realistically appraise their future participation in the global natural gas market.

The share of natural gas in the energy mix of almost all Africa and parts of the Middle East is the world’s lowest. Thus, future investments are needed to increase the rate of consumption of natural gas and reduce these regions’ dependence on other types of fossil fuels.

Regional energy challenges – Africa
The geopolitical issue is a critical uncertainty, while the continent has seen trade barriers and terrorism, which are considered as uncertain issues. Economic growth and energy poverty/access issues remain major concerns. Energy efficiency, renewable energy and energy prices are also viewed as requiring immediate, bold actions. However, climate change issues have been considered as a lower priority.

North Africa
In North Africa there is potential to increase gas production and exports. The region has large resource potentials, both conventional and unconventional, which need to be developed. Where there is a dependency on liquid fuel imports, domestic natural gas can play a significant role in reducing or removing government fuel subsidies.

Since 2004, when it returned to the international community, Libya has attempted to monetise its gas deposits. However, the country is still in a recovery mode following last year’s revolution. The lifting of US sanctions and the government’s offer of production-sharing agreements could help facilitate recovery.

Natural gas is a politicised issue in Egypt and new deals to export gas have been frozen for two years. To meet the need for exploration and development of resources, international companies have to be encouraged to invest by providing the right climate and facilities.

East Africa
With the recent huge discoveries offshore Mozambique and Tanzania, the future of African gas is expected to shift eastward. The region will have more potential if the currently limited gas activity in countries such as Sudan, Ethiopia and Uganda is stimulated by tackling infrastructure woes and political issues.
**West and Central Africa**

Known for its oil, the West African region has limited domestic markets for gas with most of the associated gas being flared. Flaring reductions and gas capture have recently been a focus in Cameroon, Gabon, Ghana and Equatorial Guinea.

In Nigeria, tribal and ethnic violence has frequently curtailed production and threatened foreign investment, while the development of a consistent government energy policy often appears to have been compromised by corruption and mismanagement. Export gas has taken precedence over domestic gas capacity building.

**Africa shale gas**

Substantial shale gas resources have been identified in Algeria, Libya, Morocco, Tunisia and South Africa.

**Regional energy challenges – Middle East**

The geopolitical issue is a critical uncertainty; other critical uncertainties include energy prices and the outlook for economic growth around the world. The region needs investment to cope with energy poverty or access issues, and ensuring electricity supply for air conditioning and desalination purposes is a priority. Energy efficiency is another issue that should be tackled, while the importance of renewables – such as solar – is growing.

The surge in domestic demand for gas in the Arab Gulf means it is no longer simply an additional export commodity. Indeed, a number of Arab Gulf states have turned into net importers of natural gas – often from Gulf neighbours – but recently also from international markets. As the political and security situation remains volatile in the region, it is rather difficult to expect a rapid increase in the resources available on the markets.

Iran has a high potential. However, the country is constrained by the USA’s Iran Libya Sanction Act and the nuclear standoff against the international community. Projects such as building a pipeline from South Pars in Iran into Iraq and then to Syria to feed the Arab Gas Pipeline have been discussed, but with no clear timetable for implementation, and seem unlikely to progress.

Iraq has high export potential, but gas is presently underdeveloped. Political instability remains Iraq’s biggest obstacle in monetising its gas reserves. Any future decision to export gas without domestic demand being fully satisfied is likely to be met by strong public opposition.

**What your aims are as Regional Coordinator?**

In the current triennium, IGU has been very keen to focus on developing areas in Africa and the Middle East. In particular, IGU is eager to encourage African countries to use gas to promote economic development at home, as well as exporting it. The IGU Management Team is asking for more concrete steps on Africa.

My position as the Regional Coordinator is a challenging and stimulating one due to the nature of these underdeveloped regions and the vast resources they hold. The region still contains huge amounts of gas resources waiting to be developed.

I am very privileged to be part of this worldwide Union where my main target is to work
for a better quality of life for all my fellow regional citizens while encouraging other non-active members in the region to enrol in more workshops, roundtable meetings and other forms of discussion. Support to members in Africa and the Middle East and the recruitment of new members in these regions is now my major focus.

How you plan to achieve them?
There is a huge amount of information and experience within the IGU community that can be shared with African and Middle Eastern countries. Assistance is already being provided to member and non-member states in the region. Different workshops and task force sessions as well as Executive Committee meetings have also been held in the region. We will continue to focus on workshops as well as conferences that connect us as regional players while transferring knowledge and debating issues. Hosting such events and workshops in different countries will give us the opportunity to meet other members and to share other experiences related to the industry.

Governments and international organisations such as IGU, the World Bank, IMF and UNIDO have a critical role to play. Collaboration and partnerships with the IOCs, big and small, will also be critical.

IGU is talking to institutions with an interest in Africa, such as the United Nations and the World Bank Group, to coordinate efforts in the energy sector. Their first and foremost role will be developing meaningful and practical master gas development plans that address:

- The upstream tax and licensing models;
- The necessary infrastructure issues and investments; and
- Social investment, as well as local training and job creation issues.

This work, aligned with a plan to develop an international legislative mechanism that governs long-term gas contracts, will help solve many geopolitical issues between countries in the MENA region as well as in all regions around the globe.

How do you see IGU membership expanding in your region?
In 2013, a third of countries in Africa and the Middle East are members of IGU. There are 12 Charter Members from Africa representing Algeria, Egypt, Libya, Morocco and Tunisia in North Africa and Angola, Cameroon, Equatorial Guinea, Gabon, Mozambique, Nigeria and South Africa in the sub-Saharan region. Currently, there are five Charter Members from the Middle East representing Iran, Oman, Qatar, Saudi Arabia and the United Arab Emirates, while Lebanon’s application to join will be considered by the Council in October.

The spotlight is now on southern and eastern Africa. In particular, the large gas finds in East Africa have put the region on the radar for energy firms and investors. Greater participation in IGU by African countries is vital so those countries new to the gas sector can learn from the experiences of others.

Potential new members from the region include Ghana, Iraq, Sudan, Tanzania and Yemen.

Khaled Abubakr, Chairman of TAQA Arabia, is the Regional Coordinator for Africa and the Middle East.

North and South America
A Q&A with Luis Domenech

What do you see as the major challenges facing the gas industry in your region?
The greatest challenge is regional integration due to the various geopolitical issues involved. Furthermore, it is important that countries in the region keep up with the development of the international natural gas market – for example, developing shale gas reserves in the region and implementing new technologies for better utilisation of natural gas, such as cogeneration projects and district heating/cooling (HVAC).
What are your aims as Regional Coordinator?
To establish a dialogue with all the countries in my region (Americas) in order to promote regional integration; and also the development of the natural gas market so that each country may tap into their comparative advantages.

This dialogue involves the players in all areas of the natural gas chain: exploration, production, transportation, marketing and distribution, including national governments and other agencies linked to the sector.

How do you plan to achieve them?
The first step is to establish a close relationship with the countries in my region by strengthening our ties with those which are already members of IGU, such as Brazil, Peru, Argentina, Colombia and Venezuela; and trying to bring countries that are not members to IGU such as Chile and Uruguay.

I will seek synergies and create a task force to work towards regional integration and the expansion of natural gas use.

Luis Domenech, President of ABEGÁS (the Brazilian Association of Piped Gas Distributors), is the Regional Coordinator for North and South America.

Russia-Black Sea-Caspian area
A message from Marcel Kramer
The Black Sea and Caspian region often serves as the centre stage for political deliberations about energy. Although the region brings together a multitude of players, the discussion is focused primarily on relations between Russia and the EU, and the latter’s desire to find a more diverse mix of sources for its energy needs.

The relationship between the different players in this energy-rich region is essentially mutually beneficial. Potential suppliers can look forward to more development and are willing to invest in the production of gas and its transmission to European markets. In turn, markets west of the Caspian and Black Seas are able to secure their energy needs through additional natural gas imports, while keeping CO2 emissions in check. Yet despite this potential synergy, political relations sometimes seem to have come to a stalemate.

In the realm of business, however, things have been moving. The region is home to some of the largest gas pipeline projects in the world, including Nabucco, Tanap, TAP and South Stream. Many of the biggest energy players in Europe are involved in projects around the Caspian and Black Seas in some way. The complexity and size of these projects require such a joint effort. Contrary to what policymakers may sometimes suggest, the gas industry in this region is in fact both a product and a driver of international cooperation.

IGU can play a key role in very much the same way. As a vehicle for cooperation between the different players in the international gas market, the organisation can bring about initiatives where traditional politics or institutions may not. It is the role of the Regional Coordinators to help strengthen relationships between national associations and networks that may turn into common projects.

Through my involvement in the South Stream project, I am a direct witness to the results that commercial joint initiatives can bring, as we work with Gazprom and a multitude of European partners to realise the 2,300km pipeline. As the Regional Coordinator for the Black Sea and Caspian, I aim to promote further dialogue and meetings between regional members, so that many more initiatives may spring from them. I invite all our members in the region to join this discussion and look forward to a fruitful and energetic exchange.

Marcel Kramer, Senior Counsel to the management of OAO Gazprom, is the Regional Coordinator for the Russia-Black Sea-Caspian area.
is emerging as a leader in the global LNG industry with the experience, skills and knowledge to safely deliver one of the world’s most important LNG projects.

The prudent and responsible development of energy resources has unmatched potential for driving economic activity, creating direct and induced employment and elevating societies to a higher standard of living. This is how Mozambique LNG views the transformational opportunity associated with the world-scale natural gas discoveries in the deep waters of Mozambique’s Rovuma Basin.

With well in excess of 35 trillion cubic feet of estimated recoverable natural gas discovered to date in the Offshore Area 1, and working in full cooperation with the government, Mozambique LNG is
advancing an onshore LNG park that, in future years, may be capable of producing 50 million tonnes of LNG per annum. The sponsoring companies are committed to sustainably developing this new strategic supply of energy in a manner that benefits the people of Mozambique, adhering to a social-investment framework that aligns with Mozambique’s Action Plan for the Reduction of Absolute Poverty, the United Nations Millennium Development Goals, with a focus on health, education and the environment.

To learn more about this world-class LNG project, its sponsoring companies and the shared vision of enhancing Mozambique’s future, visit: www.mzlng.com.
LNG 17 Sets New Record

By Mark Blacklock

The 17th triennial International Conference and Exhibition on LNG, jointly organised by IGU, the Gas Technology Institute (GTI) and the International Institute of Refrigeration (IIR), and hosted by the American Gas Association (AGA), took place in Houston, April 16-19. With a record 5,000 participants from 80 countries it was the biggest gas event of 2013, “showcasing the role LNG can play in an increasingly carbon-constrained world” as David Carroll, President and CEO of GTI and Vice President of IGU said at the opening ceremony.

The LNG 17 programme was broader in scope than previous conferences with innovations such as the Global Strategy Forum, and the working day was extended to accommodate over 300 speakers. The team of experts from around the world which developed the programme was chaired by Dr Nirmal Chatterjee, who has held the role since LNG 12, and supported by the CWC Group as conference organiser.

The accompanying exhibition managed by Exhibitions and Trade Fairs (ETF) also set a record for the event with 350 exhibitors.

Innovation has been a key driver of the LNG market since commercial trading started in 1964, and LNG 17 looked at the latest technical developments with a major focus on floating liquefaction. “The most exciting innovation of
New buyers and sellers – many of whom were represented at LNG 17 – will enter the market, which brought together 26 importers and 17 exporters in 2012. “We expect the number of importers to reach 40 countries by 2025 and the number of exporting countries to increase to 26,” said Richard Guerrant, Vice President for LNG at ExxonMobil Gas & Power Marketing.

“My view is that in five years Iran and Venezuela will emerge as new gas exporters,”

our time is floating LNG,” declared Andy Brown, Shell’s Upstream International Director.

Floating regasification has already increased the flexibility of LNG trading by making it easier for countries to join the ranks of LNG importers, while new sources of supply are being developed offshore East Africa and in the Eastern Mediterranean to add to the unconventional gas boom in North America and the forthcoming ramp-up of Australian production. End-use markets are also expanding and the transportation sector was another important focus of LNG 17.

Industry players were unanimous in their predictions of strong growth, particularly in Asia, once the current tightness in the market has eased. “There is huge scope for gas to increase its share of the energy basket in Asia,” said B.C. Tripathi, GAIL’s Chairman and CEO. “We expect global LNG demand to reach 370-400 mtpa by 2020,” said Chen Bo, Vice President of Sinopec subsidiary Unipec.

Meeting that rising demand is a challenge which requires industry players to work together. “It is only through partnerships between buyers and sellers that we can supply the market,” said Joe Geagea, Corporate Vice President and President of Chevron Gas and Midstream.
follow in November; from 2014 to the end of
the decade there will be major additions to
capacity including over 60 mt in Australia.

However, there was concern about rising
costs, notably in Australia where the impact of
increased demand for construction supplies and
skilled personnel has been compounded by a
rising exchange rate. “Cost is the Achilles heel
of LNG development,” said Daniel Yergin, Vice
Chairman of IHS and a member of IGU’s Wise
Persons Group.

Lessons have been learned from Australia.
On Curtis Island near Gladstone, for example,
three separate plants are being built alongside
each other. “As far as BG is concerned,
Gladstone will never happen again,” declared
Betsy Spomer, BG’s Senior Vice President, Growth.
“We intend to exploit all the synergies.”

Despite the concerns about rising costs,
bankers attending LNG 17 were keen to
emphasise that there is plenty of appetite for
funding the industry’s expansion. “There is no
shortage of debt finance,” said Robin Baker of
Société Générale’s Energy Group, who reviewed
a number of LNG project financings including
the $20 billion deal for Ichthys which closed in
December 2012.

Developing human resources is vital if the
gas industry as a whole is to prosper and
participants discussed the best ways to recruit
and retain skilled personnel. A social licence
to operate is also essential and there was
discussion of advocacy programmes so the
general public can gain a better understanding
of the gas industry and the role it plays in the
energy mix.

“Industry must engage directly with com-
munities to support its own commercial oppor-
tunities … we need you to step up,” urged
Gary Gray, Australia’s Minister for Resources
and Energy; while Hamad Rashid Al Mohannadi,
CEO of RasGas, called on IGU to redouble its
advocacy efforts. “We must ensure policy-
makers are aware of the benefits of natural
gas,” he said.

said Fereidun Fesharaki, Chairman of FACTS
Global Energy, who predicted that growing
demand for gas-fired power generation would
make the Middle East the number two LNG
importing region after Asia. “Saudi Arabia
alone could be a 20-30 mtpa market,” he said.

The slight contraction in global LNG trade to
236 mt in 2012 was due to shutdowns of exist-
ing trains combined with delays in new capacity
coming onstream. This year so far has seen the
start-up of Angola LNG and Sonatrach’s new
train at Skikda, with Arzew’s new train due to

Fereidoun Fesharaki: Middle East could become
the number two LNG importing region.

Daniel Yergin: cost is the Achilles heel of LNG
development.
More than just cargoes...

Since production started in 2000, we have delivered over 1,500 cargoes to customers from the plant in Sur, Oman, remaining a reliable supplier of liquefied natural gas that helps reduce carbon emissions and preserve the earth’s natural environment for future generations to enjoy.

In the years to come, our business will remain a reliable supplier of liquefied natural gas to the world as we help to shape Oman’s success story.
Pricing
But the hottest topic of all was pricing – will increased US exports indexed to the Henry Hub drive convergence of regional prices and a move away from oil-indexing? The first important variable is how many export projects will reach a final investment decision (FID), which in turn depends on permits issued by the US Department of Energy (DOE).

The DOE’s representative at LNG 17, Christopher Smith, Acting Assistant Secretary for Fossil Energy, didn’t give any indication in his address as to how many of the pending applications to export LNG to countries with which the USA does not have a free trade agreement (FTA) will be approved (exports to FTA countries are automatically entitled to permits). This is a pre-condition in most cases for FID as the only major FTA gas importer is Korea. However, Cheniere’s Sabine Pass liquefaction project gained non-FTA approval in 2011 followed by Freeport LNG a month after LNG 17, and they are likely to be joined by at least five more plants despite opposition from the US petrochemicals industry. This would give the US liquefaction capacity of around 70 mtpa and make it the world’s third largest LNG exporter after Australia and Qatar.

“The US will set a new competitive benchmark price for gas around the world,” declared Daniel Yergin, “the price threshold will be $12/mmBtu.”

Agreeing with the threshold, Betsy Spomer pointed out that “there is no such thing as cheap LNG”, as consumers in other regions cannot simply focus on the Henry Hub price, which in any case is rising from the very low levels of 2012; they have to add liquefaction and shipping costs.

Given a rough cost for liquefaction and shipping from the US to Europe of $4.3/mmBtu and to Asia of $6/mmBtu and allowing for an increase in the Henry Hub price to $5-6/mmBtu, the delivered prices would be comparable to current northern European market rates and offer a discount compared to Asian prices in the $16-17/mmBtu range.

“Japan suffers from oil indexation,” said Nobuo Tanaka, Global Associate for Energy Security and Sustainability at the Institute of Energy Economics and a member of IGU’s Wise Pricing

Betsy Spomer: no such thing as cheap LNG.

Nobuo Tanaka: new pricing formula is desirable.
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
ISO 14001 and 9001 Certified

BRUNEI LNG SENDIRIAN BERHAD
Lumut KC2935, Brunei Darussalam
Tel: +673 337 8015/6 Fax: +673 3236892
Email: enquiry@bruneilng.com
Website: www.bruneilng.com
A further factor to consider is the liquidity of the Asian market. “The challenge is to create an Asian hub for gas-to-gas competition,” said B.C. Tripathi, pointing to the need to develop more cross-border connections. Singapore, Asia’s latest importer has plans to develop LNG trading and there is a proposal to introduce an LNG futures contract on the Tokyo Commodity Exchange. “An Asian trading hub will be developed,” declared Shigeru Muraki, CEO of the Energy Solution Division of Tokyo Gas, but the consensus of opinion was that this would take time.

New supplies
Of course, strong Asian demand for LNG, led by China and India, will not just bring in new supplies from the US. Canada and Mozambique are looking to enter the market, while existing suppliers like Australia and Russia are increasing capacity.

Mozambique is targeting 2018 for the start of LNG exports following major discoveries in the offshore Rovuma Basin. “We are preparing a natural gas masterplan,” said the country’s Minister of Mineral Resources, Esperança Laurinda Bias as she briefed participants on the potential for future development.
“We see LNG as the most flexible tool to diversify sales and access new gas markets,” said Elena Burmistrova, Gazprom Export’s Deputy Director General for Oil and Gas Products, LNG and New Markets. “In 2012, Sakhalin 2 produced 10.8 mt, some 114% of nameplate capacity, and we are evaluating a third train.” She also said that the 10 mtpa Vladivostok LNG project, on which FID was reached in February, is a core project for Gazprom. Train 1 will enter service in 2018 and Train 2 in 2020 drawing on two separate supplies of gas: offshore from the Sakhalin 3 resources and onshore from East Siberia.

**Floating LNG**

Part of Australia’s new supply will come from the floating Prelude project and the development of FLNG is opening up new opportunities. Originally seen as a means of monetising stranded gas, FLNG is now “a compelling alternative to onshore liquefaction” according to Harry van der Velde, Shell’s Manager of FLNG Development.

Philip Olivier, President of GDF SUEZ LNG agreed, pointing out that a floating plant has less of an environmental impact than a shore-based one and that it is easier to control construction costs and maintain schedules in a shipyard than in a remote location. “There is reduced execution risk in a modern shipyard,” he said.

However, FLNG facilities face the challenges of a marine environment such as the response of processes to the motion of the vessel, corrosion and space and weight restrictions. “Meeting these challenges requires a mix of analysis, testing and innovation,” said Justin Bukowski, Lead Process Engineer at Air Products, while Frédéric Mollard of Technip’s Process and Technologies Division emphasised that, “for the successful operation of an FLNG vessel, it is most important to design the process from the wellhead to the liquefaction unit”.

The first floating liquefaction facility will be an inshore one on a barge moored to a jetty in Tolú on Colombia’s Caribbean coast. With a capacity of 0.5 mtpa, it will process gas brought by pipeline from the onshore La Creciente field operated by Pacific Stratus, a subsidiary of Pacific Rubiales. Black & Veatch’s Prico single-mixed refrigerant (SMR) technology will be used and Wison Offshore & Marine is building the barge for Exmar, which will operate it on a tolling basis for Pacific Stratus. Start-up is scheduled for early 2015.

Petronas will commission the first offshore FLNG project in late 2015. The Petronas facility...
with a capacity of 1.2 mtpa will be stationed 180km off Bintulu, Sarawak to process gas from the Kanowit field. It will use the Air Products AP-NTM nitrogen recycle process, and DSME and Technip have the engineering, procurement and construction (EPC) contract.

Meanwhile, Shell’s FLNG project, which was the first to reach FID, is set to start producing from the Prelude field, some 200km offshore north-western Australia, in 2017. The FLNG facility will be the world’s largest floating structure and has been designed to withstand a Category 5 cyclone. Technip and Samsung Heavy Industries have the EPC contract and it will use Shell’s dual-mixed refrigerant (DMR) technology to produce 3.6 mtpa of LNG together with 1.3 mtpa of condensate and 400,000 tpa of LPG. Harry van der Velde explained that the design can be adapted for lean fields with a 6 mtpa LNG configuration.

Shell sees great scope for more FLNG developments such as the Abadi project in Indonesia with Inpex, while Petronas is carrying out front-end engineering and design (FEED) for a second FLNG project of 1.5 mtpa to be located offshore Sabah. Other companies looking at FLNG include GDF Suez and Santos for their Bonaparte Basin project and ExxonMobil and BHP Billiton for the Scarborough field, both offshore Australia, Noble Energy for the export phase of its Israeli operations and Statoil for its Tanzanian discoveries.

**Transportation and small-scale LNG**

LNG’s breakthrough as a transportation fuel was evident at LNG 17 with a special section in the exhibition and a range of presentations on marine and trucking applications. “There was a lot of discussion at previous LNGs about the revolution on the supply side – there is a natural gas revolution on the demand side as well,” declared James Burns, Shell’s General Manager for LNG Transport Fuels in the Americas. “There has been a paradigm shift,” agreed John Hatley, Wärtsilä’s Vice President for Ship Power in the Americas, pointing to the economic and environmental benefits which are driving the use of LNG as a transportation fuel.
GTT: Solution provider for LNG

GTT, with 50 years of experience in the design of membrane containment systems for liquefied gas, is your Partner for all your LNG projects. More than two thirds of the LNG carrier fleet are equipped with GTT membrane technologies. GTT is concentrating on developments for the future use of LNG as a fuel for sea-going vessels.

As a world leader in LNG containment systems, GTT is ideally placed as a solution provider for the whole LNG chain (land/sea storage, distribution by feeder or barge, bunker tanks, offshore platforms, etc.).

GTT is ready to accompany you on the seven seas.
Participants discussed developments in small-scale liquefaction aimed at improving the cost-effectiveness of plants supplying service and bunker stations such as GE’s LNG in a box system, the launch customer for which is Gasfin in Europe, and Shell’s movable modular LNG solution (MMLS), which is being used to support two LNG corridors in the US and one in Canada.

Shell also claimed that combining MMLS units offers a cost-effective way to provide export capacity. Each unit has a capacity of 0.25 mtpa and up to 10 will be installed at the existing import terminal on Elba Island in Georgia, USA. Phase 1 of 1.5 mtpa (i.e. six MMLS units) is based on exports to FTA countries. Expansion to 10 units will depend on approval to export to non-FTA countries.

**Looking forward to LNG 18**

Back in 2007 when the US was chosen to host LNG 17 it was expected to become a major LNG importer with an urgent need for new regas terminals. The unconventional gas revolution reversed the situation and now the rush is to develop liquefaction capacity. “I am struck by how often the unexpected has changed the global energy industry,” said Daniel Yergin.

Participants were only too aware that unexpected events might affect the LNG business in the run-up to 2016, when LNG 18 will take place in Perth, Australia, but were confident that the industry has built up sufficient robustness and flexibility to see it through a myriad of challenges.

However, one thing is certain. Part of the proceeds from LNG 17 will go towards an AGA scholarship fund for students interested in pursuing a career in the gas industry. It is anticipated that more than 200 students will receive scholarships over the next five years.

*Mark Blacklock is the Editor-in-Chief of International Systems and Communications.*
As the natural gas industry continues to grow, the workforce is maturing creating a challenge for all segments to meet resource demands. According to the US Center for Energy Workforce Development, by 2015, 36% of workers considered critical to the utility industry alone may need to be replaced due to retirement or people leaving the workforce for other reasons. Another 16% could leave by 2020.

Recognising the shortage of skilled workers for the natural gas industry, the American Gas Association (AGA) announced the creation of a $1 million scholarship programme at LNG 17. AGA designated a portion of the proceeds from LNG 17 to be directed towards this scholarship programme to help support students interested in pursuing a career in the natural gas industry.

Students seeking a career in trade jobs that are in high demand in the natural gas industry such as, Welding, Pipefitters, Mechanical/Petroleum/Chemical Engineering, Engineering Technologies/Technicians, Heating, Ventilation and Air Conditioning technicians and more specific natural gas programmes such as Gas Utility Construction and Service will be eligible for a scholarship. AGA anticipates more than 200 students will receive scholarships over the next five years. More than two dozen colleges and universities from across the United States have been selected to participate.

“Natural gas is the foundation fuel for a clean and secure energy future and an economic revitalisation for our country. We are making an investment in helping to develop a skilled workforce capable of maintaining the 21st century technology that transports and utilises this clean energy source serving the needs of more than 177 million Americans,” said Dave McCurdy, President and CEO of AGA. “Our commitment will help ensure the continued vitality of the American workforce and solidify the legacy of this transformation in American energy.”

The AGA Scholarship programme was unveiled at a press conference at LNG 17. McCurdy was joined by David Carroll, President and CEO of GTI and Vice President of IGU, David McClanahan, President and CEO of CenterPoint Energy and Eloise Dunn Stuhr, Vice President and Vice Chancellor for University Advancement with the University of Houston and UH System. The University of Houston will be one of several universities participating in the scholarship programme.

AGA, founded in 1918, represents more than 200 local energy companies that deliver clean natural gas throughout the United States. There are more than 71 million residential, commercial and industrial natural gas customers in the US, of which 92% — more than 65 million customers — receive their gas from AGA members. AGA is an advocate for natural gas utility companies and their customers and provides a broad range of programmes and services for member natural gas pipelines, marketers, gatherers, international natural gas companies and industry associates. Today, natural gas meets almost one-fourth of US energy needs.
Bankers had the reputation of always looking for new deals. The global credit crunch and the fallout from the collapse of Lehman Brothers in late 2008 put an end to that – for a while at least. Bankers became more concerned with keeping cash inside their banks and not lending it out. That is until the LNG mega-project came along.

The last year has seen a remarkable rise in the lending activities of debt financiers in the global LNG sector. In 2012, two projects in Australia – Australia Pacific LNG and Ichthys LNG – raised a staggering $28.5 billion in project debt. At $20 billion, Ichthys was the largest single project financing ever. Into this year, Cheniere Energy Partners raised $5.9 billion for its Sabine Pass scheme in Louisiana, USA. And Bonny Gas Transport raised $1.4 billion to fund six ships which serve the Nigeria LNG scheme.

This article will look at the key financing themes from these deals. It will then review the host of new LNG financings which are looming to keep the boom going – in North America and East Africa.

Banks have been constrained in their lending since autumn 2008. Liquidity, i.e. access to funding, has returned to the financial sector over the last year but, faced with the task of financing the two large schemes in Australia last year – many believed the financial markets could not cope. The fact that both deals were done, in the same year and involving record sums, is down to a number of factors.

The first is that LNG has always been popular with banks. For one, the promoters of LNG schemes are usually large energy corporates and therefore they are key core clients for banks – an important consideration when banks are seeking good reasons not to lend. The financial strength of these corporates is a factor too. The companies can provide the credit standing needed to back a major project. A main risk on an LNG scheme is construction. Banks like LNG projects because during the construction phase, construction risk is taken by the project developers.

The second reason is that once the project is built, banks continue to like LNG schemes. The projects are backed by long-term gas sales agreements with buyers – utilities normally – who have a good credit standing in their own right. Indeed, on many large-scale LNG projects, the energy companies and the utilities combine to form the project sponsor group. This strengthens the consortium and doubles the pool of banks available to fund a deal with client banks of both the energy companies and utilities.

And it does not stop there. A third reason is that governments play an important role in the financings. For countries lacking their own gas, or indeed any energy resources at all, ensuring national gas supplies is a strategic imperative. Japan is a leading example. It has long been the world’s leading LNG buyer. The Fukushima nuclear disaster made LNG imports even more important as Japan raced to fill the gap left by the nuclear shutdown. Japan is willing to use its own government agencies, aligned with its gas buying utilities, to fund overseas projects which bring gas into the country.

For other countries, equipment orders on LNG schemes are vital. South Korea is a leading example. Its construction industry, partly helped by a favourable exchange rate, has become the main source of supplying the engineering,
procurement and contracting (EPC) services to the global projects market. It backs up competitive EPC prices with competitive financing packages from its government agencies.

**Australia**

If we consider the two Australian projects, we can see how these themes – resource and equipment contracts – came together in the project financings.

Queensland’s Australia Pacific LNG (AP LNG) is sponsored by ConocoPhillips, 37.5%, Origin Energy, 37.5% and Sinopec, 25%. All three provided standard construction guarantees on the project. In addition, AP LNG was one of the first LNG projects to be supplied by coal-bed methane (CBM) fields – and as such extra protections were given to the project company to guarantee the supply of gas by the sponsors. The $8.5 billion financing only funded the LNG processing plant, not the CBM fields. The gas sales agreements are with Sinopec into China, for 7.6 mtpa, and a smaller contract with Japan’s Kansai Electric for 1 mtpa.

In order to raise the project debt, interested governments and banks were called upon. Given ConocoPhillips’ involvement in the scheme, plus the fact that Bechtel is the lead contractor on the project – US Exim, the export credit agency (ECA) of the USA provided a $2.9 billion loan to the project. Given Sinopec’s involvement as a buyer of the gas, China’s ECA China Exim provided a $2.8 billion loan.

This left the commercial banks needing to supply “just” $2.8 billion. In the credit-squeezed environment of early 2012, this was a substantial task, particularly given the fact that the loan tenor was 16-17 years, a long period of time for banks to tie up capital these days. In the end 15 banks – a mix of local, European and Japanese institutions – joined the deal, attracted by a lending margin of 2% over libor moving up to 2.5% to 3.5% and debt arranging fees of 2%. There was a sting in the tail, however. It emerged China Exim, the government agency, received 4.25% on its loan. And only one Chinese commercial bank, Bank of China, came into the deal.

At $20 billion, Ichthys was the largest single project financing ever. Site preparation for the plant is underway at Blydlin Point, Darwin and operations are due to start in 2017.
For Ichthys, the quantum of debt required was more than double that for AP LNG. The project had many factors in its favour, however. Firstly the processing plant will be supplied via a pipeline from a conventional gas field – not CBM fields – 890km off the coast of northern Australia. Secondly, the scheme is being developed by Japan’s Inpex – the company spun out of Japan National Oil Corporation (JNOC) and listed on the Tokyo stock market in 2004. It has a 66% stake in the project. France’s Total, an experienced LNG project developer, is its partner, taking a 30% stake. And thirdly, the gas buyers are Japanese utilities, who are taking 60% of the gas and investing in small stakes in the project company. Taiwan’s CPC is buying 20% and Inpex and Total are buying the rest. In addition, the project will have substantial revenues from LPG and condensates.

The project company needed to raise $20 billion in project debt. A variety of funding sources were utilised incorporating commercial and national finance. The first $4 billion came via sponsor loans, showing again the importance of strong sponsors to a financing. These loans are in addition to the equity of around $14 billion the sponsors are putting in. However, the sponsor loans can be raised by sponsors from other sources and then on-lent to the project. Total raised the funds for its sponsor loans from commercial banks as a corporate loan.

The other $16 billion came from a mix of ECA and bank sources. There was $5.8 billion of direct loans from three ECAs. Japan’s JBIC lent $5 billion, its largest single loan, to help secure the gas supplies, South Korea’s Kexim lent $80 million on the back of EPC contract work for Korean contractors and Australia’s EFIC chipped in with $150 million. There was a further $5.4 billion of commercial bank debt guaranteed by ECAs backing equipment supply contracts – Japan’s Nexi, $2.75 billion, France’s Coface, $228 million, Korea’s Kexim and K-Sure, $1.3 billion, Germany’s Hermes, $544 million and The Netherlands’ Astradius, $578 million.

The rest of the debt came from the commercial banks, $4.8 billion – a huge sum, particularly given the credit crunch was still a factor in...
All this in our pipeline

The National Gas Company plays a major role in the development of Trinidad and Tobago’s natural gas sector and by extension our country’s growth and development. Our contributions enable T&T to enjoy a quality of life that is envied by many developing countries worldwide. We see our responsibilities to the nation as being a major driver of our values, mission, vision and strategy, as we set our sights on the future.
2012. The loan runs for 16 years, and as we have seen on AP LNG, that is a long time to tie up bank capital. The margin on the commercial loan is 2.4% over libor during the construction phase and then stepping up to eventually end at 375 basis points. These margin step-ups are put in place to encourage the project sponsor to refinance the debt before it gets to year 16. The fees are around 2.5%. The margins on the ECA covered debt vary, depending on the credit standing of the ECA’s sponsoring government, but they were around the 2.2% mark with fees at 2%. The bank debt was provided by a mix of Australian, European and Japanese banks.

The lenders benefitted from sponsor guarantees during the monster construction phase, via debt service undertakings – that is, guarantees to pay the debt service in case there are construction problems. Inpex, as a strategic Japanese corporate, was able to back $2 billion of its debt service obligations from national sources via another state-owned entity, Japan Oil, Gas & Metals National Corporation (JOGMEC). It was set up in 2004 to provide guarantees to Japanese corporate borrowings in relation to oil and gas exploration and production projects.

**North America**

If 2012 was about Australia in the LNG finance market, 2013 is about North America and East Africa. The opportunities are huge – for shale gas linked projects in North America and for conventional gas projects in East Africa. These projects take time to pull together, however, and thus far only one has been financed, albeit a trail blazer.

Cheniere Energy Partners has been a regular user of the capital markets. The project company initially raised debt to back its LNG import terminal scheme in Louisiana, in the days when the US was expected to require increasing imports of gas. The boom in domestic shale gas production meant that business model did not work out too well and now Cheniere, backed by Blackstone, is adding liquefaction capacity to turn the Sabine Pass terminal into an LNG export facility. Last year the company raised $2.5 billion in debt solely from commercial banks and this year, it upped the size of its bank facilities by a whopping $5.9 billion.

The new 2013 deal was a mix of national finance and commercial bank debt. Korea’s Kexim and K-Sure provided commitments of $1.3 billion to the project financing. This time, their involvement was not on the back of equipment contracts but based on the involvement in the project of Kogas, which is buying some of the project’s LNG.

The bank debt was provided by 17 banks, a mix of American, European and Japanese banks. Pricing was in the 3% range with fees at 40% of the margin. The deal had an important new feature, which could set a trend for other LNG financings.

In the North American loan markets, loan tenors are much shorter than elsewhere. On Cheniere the tenor is seven years. The loan is not fully repaid and instead the sponsor relies on refinancing the loan before maturity. ECAs do not like this structure. They want the loan to fully amortise during its stated period and they want the commercial banks to come in on the deal on the same terms. Given the attractiveness of ECA finance, the ECA’s view usually prevails. However on Cheniere, for the first time, Kexim and K-Sure came into the financing on the mini-perm, i.e. short-term loan structure. Given the number of LNG projects in North America lining up for finance, it will be interesting to see if this new financing model prevails.

Another feature of Cheniere is the fact it has been raising further debt packages via the bond, not loan, markets. Given the issues in the global banking sector, using bonds has become an attractive option. Just before its project financing was completed, Cheniere raised $3 billion of debt in the bond market at 5.625%. There are pros and cons to using bank and
bond debt. Banks are said to be more flexible while the bond market offers a huge pool of liquidity, particularly in a low interest rate, quantitative-easing backed environment. And bonds are often used to refinance bank debt on projects. The Sakhalin 2 LNG scheme in Russia, for instance, is looking at a bond refinancing.

That said, the next financing in North America is likely to be traditional project financing with no mini perms and no bonds.

The sponsors of the Cameron LNG scheme – Sempra, Mitsubishi and Mitsui – are already talking to JBIC about a Japanese-backed deal. The $6 billion Louisiana export project will involve gas sales to Japan with JBIC and the Japanese banks supplying long-term finance. JBIC is one of the biggest ECAs with perhaps the biggest cheque book, and it is not keen on too much financial innovation.

There are a whole range of US and Canadian schemes seeking to move forward. The stumbling block currently is obtaining export licences from the governments. If and when they do go ahead they will create a whole new range of financing issues, not least of which is whether to bank a deal based on a Henry Hub gas price or an oil-linked price.

**Africa**

Nigeria is Africa’s largest LNG exporter and a range of financings have been secured over the years on the country’s seven-train Nigeria LNG scheme. This year the project’s shipping arm, Bonny Gas Transport, raised $1.4 billion in seven- and 12-year debt, priced at 3% and 3.5% above libor, from a syndicate of international banks to help pay for six new ships. The Korean ECAs – Kexim and K-Sure – were involved again, this time backing ship-building contracts.

In East Africa, the LNG excitement is just beginning. Huge new gas finds off Mozambique and Tanzania have led to much talk of new LNG industries being created in these countries. The excitement is attracting the regular LNG market players – oil majors and explorers, gas buyers, equipment suppliers and financiers. Indeed, for the gas buyers opening up another new supply area can only be beneficial – giving them the chance to have competition for their
Bharat Petroleum and Videocon last year raised standby letter of credit (SBLC) facilities to back their involvement in the upstream gas developments in Mozambique. These SBLC facilities are provided by Indian banks, led usually by State Bank of India, or by overseas banks as foreign currency loans, backed by Indian SBLCs. Bharat Petroleum raised around $1 billion in this way priced at 2.75% to 3% while Videocon obtained more than $2 billion, priced at around 3.25%. India is expanding into the global LNG arena and so are its banks.

There promises to be no let-up in the financing activity for LNG projects around the world. As we have seen, the finance will come from a mix of the project sponsors, commercial banks, the bond markets and governments seeking to secure, on the one hand, gas supplies from the projects and on the other, equipment contracts on the projects. It is going to be an exciting and varied time for the LNG finance marketplace.

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

Bonny Gas Transport has raised $1.4 billion to help pay for new ships.

Mozambique has the largest finds and work on the LNG projects is still at an early stage. Financing activity has started. On the Area 1 gas fields Anadarko is leading the consortium with a 36.5% stake. It has appointed Société Générale as its financial adviser, the first step in the financing process. Other shareholders include Mitsui from Japan, PTT from Thailand, India’s Bharat Petroleum Corp and ONGC, which recently bought its stake from Videocon.

On the Area 4 gas fields, the Eni-led team is – at the time of writing – seeking to appoint a financial adviser. Galp and Kogas are fellow shareholders and CNPC is set to take a stake. In addition, the local state oil and gas company ENH is currently seeking a financial adviser for a mandate which will be funded by the World Bank’s technical assistance programme. ENH has stakes in both schemes. Eventually the projects will be combined into one scheme.

Despite being in the early stages, loans on the projects have already been arranged. Both Bharat Petroleum and Videocon business. While LNG is a sellers’ market at present, it could switch to a buyers’ market, creating new headaches for financiers.

business. While LNG is a sellers’ market at present, it could switch to a buyers’ market, creating new headaches for financiers.
FBM Hudson Italiana, established in 1941, is a worldwide leading manufacturer of Process Equipment for the Oil & Gas and Petrochemical sectors. Specialising in the research, design and manufacture of Air Cooled HE - Steam Condensers - Shell & Tube HE - HPHE Urea/Ammonia – Process Gas Waste Heat Boilers - Special Tubular Reactors.

FBM Hudson Italiana hold proven and trusted experience and, in the perspective of the ever growing global demand for LNG, have developed a new modular concept in particular for Air Cooled HE.

FBM Hudson Italiana boasts its position as a leader in thermal design thanks to the optimisation of fans’ air side performance (i.e. different blades, linear or twisted blades, etc.) along with the optimisation and integration of steel structures, strictly in compliance with clients’ specific requirements.

The long construction time, as well as the high cost and/or limited availability of manpower at site, have prompted the introduction of pre-assembled units to the market as a way to significantly reduce the timing and logistics of plant installation.

Our extensive experience in this area allows us to tailor-make equipment according to clients’ specific objectives and by studying enhanced and innovative solutions. This involvement has led us to improving performance in the evolution of modularisation, which aims at obtaining bigger and bigger modules by extending the inclusion of pre-assembled components.

Therefore not only the AFC modules alone, but also complete pipe-rack, piping, instrumentation, walkways, valves, lighting system can be now considered as a whole and unique multibay pre-assembled module.

FBM Hudson Italiana, working closely with major EPCs, has met the challenge in moving to world-class projects, using advanced technology to power an “off the shelf” design & technology modularisation concept. This new concept leads to faster construction and faster LNG to market, while also maximising field construction by fostering a “plug and play” solution.
Is FLNG the Future for Liquefaction?

By Alex Forbes

Once seen primarily as a means of monetising remote stranded natural gas, FLNG is increasingly seen as a way of tackling arguably the biggest challenge the LNG industry faces: the eye-watering escalation in the construction costs of onshore liquefaction. If the capital expenditure figures that some developers are claiming turn out to be achievable, floating liquefaction could be the biggest LNG game-changer of our time.

South Korea’s Geoje Island is an extraordinary place. Home to two of the world’s largest shipyards – one owned by Samsung Heavy Industries (SHI), the other by Daewoo Shipbuilding and Marine Engineering (DSME) – its economy is dominated by shipbuilding.

Both shipyards have played a major role in the development of the LNG industry. It is in their vast dry docks that many of the world’s largest LNG carriers and FSRUs (floating storage and regasification units) have been fabricated. Today it is in these mighty and impressively efficient yards that what could prove to be the future of liquefaction is taking shape.
Last May, in the number 3 dry dock at SHI’s shipyard at Gohyeon, the shareholders in the Shell-led Prelude LNG FPSO (floating production, storage and offloading) project – which include Japan’s Inpex, South Korea’s Kogas and Taiwan’s CPC – celebrated the laying of its keel. When completed, Prelude will be the world’s largest-ever floating structure and by far the largest FLNG project to have made it off the drawing board.

Weighing 600,000 tonnes when fully ballasted, Prelude will be 488 metres long by 74 metres wide. Its turret mooring system, 93 metres high, is currently under construction in Dubai and will be transported to Gohyeon in five parts, to be fitted vertically through the hull at one end. Once moored above the Prelude field, 475 kilometres north-east of Broome in Australia, using four sets of anchor lines, the turret will allow the hull to rotate with the direction of the wind. The whole assembly has been designed to withstand Category 5 cyclones, so it will be able stay on station in even the worst of metocean conditions. It will be capable of producing 3.6 mtpa of LNG, 1.3 mtpa of condensate and 0.4 mtpa of LPG – giving total liquids production of 5.3 mtpa.

If all goes to plan for Shell and its strategic FLNG technology partners – SHI and Technip – Prelude will be just the first of a series of similar facilities. A version being developed to monetise dry gas fields, rather than the liquids-rich Prelude and Concerto fields, will have gas liquefaction capacity of 6 mtpa.

Only a short drive from Gohyeon, at the DSME shipyard at Okpo, another mammoth LNG FPSO project is under construction for Petronas. Though less ambitious than Prelude, with a liquefaction capacity of 1.2 mtpa, the Petronas FLNG 1 (PFLNG 1) project is still huge, with a length of 300 metres, a width of 60 metres and capable of storing 180,000m$^3$ of LNG. A ceremony to celebrate steel-cutting for the hull was held in June.

Both projects claim to be world firsts – and each is in its own way. Prelude was the first
**A sea change for FLNG**

Floating LNG has been decades in development. When Shell announced FID for Prelude in May 2011 it revealed that it had spent hundreds of millions of dollars and 1.6 million man-hours on the engineering design. The new technology includes LNG tanks that can handle sloshing, close coupling between the producing wells and the LNG processing facility, LNG offloading arms, water intake risers, mooring systems, and the marinisation of processing equipment such as absorption columns and the main cryogenic heat exchangers. Shell says all of these technologies have been extensively modelled and tested to ensure they can operate safely and efficiently in a marine environment.

However, in commercial terms, it is only now – with real projects coming to fruition – that the full potential of FLNG technology is becoming apparent.

But attitudes towards FLNG have changed radically in the past year or two. Almost certainly the biggest factor driving this change has been the ballooning cost of onshore liquefaction development, notably in Australia, where capital expenditure is now an order of magnitude greater than for the projects that were FLNG project to reach final investment decision (FID), back in May 2011, but because of its size and complexity is not expected to begin operations until late 2016 at the earliest and more probably 2017. Meanwhile, DSME plans to deliver the Petronas FPSO in June 2015, in time for the start of operations before the end of the year. This means that PFLNG 1 will be the first LNG FPSO to be deployed a long way offshore – 180 kilometres offshore Sarawak at Malaysia’s Kanowit field.

Indeed, Petronas is planning a second FLNG project – PFLNG 2 – which is currently in front-end engineering and design (FEED). If FID is reached before the end of this year, as planned, that too could conceivably come on stream before Prelude, in 2016.

The accolade of first-ever FLNG project to come on stream will almost certainly go to a much smaller facility to be deployed in Colombia. Belgian shipping company Exmar announced in March last year that it had signed an agreement to provide a floating liquefaction, regasification and storage unit (FLRSU) – which it will own and operate on a tolling basis – for a subsidiary of Canada-based Pacific Rubiales Energy. The non-propelled barge, with liquefaction capacity of 0.5 mtpa and storage capacity of 14,000m³, will be moored to a jetty and supplied with gas from the onshore La Creciente gas field.

Currently under construction at a shipyard at Nantong in China, owned by Shanghai-based Wison Offshore & Marine, it is expected to come on stream in early 2015. It passed a significant construction milestone at the beginning of July with the laying of its keel.
WE’RE REACHING NEW GAS RESERVES WITH THE FIRST FLOATING LNG FACILITY.

WORK FOR THE MOST EXCITING ENERGY COMPANY IN THE WORLD.

TO JOIN OUR WORLD-CLASS TEAM, VISIT WWW.SHELL.COM/TECHNICAL
Is FLNG the Future for Liquefaction?

Field may be a competitive proposition versus an onshore LNG plant.”

It was a message echoed, often in stronger terms, by several other companies working on FLNG projects. They included Excelerate Energy, which is planning a near-shore project in the United States, and Pangea LNG, a company headed by former Excelerate CEO Kathleen Eisbrenner, which is pursuing FLNG projects offshore Israel and near-shore in the United States.

“Competitive . . . in almost every scenario” Excelerate’s CEO, Rob Bryngelson, believes that floating liquefaction has a much brighter future ahead of it than many in the industry realise: “The market has the same perception of floating liquefaction that it did initially on floating regas, which is that it’s only for specific applications, such as stranded gas that you can’t reach with other means. But if we truly can deliver at the numbers that we say we can, then FLNG becomes competitive with land-based liquefaction in almost every scenario. It really could change things in terms of much quicker times to construction, and much better cost control.

“If you want to build an LNG project in a remote location, you have to go in and spend
Customised Contract Publishing Solutions

International Systems and Communications Limited (ISC) was set up in 1991 to offer a high-quality, customised publishing service for event-linked, commemorative and annual publications. Today’s prestigious client base is testimony to a business philosophy based on quality and a flexible approach.

- **CLIENTS**
  Organisations including the World Petroleum Council, International Telecommunication Union, United Nations Conference on Trade and Development, Universal Postal Union and the Secretariat General of the Gulf Cooperation Council have contracted ISC to produce publications.

- **QUALITY**
  Experienced editing, production and sales team; editorial contributions from respected journalists and international figures; and high-quality production standards.

- **FLEXIBILITY**
  We tailor our services to meet your requirements ranging from an advertising sales and printing contract to a full turnkey operation including multiple language editions.

- **DELIVERY**
  On-time performance; international distribution.

- **SERVICE TO ADVERTISERS**
  Targeted access to an international audience of influential decision-makers; full design and production service available for advertisements.

For all your contract event-linked, commemorative and annual publishing needs contact Nigel Ruddin, Publisher or Robert Miskin, Publications Director at:

**ISC LTD**
Park Place
12 Lawn Lane
London SW8 1UD, UK
Telephone: + 44 20 7091 1188
Facsimile: + 44 20 7091 1198
E-mail: general@isyscom.com
Website: www.isyscom.com
Is FLNG the Future for Liquefaction?

Excelerate worked closely with SHI, which is to build the hull, and Black & Veatch, which will do the topsides. Not surprisingly, the company has encountered scepticism. However, says Bryngelson: “We’ve had three or four groups come through and do detailed due diligence work on our floating liquefaction. They’ve come in being sceptical and they’ve left being convinced it works.”

There continues to be great interest in the economics of Prelude, but Shell has been playing its cards close to its chest on costs. There has inevitably been a great deal of speculation within the industry about the capital expenditure involved and the general consensus appears to be a range of $10-12 billion for the entire development (but excluding the cost of tying in the Concerto and Crux fields at a later stage). That suggests a figure of around $6-8 billion for the FPSO alone, which for a 6 mtpa dry-gas version of Prelude would suggest a specific capital cost of around $1,000-1,300/t/y (see Figure 1).

The message from Eisbrenner was similar to Bryngelson’s and – like Bryngelson’s – stressed the importance of leveraging the capabilities of South Korea’s great shipyards. Indeed, the company of which she is CEO, Pangea LNG, is 70%-owned by DSME.

“While floating regas has had a very significant impact over the last decade,” she said, “I believe that floating liquefaction is going to have the potential for very significant impact over the next decade.”

Posing the question of whether it was time for a new model in the liquefaction side of the LNG business, Eisbrenner presented a chart (see Figure 2) comparing specific capital costs for land-based, large-scale offshore, and small-scale offshore/near-shore projects.

“The message from Eisbrenner was similar to Bryngelson’s and – like Bryngelson’s – stressed the importance of leveraging the capabilities of South Korea’s great shipyards. Indeed, the company of which she is CEO, Pangea LNG, is 70%-owned by DSME.

— Figure 1.
than the metric of how much per tonne is the absolute magnitude of the dollars. It’s daunting. There are only a handful of companies that can afford to pursue these kinds of projects . . . So what we are looking to do, with our partners, is to establish a new model where we find much less expensive opportunities to monetise mid-scale sizes of gas, perhaps in the $750-1,500/t/y range.”

A growing list of credible contenders – for projects and technology
While there are still only three FLNG projects under construction, the list of credible projects at various stages of planning and development continues to grow.

Shell, not surprisingly, is involved in several of them, including the Inpex-led Abadi project in Indonesia, and planned projects for its Prelude technology in Australia that include Sunrise (assuming that Australia and East Timor are able to resolve their political difference over the proposed project) and, of course, Browse, depending on what the politicians and project sponsors eventually decide.

Petronas, as we have seen, hopes to reach FID on PFLNG 2 before the end of this year. If it goes ahead it will be larger than PFLNG 1 with liquefaction capacity of 1.5 mtpa.

Exmar has signed a cooperation agreement with Wison and Black & Veatch, which is supplying the liquefaction technology for the Pacific Rubiales project, to pursue further FLNG projects, the first of which could well be a 1 mtpa facility for EDF Trading, for deployment in the United States.

Pangea LNG’s Tamar project passed an important milestone earlier this year when it began FEED and signed a 20-year Heads of Agreement with Gazprom for the whole offtake from the project, and the company continues to pursue a near-shore LNG project in the United States.

Other potential projects still in the early stages include GDF SUEZ’s Bonaparte proposal for Australia, and the Scarborough project recently announced by ExxonMobil and BHP, which would be even larger than Prelude. There are several more near-shore projects planned for the US, as part of the great LNG export stampede that is under way there.

We are also seeing the emergence of clear leaders as technology, equipment and engineering companies jostle for position in what looks likely to become a large and lucrative business. At the forefront are the South Korean shipyards for the hulls, Air Products and Black & Veatch for the liquefaction processes and equipment, and Technip, involved in both Prelude and PFLNG 1, for the engineering of the topsides.

FLNG may have been a long time coming – but it is clear that the long wait will soon be over. What we have yet to see is whether its proponents will be able to deliver on their cost promises.

Alex Forbes is an independent journalist and consultant who has been reporting on energy developments and analysing trends for three decades.
Expanding into Uncharted Waters: World’s First FLOATING LNG

PETRONAS is poised to be a significant player in the gas landscape of the next two decades and we are at the forefront of efforts to meet the world’s growing demand for energy. In line with our journey to further strengthen our position as a major LNG player, PETRONAS is aggressively expanding into the uncharted waters of Liquefied Natural Gas (LNG) floating vessels to monetise stranded gas in small and scattered conventional fields.

Aiming to be the first of its kind in the world, PETRONAS’ FLNG 1, with a capacity of 1.2 million tonnes per annum (mtpa) offshore Sarawak, is targeted for commissioning in 2015. PETRONAS FLNG 2 with a larger capacity of 1.5 mtpa is scheduled to come onstream a year later offshore Sabah. This project forms part of PETRONAS’ long-term growth strategy as natural gas is becoming increasingly important for power generation in the region and globally.

Designed to extract natural gas from offshore wells, liquefy and store it for later transport, PFLNG will access and process natural gas into LNG which will be sold domestically, in Peninsular Malaysia and other designated areas at prevailing market prices. The LNG will be marketed by PETRONAS LNG Limited (PLL).

This ground breaking facility will also enable PETRONAS to monetise upstream stranded gas assets and eliminate high costs associated with the construction of infrastructure such as subsea pipelines involved in getting the gas to shore.

The knowledge and technical expertise gained from the PFLNG project will also enhance PETRONAS’ institutionalised core capabilities to develop floating facilities as a solution or technology to monetise gas reserves offshore.

We have awarded the Engineering, Procurement, Construction, Installation and Commissioning (EPCIC) contract for PETRONAS Floating LNG 1 in May 2012, targeted for completion by quarter four 2015 while the Dual FEED for PETRONAS Floating LNG 2 was awarded in June 2012.

Together with PETRONAS’ strong track record in integrated oil and gas operations and other significant LNG projects being undertaken, we aim to retain our current position as one of the major LNG players in the world.

In Malaysia for example, we are constructing another train at the PETRONAS LNG Complex which will increase its capacity by 3.6 mtpa while our first regasification facility RGT 1 was also commissioned. Utilising new technology in our ventures in shale gas in Canada and coal bed methane in Australia, we are making conscious efforts to focus on pursuing value driven and sustainable growth.

At PETRONAS, we continue to seek new opportunities to access hydrocarbon resources efficiently and effectively. Technology is the key enabler as the search for hydrocarbons becomes more challenging and with the PETRONAS’ first Floating LNG, we are doing just that.

We have awarded the Engineering, Procurement, Construction, Installation and Commissioning (EPCIC) contract for PETRONAS Floating LNG 1 in May 2012, targeted for completion by quarter four 2015 while Dual FEED for PETRONAS Floating LNG 2 was awarded in June 2012.
# PFLNG 1 & 2 HIGHLIGHTS

<table>
<thead>
<tr>
<th>Location</th>
<th>PFLNG 1</th>
<th>PFLNG 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coast of Sarawak 180km offshore</td>
<td>Coast of Sabah 240km offshore</td>
</tr>
<tr>
<td></td>
<td>Bintulu (Kanowit Gas Field)</td>
<td>(Rotan Gas Field)</td>
</tr>
<tr>
<td>Train Capacity</td>
<td>1.2 MTPA</td>
<td>1.5 MTPA</td>
</tr>
<tr>
<td>LNG Offloading</td>
<td>Cryogenic marinated loading arm</td>
<td></td>
</tr>
<tr>
<td>FLNG Mooring</td>
<td>External Turret Mooring</td>
<td></td>
</tr>
<tr>
<td>LNG Carriers Mooring</td>
<td>Side-by-side</td>
<td></td>
</tr>
<tr>
<td>Water Depth</td>
<td>200 meters and below</td>
<td>More than 1000 meters (deepwater)</td>
</tr>
<tr>
<td>Design Life</td>
<td>20 years for both Hull and Topside</td>
<td></td>
</tr>
<tr>
<td>Partnership</td>
<td>EPCIC contract awarded to</td>
<td>EPCIC is scheduled to be awarded post</td>
</tr>
<tr>
<td></td>
<td>Consortium of Technip and Daewoo</td>
<td>mid-2013</td>
</tr>
<tr>
<td></td>
<td>Shipbuilding &amp; Marine Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(DSME) Co., Ltd. in May 2012</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Front End Engineering and Design</td>
<td>Dual Front End Engineering Design</td>
</tr>
<tr>
<td></td>
<td>(&quot;FEED&quot;) contract awarded to Technip</td>
<td>(dual FEED) competition contract</td>
</tr>
<tr>
<td></td>
<td>- Daewoo Consortium (TDC),</td>
<td>awarded to JGC Corporation &amp;</td>
</tr>
<tr>
<td></td>
<td>completed in January 2012</td>
<td>Samsung Heavy Industries Co., Ltd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and MITC consortium consisting of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MODEC, Inc., IHI Corporation, Toyo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Corporation and CB&amp;I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nederland B.V</td>
</tr>
<tr>
<td>Completion</td>
<td>To achieve Ready for Sail Away (RFSA)</td>
<td>Ready for Start Up, a year after</td>
</tr>
<tr>
<td></td>
<td>and Provisional Acceptance (PA) by</td>
<td>PFLNG in 2016</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The first commercial delivery of this</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vessel is expected to be in 2016</td>
<td></td>
</tr>
<tr>
<td>Accommodation</td>
<td>100 personnel</td>
<td></td>
</tr>
</tbody>
</table>
The discovery and development of unconventional gas has killed the US market for LNG imports. Nevertheless, is this the final chapter in the story or is there an unanticipated twist waiting just around the corner?

In the early 2000s, the US was regarded as a potential major importer of LNG. Production countries were reserving liquefaction capacity for this market while significant regasification capacity was being constructed in the US. Throughout this period, LNG imports in the US had grown steadily from 226 bcf (6.3 bcm) in the year 2000 to a peak volume of 770.8 bcf (21.8 bcm) in 2007.

Enter shale gas. Already in 2007, the US shale production reached 1,293 bcf (36.6 bcm). However, volumes were set to skyrocket, quadrupling their size to a staggering 5,336 bcf (151.1 bcm) in 2010. This paradigm shift squashed any serious prospects of importing considerable volumes of LNG into the US market. The impressive expansion in shale production eroded LNG imports to a mere 174.6 bcf (4.9 bcm) in 2012, four times less than the 2007 volumes.

Let’s pause here for a brief analysis. Given the US experience, shale gas appears to be the “Kryptonite” for LNG imports. Accordingly, the prospect of the American shale gas success story being repeated in other regions of the world draws the wary gaze of LNG stakeholders. But the stakeholders’ perception is about to be challenged. Looking to the future, one does not have to go far to see a completely new story unfolding in the LNG-unconventional saga.

The displaced LNG volumes initially intended for the US have not gone to waste. They have been redirected to other gas markets around the globe, Europe being one of them. Over the last decade, Europe has almost tripled its regasification capacity and roughly doubled its LNG imports. The underlying driving factors have been declining domestic production in many countries coupled with rising demand. However, a good deal of this increase springs from Europe’s traditional pursuit of increased security of supply especially when considering the amplified strength that an LNG option brings to gas buyers in their interaction with pipeline gas exporters. Had the US turned out to be the major LNG importer that it promised to become, the cheaper LNG supplies now available for Europe would have been significantly diminished. Thus, the development of unconventional gas and subsequently the erosion of LNG imports into the US liberated
considerable supply volumes that contributed to market creation and expansion in European countries. It must be pointed out, however, that this expansion has since been curtailed, as the current soft European economic situation has sent many LNG cargoes East.

Meanwhile, in the US the interaction between shale gas and LNG is about to be fundamentally redefined. The spectacular development in US shale gas has eroded demand for LNG imports. Nevertheless, production volumes continue to grow, exceeding domestic demand and thus presenting the US with the option of becoming a net exporter of natural gas (in the form of LNG). Licences to export LNG to countries with which the US does not have a free trade agreement (most of the major gas importers) have been granted to two new liquefaction projects (Sabine Pass and Freeport) and 19 other petitions have been submitted for consideration. Not all licences will be granted and not all allowed projects will find the financial resources to be constructed. However, suppose one or two additional terminals are allowed and start construction and, within a few years, two or three additional facilities arise. Following this trend, within one-to-two decades, the exploitation of shale gas could convert the US from a prospective major LNG importer into a key global exporter. Should the US become a serious exporter, the implication for the global gas markets would be vast.

Let’s take this scenario one step further. Imagine that, overcoming serious challenges such as water supply and personnel shortages, over the coming two decades, the US story of unconventional-to-LNG is repeated in other parts of the world, to various scales. One of the major benefits that LNG offers is security of supply. Thus, a significant increase in global supply volumes springing from unconventional sources would boost the attractiveness of LNG worldwide. Following this train of thought I venture to ask: could unconventional gas turn out to be the catalyst that will drive the future LNG industry to the next level?

Marius Popescu, the founder and CEO of Energy Brains Consulting is the Vice Secretary of Task Force 1 – Human Capital.
The use of liquefied natural gas (LNG) as bunkers for conventional shipping has become a hot topic. There have been many column inches written advocating its undoubted environmental and economic benefits, many conferences on this topic are being held and expert consultants are springing out of the woodwork offering to assist various stakeholders in feasibility studies etc.

At SIGTTO (The Society of International Gas Tanker and Terminal Operators), as the industry body for liquefied gas shipping, we welcome the increased use of LNG as bunkers. This will result in more volumes being sold and shipped on LNG vessels, due to the increased demand, this increased activity is very good news for our membership. The current worldwide bunker consumption is the energy equivalent of approximately 70% of the current LNG export market. Clearly, the impact on the global LNG market will be considerable if even only a small percentage of conventional vessels switch to using LNG as fuel.

SIGTTO has no doubt that LNG can be safely used as ship’s bunkers; however, there is one caveat to that statement – more on that later.

First of all I wish to mention the figure 40. This is the estimated maximum amount, in cubic metres, which we have spilt in the LNG shipping industry in almost 50 years of operation, with close to 75,000 cargoes safely delivered. During this time there has been no loss of cargo tank containment and no on-board fatalities directly attributable to the cargo; a very impressive, in fact, unprecedented, safety record for the carriage of liquid hydrocarbons at sea in bulk.

A simple internet search will throw up some rather sobering figures regarding the amount of fuel oil and diesel oil bunkers spilt during the last decade or longer. I do not wish to mention the quantities involved; however, with all due respect to the bunker industry, these figures are considerably in excess of 40m³. It is quite clear that the use of LNG as bunkers needs to be conducted, across all areas of the supply chain, with a totally different approach and philosophy to that of traditional bunkers. A low flash point cryogenic fluid will be introduced onto non-LNG carriers, and this requires unique materials, designs, training, control measures and procedures. LNG possesses the same properties and hazards whether it is stored on board a vessel for use as fuel or being carried as cargo. LNG does not discriminate as to its purpose for being on board a vessel.

We have heard, at conferences, some very worrying statements about how LNG as fuel should be handled. “Inconvenient standards and codes” are being debated away by persons and organisations without the knowledge of the properties and hazards of LNG and without the experience of the current LNG industry simply because they do not fit intended business models. We have even heard LNG being referred to as “it’s only cold diesel”.

The use of “Type C” pressure tanks introduces the risk of BLEVE (boiling liquid expanding vapour explosion) of LNG tanks at sea for the first time. On the LNG vessels of the SIGTTO membership the LNG is carried at atmospheric pressure in non-pressure tanks and therefore cannot BLEVE. LNG will also be transported deeper (although it will generally be in smaller quantities) into port areas and further upriver than LNG vessels normally trade where terminals are generally well
We are aware of some minor leakages to date on the handful of LNG-bunkered conventional vessels in operation. A major incident on an LNG-fuelled vessel, especially one involving passengers, would impact the LNG shipping industry but also have the potential for port and flag states to impose severe restrictions, or even prohibit entry within their jurisdictions, for LNG-fuelled conventional vessels.

A final point to consider concerns the nuclear-powered cargo ship Savannah which was in service in the 1960s and probably has the best emissions record of all time amongst commercial vessels; however, it never fully gained the confidence of port and flag states. To avoid supplying potential modern day successors to the Savannah (now a museum ship), it is imperative that the shipping industry embraces the use of LNG as a fuel in the same manner that the LNG shipping industry has. As previously mentioned, SIGTTO has no doubt that LNG can be safely used as ship’s bunkers and SGMF will be paramount in achieving this.

We are aware of some minor leakages to date on the handful of LNG-bunkered conventional vessels in operation. A major incident on an LNG-fuelled vessel, especially one involving passengers, would impact the LNG shipping industry but also have the potential for port and flag states to impose severe restrictions, or even prohibit entry within their jurisdictions, for LNG-fuelled conventional vessels.

A final point to consider concerns the nuclear-powered cargo ship Savannah which was in service in the 1960s and probably has the best emissions record of all time amongst commercial vessels; however, it never fully gained the confidence of port and flag states. To avoid supplying potential modern day successors to the Savannah (now a museum ship), it is imperative that the shipping industry embraces the use of LNG as a fuel in the same manner that the LNG shipping industry has. As previously mentioned, SIGTTO has no doubt that LNG can be safely used as ship’s bunkers and SGMF will be paramount in achieving this.

Andrew Clifton is the General Manager of SIGTTO (generalm@sigtto.org) and Acting General Manager of SGMF.
Realising the Value of Your Natural Gas and Synthesis Gas Resources

Many experts agree that by 2035 global gas use will rise by more than 50% and account for more than a quarter of energy demand. In order to prepare for this future, it is vital to develop existing, proven reserves and tap into the world’s vast unconventional gas and oil resources.

UOP, a Honeywell company, is continually developing new technologies to enable gas processors to monetise gas for global opportunities. The development of unconventional, remote and sub-quality gas resources is critical to contributing to the world’s natural gas supply. These emerging resources generate processing challenges as a result of variability in gas composition, logistics and complex processing needs.

A global leader in gas processing technologies, UOP continues to create world-class, efficient and effective solutions to help meet global demand. These solutions focus on meeting product specifications through contaminant removal and providing added revenue with natural gas liquids (NGL) recovery. Projects range from single-unit to highly integrated, multiple technology operations. Working with a single technology provider to design and specify the entire gas processing unit reduces project complexity, eliminates plant overdesign, shortens the project schedule and helps ensure a smooth start-up and operation with a high flexibility and uptime.

Onshore and Offshore Gas Processing
UOP provides integrated solutions for onshore and offshore natural gas conditioning and treating and NGL recovery. These solutions are available as licensed technology or as modular equipment through the UOP Russell line.

- **Dew pointing**
  With a broad range of dew-pointing technologies, UOP can help customers control the gas heating value and avoid condensation, hydrate formation or freeze-up in downstream equipment and pipelines.

- **Mercury removal**
  UOP adsorbent solutions help prevent mercury contamination which poses a threat to the structural integrity of processing equipment.

- **Acid gas removal**
  Harmful acid gas can often be efficiently removed using UOP’s flexible portfolio of acid gas removal technologies and improve overall performance.

- **Dehydration**
  Industry-leading adsorbents from UOP combine to help simultaneously remove water and contaminants from the gas stream, protecting downstream equipment and reducing operating costs.

- **NGL recovery**
  UOP offers the industry’s broadest portfolio of solutions for recovering valuable NGLs.

Liquefied Natural Gas (LNG) Pretreatment
UOP’s flexible LNG feed gas pre-treating technologies and equipment help remove mercury, sulphur compounds and carbon dioxide and recover NGLs to meet rigorous operating and product specifications.

Synthesis Gas Treating
As an industry leader in synthesis gas treatment, UOP technologies help efficiently convert low value feedstocks, such as coal or biomass, to produce high value products including natural gas, power, hydrogen or chemicals. UOP’s extensive gas separation and purification process technologies also help enable acid gas removal for gasification, steam methane reforming and hydrogen purification.

About UOP
Honeywell’s UOP provides processes, technologies and equipment for gas processing, refining and petrochemical industries. With five engineering centres and 11 manufacturing facilities in 16 countries, UOP remains close to its customers. Since 1914, UOP has developed more than 70 licensed processes for the industries it serves. Through the UOP Russell product line, UOP also offers modular equipment solutions. UOP is the world’s leading supplier of catalysts and molecular sieve adsorbents and provides a full range of technical services and support.
fast returns

YOUR PLANT HERE
SIX MONTHS FASTER
WITH UOP RUSSELL FACTORY-BUILT PLANTS

Quickly maximize the value of natural gas assets with NGL recovery solutions from UOP.

Get cash flow and profits sooner with hydrocarbon management solutions from UOP, including the UOP Russell line of complete, modular, factory-built systems that are designed to have you up and running six months quicker than other options. The reduced on-site installation time, proven designs and pre-fabricated solutions can deliver an earlier startup at a lower cost than stick-built facilities. Or choose the UOP-Twister® Supersonic Gas Separation System, with a small footprint and low maintenance that’s often ideal for remote and offshore facilities. Or get maximum NGL/LPG recovery — an industry-leading 99+% — with solutions from UOP and Ortloff Engineers, Ltd. In short, whether you need fast, compact, efficient or all of the above, UOP has a solution for your NGL-recovery needs.

A Honeywell Company

For more information about UOP Russell solutions, visit www.uop.com/uoprussell or visit www.uop.com to learn about all of the UOP hydrocarbon management solutions.
Q&A with Bent Svensson, Outgoing Manager of the GGFR Partnership

After a decade at the helm, Bent Svensson is stepping down as Programme Manager of the World Bank-led Global Gas Flaring Reduction (GGFR) partnership. The IGU Magazine asked him about the progress made since the GGFR partnership was launched at the World Summit on Sustainable Development in 2002 and the challenges going forward.

When the GGFR partnership was launched what did you see as the main challenges in getting the initiative underway?
Looking back it is important to remember that early work on flaring reduction was first supported by the government of Norway and the World Bank Group. A joint initial assessment of the global flaring situation indicated that in spite of some flaring reduction efforts in some countries, global flaring levels had remained virtually constant for the past 20 years. The assessment also showed that to achieve concrete progress in flaring reduction, companies and governments needed to coordinate and collaborate more closely, and so the GGFR partnership was born as a public-private initiative.

The first challenge then was to bring major players on board. Besides Norway and the Bank, Shell, BP and Sonatrach were amongst the first to join. Others followed soon after. Today we have more than 30 government and industry partners.

How did you set about signing up a critical mass of members and getting them to work together?
In my view at least three factors were influential. One is that the GGFR partnership was led by the World Bank, which brought value to the table on various fronts, and this gave the initiative its initial credibility and also confidence to both industry and governments that they could count on an honest and neutral broker. The other is that GGFR was conceived as a needed platform for dialogue and collaboration, technical assistance, and best practice dissemination, a space that did not exist before, at least not on flaring reduction. And third, many companies/countries saw that supporting GGFR was well aligned with their flaring reduction and sustainability strategies.

The fact that this year we started the fourth phase of the programme shows that many stakeholders still value the role played by GGFR. By now, most companies and governments in

Bent Svensson

Bent Svensson joined the World Bank in 1991 and served as Programme Manager of the GGFR partnership from the setting up of the Secretariat in 2003 to June 2013. He was also Lead Energy Economist in the Sustainable Development Department – Gas, Oil and Mining, and provided policy advice on oil and gas and related issues to around 40 countries. Prior to joining the Bank, he worked for the International Energy Agency and Komgas, an association of regional natural gas companies in Denmark.
oil-producing countries are very conscious that without a concerted effort between public and private stakeholders, substantial progress on flaring reduction is simply not possible.

Did it take long to agree on the Global Standard for Flaring and Venting Reduction and on a system of data collection?
The whole effort took almost a year, but what really mattered the most was the process, the how it was done. GGFR’s Voluntary Standard for Flaring Reduction was based on a review of best practices, policies and environmental standards, garnered from extensive World Bank-led consultations with representatives of state-owned and international oil and gas companies, as well as governments of various producing countries. Getting to the Standard’s final form took a lot of listening and dialogue with multiple public and private stakeholders. This process not only brought them together, but also gave the partners the ownership of the Standard.

When did you first see concrete results and where?
One of the first results from our work was precisely the adoption of the Voluntary Standard. This was a major step since compliance with the Standard meant that new oil projects were launched without routine flaring, if economically viable. GGFR partners that have endorsed the Standard are committed to minimum flaring.

Another concrete result came through our joint work with the US National Oceanic and Atmospheric Administration (NOAA) when we produced the first flaring estimates based on satellite observations. These annual estimates have helped us better understand some global and country-specific trends.

For example, we know that in the past six years, flaring of gas has dropped worldwide: from 172 bcm in 2005 to 140 bcm in 2011. This decrease of almost 20% in global flaring has prevented more than 270 million tons of CO₂ emissions equivalent, roughly the same as taking some 52 million cars off the road.

This is important progress, but we are conscious that some 140 bcm of natural gas are still flared around the world, and the global downward trend in flaring could be reversed for a number of reasons, including significant additional oil production (i.e. shale oil, offshore discoveries, Iraq) in various countries over the next few years.
Important also to note is that flaring reduction is considered a high-impact opportunity under the UN’s Sustainable Energy for All initiative, which is supported by multiple stakeholders from around the world.

Would you like to highlight a particular project?

Because of the nature of our activities, we see GGFR more as a “seed planter” behind many projects, big or small, either by bringing partners together around the table so they can design a project, or by providing technical assistance or risk guarantees that will ultimately help projects get off the ground; or simply by encouraging partners to remain focused on associated gas utilisation in spite of economic or infrastructure challenges.

In this context, Angola LNG comes to mind, just to pick the most recent example from the news. LNG production recently started at the

GGFR partners have made good progress in reducing flaring since then. Could you give a brief summary of what has been achieved?

Over the past decade the GGFR partnership has facilitated critical dialogue between oil-producing countries and companies to foster collaboration on policy challenges and the implementation of gas utilisation projects around the world. Scaling up associated gas utilisation requires relevant and balanced regulations and incentives, viable technologies, and effective domestic gas markets and prices.

We have aimed to work on all these fronts: from increasing global awareness of the need to reduce flaring to supporting the drafting of regulations in various countries; to helping governments and companies develop associated gas recovery plans, and to increasing the understanding of carbon finance mechanisms and small-scale gas utilisation technologies.

The Sonangol Sambizanga leaving Soyo with the first cargo from Angola LNG – a major gas flaring reduction project.
What do you see as the main challenges for the GGFR partnership going forward?

GGFR’s main role is that of a catalyst that brings key stakeholders around the table, facilitates the establishment of a common ground with clear targets, and does not allow them to give up or get distracted from the ultimate objective. We need to keep playing that role.

Through various efforts, the GGFR partnership is helping unlock the value of wasted natural gas by improving energy efficiency, expanding access to energy and reducing greenhouse gas emissions from flaring.

To me the next big challenge is to scale up these flaring reduction efforts to have greater impact, and to keep the downward trend in flaring reduction. Increasing the use of gas for power generation is also an important dimension of our poverty reduction efforts in developing countries. The impact of black carbon, some of which comes from flaring, is also an issue that deserves more attention.

Another major challenge is to bring in more key players who still need to join the global efforts to reduce flaring. And the need for faster implementation of gas flaring reduction projects so that global gas flaring continues to decline in greater volumes.

After 10 years of partnership, we now understand that to scale up associated gas utilisation will take a holistic approach along the whole gas value chain, both upstream and downstream. This involves developing effective domestic gas markets and prices, harnessing viable technologies and fostering partnerships with multiple actors across various industries, such as power and petrochemicals.

The new phase for the GGFR (2013-2015) is certainly moving in that direction.
Some GGFR Results

Azerbaijan cuts flaring by almost half in two years
In 2010, just two years after joining the GGFR, Azerbaijan’s national oil company SOCAR had reduced associated petroleum gas flaring and venting almost by half—to less than 300 mcm. The key to this success was measurement and planning, and the GGFR contributed to both. SOCAR needed reliable data on how much, where, and how gas was being flared. GGFR helped by providing measuring equipment and trained the company’s staff in using it. Based on data gathered, SOCAR worked with BP to draft a gas recovery plan that will put 1.6 bcm of natural gas to productive use in five years. This will power Azerbaijan’s economy and development, while assuring a cleaner environment.

Qatar transforms flared gas into electricity
In the Al Shaheen project, Qatar Petroleum and Maersk have worked together to capture and use 5 mcm of gas per day for electricity. The gas, produced as a byproduct of pumping oil from 300 offshore wells, had been flared since oil production started at the Al Shaheen field in 1994. But thanks to the project, the gas is now providing about a third of Qatar’s electricity, and emissions have been significantly reduced.

Kuwait: reaching less than 1% of gas flared
Kuwait Oil Company and GGFR are working together on a plan to reduce flaring below 1% of the in-take associated gas and reach a “technical limit” for gas flaring reduction.

Mexico cuts flaring by 66%
Mexico has reduced gas flaring by 66% in just two years, thanks to collaboration among the country’s Secretary of Energy, its national oil company Pemex, regulators and GGFR. Pemex is committed to reducing flared gas while strengthening flaring and venting regulations, as well as investing in gas recovery.

Republic of Congo: gas for power generation
The government and operating companies in the Republic of Congo have developed a 350 MW gas-to-power project feeding two power plants with gas from the M’Boundi oil field. The initiative has reduced emissions of greenhouse gases and increased access to electricity for some 300,000 people.
Sonangol EP is the exclusive Concessionary for liquid and gaseous hydrocarbon in Angola. Our activities include exploration, production, commercialization and refining of hydrocarbons and their derivatives.

The competitive vision of our affiliate Sonangol Gas Natural to supply the market, has made Angola a new player in the world of LNG exporters.

With 5.2 million tonnes a year of liquified natural gas to the international market, on schedule to be delivered in 2013, sustainability and growth remains our priority.

Health, Safety and Environmental best practices are the standards to achieve.
The Sustainable Energy for All initiative is a multi-stakeholder partnership between governments, the private sector and civil society. Launched by the UN Secretary General Ban Ki-moon in September 2011, it has three interlinked objectives to be achieved by 2030: provide universal access to modern energy; double the share of renewable energy in the global energy mix; and double the global rate of improvement in energy efficiency.

A Global Action Agenda guides efforts undertaken in support of achieving the initiative’s three objectives. It contains 11 action areas and provides a framework for identifying the high-impact opportunities that will catalyse change and prompt innovation. Using this framework, countries and stakeholders can create their own pathways towards Sustainable Energy for All.
The action areas are grouped into two categories – sectoral and enabling. The seven sectoral action areas address power generation and the principle sectors of energy consumption. They are: modern cooking appliances and fuels; distributed electricity solutions; grid infrastructure and supply efficiency; large-scale renewable power; industrial and agricultural processes; transportation; and buildings and appliances. The four enabling action areas characterise cross-cutting mechanisms designed to support effective sectoral action and address existing obstacles. They are: energy planning and policies; business model and technology innovation; finance and risk management; and capacity building and knowledge sharing.

Following a campaign in 2012, which the UN General Assembly declared the International Year of Sustainable Energy for All, more than 70 countries have opted-in to the initiative, with support coming from every part of the world. The initiative is also mobilising businesses, investors and civil society to take action on “high-impact opportunities”. These opportunities, which fall within the 11 action areas of the Global Action Agenda, are defined based on their significance and ability to make an immediate impact towards reaching Sustainable Energy for All’s three objectives. Examples include off-grid lighting, building energy efficiency, energy and women’s health and the procurement of renewable energy.

Dr Kandeh Yumkella, former Director General of the UN Industrial Development Organisation (UNIDO) and a member of IGU’s Wise Persons Executive Committee Members

- Heikki Holmås, Development Minister, Norway
- Luciano Coutinho, President, Brazilian Development Bank
- Brian Dames, CEO, Eskom
- Rachel Kyte, Vice President for Sustainable Development, World Bank
- Robert Orr, Assistant Secretary General for Strategic Planning, United Nations
- Leena Srivastava, Executive Director, The Energy and Resources Institute (India)
- Andrew Steer, President, World Resources Institute
- Timothy Wirth, Vice Chair, UN Foundation
- Carlos Pascual, Special Envoy and Coordinator for International Energy Affairs, US State Department
- Klaus Rudischhauser, Deputy Director General (EuropeAid), European Commission
Board, co-chaired by Ban Ki-moon and Jim Yong Kim, marks the first time the two leaders have jointly led such an effort, underscoring the emphasis each institution places on providing Sustainable Energy for All.

“Sustainable energy is the golden thread that connects economic growth, social equity, and a stable climate and healthy environment. The Advisory Board has the top-flight expertise and experience needed to help us reach our goal of providing sustainable energy for all by 2030,” said Ban Ki-moon. “This initiative represents a new era of partnership with the World Bank. Working together, I am confident we can help to transform the world’s energy systems.”

“More than 1.2 billion people don’t have access to electricity, and another 2.8 billion use solid fuels to cook and heat their homes. This is deadly – it exposes them to toxic smoke that kills about four million people a year,” said Jim Yong Kim. “Delivering universal access to electricity and safe household fuels is a fundamental condition to end poverty. We have to meet this challenge in a sustainable way that also takes into consideration the battle against climate change.”

Advisory Board members will provide strategic guidance and serve as global ambassadors for the initiative, conducting high-level advocacy for action on energy and mobilising stakeholders on behalf of Sustainable Energy for All. Additional Advisory Board members will be announced after further consultations with stakeholders.

At the launch of the Advisory Board, Ban Ki-moon also named the members of the initiative’s 10-person Executive Committee, which is headed by Chad Holliday, Chairman of Bank of America.

Global tracking framework
The Sustainable Energy for All Global Tracking Framework Report, released at the Vienna Energy Forum in May, was compiled by a team of experts from 15 agencies and led by the

Countries such as Senegal are promoting the use of LPG as a cleaner fuel than firewood and charcoal.
IGU has offered to support Sustainable Energy for All through a competence programme focusing on the use of natural gas. This support is being coordinated through UNIDO, and the first joint IGU-UNIDO Sustainable Energy for All gas seminar will be held with high-level representatives from sub-Saharan Africa, mainly western Africa, in Abidjan, Côte d’Ivoire, November 4-5. The seminar will be co-organised and supported by the Economic Community of West African States (ECOWAS) and the IGU Charter Member for Côte d’Ivoire, Petroci.

The seminar will provide customised information based on best practices and case studies as well as country studies allowing for the best-possible learning effect. Focus topics will include electricity generation with gas, combination options for gas with renewables, gas for households as well as gas for industrial development. The seminar will be held two days prior to the Gulf of Guinea conference which will take place in the same location, November 6-8.

Adrian Giddings is a Contributing Editor at International Systems and Communications.
Gulf of Guinea Gas Conference
6-8 NOVEMBER 2013 | ABIDJAN | CÔTE D’IVOIRE

Keynote Addresses From:

H.E. Adama Toungara
Minister of Mines, Petroleum & Energy
Côte d’Ivoire

Daniel Gnangni
Director General
Petroci

Jérôme Ferrier
President
International Gas Union

The Ministry of Mines, Petroleum & Energy, Côte d’Ivoire, Petroci, IGU &
the 16th Gulf of Guinea Gas Conference Welcome Oil & Gas Leaders From:

Angola  Cameroon  Chad  Congo  Côte d’Ivoire  DRC  Gabon  Ghana

Namibia  Equatorial Guinea  Liberia  Nigeria  São Tomé & Príncipe  Sierra Leone  South Africa  Togo

www.cwcgog.com
A Vision for the Gulf of Guinea - New Opportunities & Investments in the Gas Sector

“We are very pleased to be co-hosting the 16th edition of CWC’s Gulf of Guinea Gas Conference (GOG16), recognised as the most senior and established forum to focus on West Africa’s thriving gas sector that will be held in Abidjan on 6-8 November 2013. This strategic conference will gather representatives from governments, national oil and gas companies and leading operators to exchange ideas, share experiences, and devise future strategies to increase the participation of indigenous players in gas activities and promote industrial and economic development.”

Daniel Gnangni, Director General, Petroci

“...”

Jérôme Ferrier, President, International Gas Union

Key Topics Include:

- Gas monetisation options: the role of gas in unlocking economic potential in the region
- Developing sustainable economic growth through gas
- Regional collaboration in gas
- New investment opportunities in gas: reviewing opportunities in conventional & unconventional gas
- Upstream gas: reviewing project & reserve potential
- Maximising the potential of offshore & on shore gas projects
- Partnerships & Joint Ventures: working together to unlock Gulf of Guinea's gas potential
- Technologies to optimise the region’s gas reserves
- Successful capacity building in the Gulf of Guinea’s gas industry
- Local Content development policies in gas
- LNG in the Gulf of Guinea: what role does it play in global markets?
- The role of gas in supplying power to the region
- Gas infrastructure & logistics: projects, developments & plans
- Financing energy projects in the Gulf of Guinea: what role can financiers play in the Gulf of Guinea's energy future?

Secure your involvement early! For more information call Elliott McGinn on +44 20 7978 0029 or email emcginn@thecwcgroup.com
The Advancement of Key Carbon Capture Technologies

By Frank Ellingsen

The CO₂ Technology Centre in Mongstad, Norway is preparing the ground for widespread CCS deployment.

The IEA estimates that fossil fuels will account for 60% of energy generation by 2030, making carbon capture and storage (CCS) a vital technology for decarbonising the world’s energy supply. According to the UN’s Intergovernmental Panel on Climate Change (IPCC), exceeding a global temperature rise of 2°C would be “catastrophic” for the global economy, and there has been international accord that a pathway to keep global warming within that level to 2050 must be set. The IEA, EU and IPCC indicate that a fifth of the carbon reduction target needed to keep to the 2 Degrees Scenario (2DS) by 2050 could come from CCS alone. CCS is capable of reducing CO₂ emissions from fossil fuel power stations by up to 90%, so the race to commercialise and industrialise the technology is on.

While energy companies have been capturing and transporting CO₂ gases in large-scale plants for decades – which has been utilised in enhanced oil recovery, as well as the production of carbonated drinks – the unfortunate fact remains that unlike other now mainstream low-carbon technology sectors, such as wind and solar, CCS technologies do not currently exist at commercial scale. Currently, carbon capture is costly; the Global CCS Institute estimates that each MWh supported by CCS costs energy generators an additional $50-$100, as well as substantial capital costs for development.

Technology testing is increasingly necessary for verifying capture technology, which in turn reduces costs, plus technical, environmental and financial risks, thereby creating the preconditions for the industrialisation of CCS. The UK Energy Research Council, which spent two years researching the means for establishing CCS as a mainstream technology, came to the same conclusion: a regulatory approach making CCS compulsory in all fossil plants will only work if the technology is more advanced. So what are the greatest barriers from a technology perspective and what advancements have been made?

To meet the need to evolve cost-effective capture methods, test centres have been developed on a major scale; allowing the safe simulation of carbon capture. CO₂ Technology Centre Mongstad (TCM) at the Mongstad refinery and combined heat and power (CHP) plant is the most advanced of these, a $1 billion joint venture part-owned by the Norwegian government, Statoil, Shell and Sasol. TCM has been set up for vendors to test their
Based on the findings from the amine plant, TCM and Aker Clean Carbon have published papers, which verify safe amine carbon capture from flue gases. The TCM amine plant is capable of processing 100,000 tonnes of CO₂ per year. The sources are the refinery with a CO₂ output equivalent to a coal-fired power plant and the CHP plant.

Here at TCM, there have been proven results. Since TCM opened, the facility has been in operation for more than 5000 hours. The results from the first year of testing contribute to preparing the ground for widespread CCS deployment to combat climate change and demonstrate achievements that are crucial to de-risking CCS investments. The TCM core utility infrastructure has operated with more than 98% availability and this has made it possible to supply the two absorption plants with exhaust gas and other utilities as requested by the two technology owners utilising the large-scale test units. Based on the TCM programme, three scientific reports have been published.

Amine carbon capture
One of the technologies which has been tested since TCM opened in May 2012 is amine solvent carbon absorption, which has been tested in collaboration with technology partner, Aker Solutions.

In amine processing, CO₂ is captured by an amine solvent, a liquid comprising water and amines, which is used to absorb the CO₂ from the flue gas. Amine technology has been used for decades in other applications and is therefore considered to have a moderate technical risk. However, at TCM the vendors will evaluate opportunities for improvements in process design, construction methods and operations with the purpose to qualify the technology for use in large scale post-combustion plants.
Evolutionary process

It’s important to remember that CCS technology is an evolutionary process, which must be started now, to enable us to decarbonise existing fossil fuel reserves, as well as future fossil fuel excavations. As well as amine processing which is far along the evolutionary scale, and also chilled ammonia technology developed by Alstom, TCM’s facilities enable future technology evolution, by providing the available area, utilities and infrastructure for the construction and testing of further carbon capture technology.

CCS technology has a vital role to play in the decarbonisation of global energy supply between now and 2050 and will have an even greater role to play beyond that, as unconventional energy sources take on an even greater resonance. It’s not a case of if, but when these technologies are developed and the longer we wait, the more expensive they become. These projects will only work through the sharing of knowledge allowing each project to stand on the shoulders of the previous, in order to develop the market.

Recently, an international test centre network for carbon capture test facilities was launched, which for the first time have independently recommended the viability of safe amine carbon capture.

Off the back of operational experience built up at TCM, among others, Shell is developing Quest; one of the world’s largest full-scale CCS projects that will be operational in 2015. Shell is constructing the project on behalf of the Athabasca Oil Sands Project joint venture owners, which are Shell Canada Energy (60%), Chevron Canada Limited (20%) and Marathon Oil Canada Corporation (20%). The project has also received funding from the governments of Alberta and Canada.

Beginning in 2015, Quest will capture more than 1 million tonnes per year of CO₂ from Shell’s Scotford oil sands upgrader near Fort Saskatchewan, Alberta – the equivalent of taking 175,000 cars off the road annually. The CO₂ will be sent by an 80km pipeline to a suitable storage site where it will be injected and permanently stored more than 2km underground. Shell’s patented ADIP-X amine-based capture technology has been a worldwide gas processing industry standard for extracting hydrogen sulphide and CO₂ from natural gas for more than 40 years.
to share knowledge and accelerate the commercialisation of technology. The key aims of the network are diverse: to share technological developments, construction and operational experience, establish performance indicators, promote technology certification and standardisation. A collaborative playing field has now been established allowing technologists to advance technology innovation, secure public support for and develop awareness of CCS benefits.

It’s encouraging that technologies are advancing, and that knowledge sharing is taking place. The lead time for any new energy technology, from pilot to the beginnings of commercial deployment and then to materiality in the energy system (>1%) typically takes some 25-30 years. That seems a long time, but the CCS industry also has in its favour the benefit of scaling up existing methods known to the oil and gas industry, such as amine processing.

At a time when it is proving difficult to finance a large-scale CCS demonstration, due in part to the current economic concerns as well as uncertainty in climate policy, these results provide a path forward for technological innovation. Our experience and that of the generators that use the facilities at Mongstad is, “build it and investment will come”. We cannot predict exactly which technologies will be used by 2050, but what’s clear is that each of the various technology stages is vital for industrialisation, including the need for commercial demonstration programmes. This process begins to de-risk the technology for future business investment, bringing some level of certainty to expected capital expenditure and ongoing operating costs. This evolution of technologies helps to establish infrastructure, which in turn lowers the cost for the next projects.

At TCM we are already preparing for the next phase of testing. Several major CCS players like Mitsubishi, Hitachi, Siemens and Aker are lining up to use the amine plant after the initial test phase is completed. A number of companies have also expressed an interest to use the available space and utilities. TCM is no doubt going to play a key role in progressing carbon capture technologies in years to come.

Frank Ellingsen is the Managing Director of CO₂ Technology Centre Mongstad (www.tcmda.com).
Japan Launches CCS Demonstration Project

By Susumu Nishio

After the Great East Japan Earthquake of March 11, 2011, nuclear power plants in Japan were shut down in rapid succession and the working rate of fossil-fuelled power increased drastically (see Figures 1 and 2). Only two plants remained in operation, for a total capacity of 49 GW. As a result, CO₂ emissions in 2011 increased by a remarkable 4% compared to 2010, which is equivalent to a 3.7% increment compared with the reference year in the Kyoto Protocol. In response, the Japanese government raised expectations for renewables; however, the target ratio of over 30% for renewables on a kWh basis is challenging. CCS is another option to reduce CO₂ emissions for fossil-fuel-dependent Japan.

CCS project

According to the IEA, CCS will be one of the applications used to bring about a reduction in emissions. In the 2 Degrees Scenario (2DS), by 2050, CCS could account for up to 20% of cumulative CO₂ reductions worldwide, making it second only to renewables. In the meantime, the IEA perspectives show that 82 industrial projects and 16 GW-class power plants with CCS will lead to a 260-Mt reduction in CO₂ emissions by 2020.

In Japan, a large-scale CCS demonstration project has been launched with the support of a government subsidy in Tomakomai, which is in the north of the country. Japan CCS Co., Ltd (JCCS) has been commissioned to execute the project.

Primary Energy Portfolio and CO₂ Emissions in Japan

Nuclear Power Plants in Japan (July 2013)

Source: Japanese Ministry of the Environment and Resources and Energy Agency.
Japan Launches CCS Demonstration Project

Project for the first four years until 2016. A total of at least 100,000 tonnes of CO₂ per year from a refinery plant will be sequestrated in two separate reservoirs (saline aquifers) of approximately 1,100 and 2,400 metres depth, respectively, under the seabed at an offshore site (see Figure 3). The actual sequestration is scheduled for the 2015 fiscal year.

Lack of merchant CO₂ source

CO₂ is generally provided as merchant material for the industry. The main applications are in the areas of welding, beverages, refrigeration, chemicals, etc. The total annual traded amount in Japan has been approximately 1 million tonnes for the past several years, including liquefied CO₂ (L-CO₂) and dry ice (see Figure 4).

Merchant CO₂ is mainly produced in refinery plants. However, some refinery plants in Japan...
have been shut down or have reduced crude throughput recently because of decreasing domestic demand for petroleum and the consolidation of refinery companies. One of the reasons for this consolidation has been the implementation of new regulations in the oil industry. According to the regulations, all of the refinery companies in Japan must equip their plants with a heavy-oil cracking unit, whose capacity is determined by each company’s total crude throughput. Therefore, some companies, for which a heavy-oil cracking unit was not put in place, shut down their plants in order to reduce the total crude throughput.

One of the effects of shutting down and reducing the throughput of refinery plants has been the reduction of CO₂ emitted from the plants. At present, merchant CO₂ manufacturers are facing a lack of CO₂. The balance between supply and demand for merchant CO₂ is getting tight, especially in the summer. The dry ice supply is currently dependent on imports from Korea (see Figure 5).

Although CO₂ emissions have increased significantly because of the fossil-fuel dependence in the Japanese power sector, merchant CO₂ is imported from abroad for industrial applications. If a very small amount of CO₂ emitted from power generation was captured and utilised, the problem of the lack of merchant CO₂ would be solved.

CO₂ utilisation
A “CCS-ready” status for power generation and other sources will be achieved by promoting the commercial utilisation of captured CO₂. There are two categories of CO₂ utilisation: direct and indirect.

For direct utilisation, L-CO₂ and dry ice are already traded as merchant CO₂ in the industry. In exploration and production, enhanced oil recovery (EOR) is also commercialised.

For indirect utilisation, CO₂ is converted to other materials using catalytic reaction processes. Typical examples include the methanation process (CO₂ + 4H₂ -> CH₄ + 2H₂O) and the dry reforming process (CO₂ + CH₄ -> 2CO + 2H₂). Both reaction processes have a common challenge from the standpoint of engineering, namely catalyst durability and conversion efficiency.

For CCS projects, CO₂ utilisation will create new value that goes beyond the reduction of emissions.

CCS in the Triennial Work Programme
To promote sustainability in the gas industry, Study Group 1 of PGC A is looking at CCS as part of the Triennial Work Programme. SG A.1’s goal is to create a CCS roadmap, which includes a discussion about when, what and how the gas industry should develop and deploy CCS in the future. SG A.1 members are currently gathering information about the technology, cost, benefits, legal framework and public acceptance of CCS.

In addition to the information collected internally by SG A.1, there will be open questions for IGU members via the website. SG A.1 members will also discuss the CCS roadmap and the critical points regarding the realisation of CCS for the gas industry, and will present their report at WGC 2015.

Susumu Nishio of the Scenario Study Team, Tokyo Gas, is a member of Study Group A.1 in Programme Committee A – Sustainability.
ENERGY?
ENVIRONMENT?
YOU NEED A PICTURE?
WE HAVE IT!

www.energypicturesonline.com

Strategic ‘power’

İGDAS with its 5.2 million customers and almost 16,000 km. natural gas distribution infrastructure operates in İstanbul, one of the largest metropolises in the world with a population of over 13 million, is an energy giant that brings natural gas to almost all İstanbullians and grows more and more every day.
Life Cycle Assessment as a Tool for Decision-making in the Gas Industry

By Anne Prieur Vernat

Companies in all business sectors face increasing demands for transparent information on the environmental impacts of products and services. The expectations of stakeholders – including civil society, investors, suppliers, final customers and competitors – have been reinforced by the development of life cycle oriented regulations and the launch of the International Reference Life Cycle Data (ILCD) System. This European Commission project supports business and policymaking in Europe and worldwide with reference data and recommended methods on life cycle assessment (LCA).

In this context, Programme Committee A – Sustainability has set up a study group on LCA for the 2012-2015 Triennium. SG A.3 aims to:
- Meet stakeholders’ expectations of full information on the environmental impact of the natural gas chains;
- Promote the environmental performance of natural gas; and
- Contribute to one of the strategic guidelines of the triennium: advocating for the recognition of natural gas as a foundation fuel for sustainable development.

What is LCA?
LCA is a methodology developed for the evaluation of environmental impacts associated with a product, a service, a process or even an organisation. It is a standardised approach (ISO standards ISO 14040 and 14044), recognised by academia and industry as an efficient tool to support decision-making and also to evaluate the global environmental performances of products and services, e.g. for the benchmarking of products.

All the stages in the lifetime of an object (extraction, processing, recycling, etc.) and all types of impacts (greenhouse gas emissions, toxicity, ionising radiation, impacts on water resources, etc.) and damage to ecosystems, human health and resources are taken into consideration through an in-depth analysis of incoming and outgoing flows. It is thus a multi-criteria environmental evaluation methodology of which global warming potential is only a part. Figure 1 shows the stages included in the case of LCA applied to 1 MJ of natural gas distributed to the final customer.

The assessment is divided into four main steps, as shown in Figure 2. Once the scope of the study is set, environmental impacts are
Despite improvements achieved along the gas chain several years ago, the impacts could be further reduced by:

◆ Developing high efficiency gas conversion systems;
◆ Improving the efficiency of liquefaction units which is a main issue for LNG chains;
◆ Improving compressor efficiencies for long distance transmission;
◆ Reducing gas flaring during production from associated fields; and
◆ Reducing leakages along transport and distribution pipelines.

The results presented here may also be used to identify further actions, including at a regulatory level. In this case, LCA has been used to quantify the impacts associated with each step and the extent of impact reduction that can be expected from each action. This application of LCA can also be used to benchmark the environmental efficiency of the various actions.

Better design: support R&D and investment
LCA may be applied to future technologies and pathways, in order to:

◆ Assess the potential impacts of new supply

LCA, the Four Steps as Described by ISO 14040

Source: ISO 14040:2006, Figure 1 – Stages of an LCA (reproduced)

The Added Value of LCA

Figure 2.

Figure 3.
chairs, such as biomethane or unconventional resources. In this way, it may also be applied to compare various prospective scenarios; and
◆ Evaluate the environmental performances of technical innovations.

Better monitor: accounting for environmental impact modifications due to evolutions of the natural gas supply chains
With periodically updated assessments, LCA can be used to evaluate the influence on environmental impacts of:
◆ The evolution of the supply mix (e.g. LNG vs. pipeline transportation, new supply chains); and
◆ Observed technical improvements (e.g. reduction of leakage rates at storage facilities, improvements of energy consumption of compressors, maintenance or industrial safety programmes).

Better communicate: a standardised methodology to promote the environmental performance of natural gas and meet stakeholders’ expectations
As LCA is widely recognised as a relevant methodology for environmental assessments, associated results may be used to promote the environmental performances of natural gas:
◆ On all impact categories, but especially on impacts where natural gas is competitive (such as local pollution);
◆ Environmental information will influence the choice of energy by the final customer. It is therefore crucial to deliver scientific and robust information, and results can be used to enhance the quality of existing reference databases.

Triennial work programme for SG A.3: achievements so far and next steps
SG A.3, led by GDF SUEZ, has 13 members from 11 countries:
◆ Algeria (Sonatrach);
◆ Belgium (Marcogaz, Synergas);
◆ Brasil (Petrobras);
◆ France (GDF SUEZ, Storengy);
◆ Italy (Eni);
◆ Japan (Osaka Gas);
◆ Korea (Korea Gas);
◆ Poland (Polish Oil and Gas Company – PGNiG SA);
◆ Spain (Union Fenosa Gas);
◆ USA (American Gas Association); and
◆ Venezuela (PDVSA).
The study group is collecting data from the natural gas industry on environmental impacts related to the various steps of the supply chains, and assessing current environmental impacts for selected typical supply chains.

These two objectives are clearly separated because the environmental impact assessment won’t be done for all existing supply chains. The modelling and calculation will be done for typical chains in each region, based on the statistically most representative supply chains.

Data collection is based on a questionnaire sent to all relevant committees and study groups, and each member of SG A.3 is collecting data for the steps and countries for which they are responsible. The work will also benefit from actions conducted by Marcogaz at the European level. Answers have already been collected for natural gas storage, distribution and transport (both pipelines and LNG). Additional information still needs to be collected, in particular for the production step.

The next stage of the work, apart from the data collection, will be to examine the integration in the study of the potential environmental impact of new chains, such as unconventional resources or renewable gas (biomethane).

Anne Prieur Vernat of CRIGEN, the GDF SUEZ R&D centre, is the leader of Study Group A.3 in Programme Committee A – Sustainability.

Figure 5. Comparison of the Division of GHG Emissions along the Upstream Chains

- Low pressure distribution in EU-25
- High pressure transmission in EU-25
- Storage in Europe
- Gasification in Europe
- Export by LNG tanker
- Liquefaction
- Transmission by pipeline
- Production/processing

SG A.3’s data collection is underway although additional information still needs to be collected, in particular for the production step.
Managing the Diversification of Gas Quality

By Peter Flosbach and Uwe Klaas

Over more than 50 years natural gas has benefited from continuous and stable growth. As the fuel of choice, natural gas steadily conquered increasing market share in competition with other fuels such as coal and oil. Amongst these competitors, natural gas enjoyed the image of being clean and environmentally friendly with the lowest CO₂ emissions of all fossil fuels.

Today, however, the energy panorama is rapidly changing. Four major issues are driving this change:

- The quest for cleaner energy;
- The development of a global gas wholesale market and regulation for gas grid infrastructures;
- The challenges relating to renewable energy storage; and
- The shale gas boom – natural gas resources for another century.

The quest for cleaner energy is driving the introduction of more legislation and regulation for the reduction of CO₂ and the fulfilment of the Kyoto targets. As gas is both clean and flexible compared to other fossil fuels this development is clearly favourable for natural gas.

Increasing LNG trade is linking the regional gas markets and improving liquidity. We also see a clear trend towards strictly regulated markets for gas transportation and distribution infrastructures.

Then there is the question of increasing demand for energy storage capacity, following the introduction of renewable production such as wind and solar. This is due to the fact that electricity cannot be stored adequately in the required amount in order to balance supply and demand. Excess electricity can be used to produce hydrogen which can be stored in the gas grid.

Finally, the production of shale gas is reshaping firstly the US market and increasingly the rest of the world.

However, the merits of natural gas are often not fully appreciated by the general public. As a consequence, the further introduction of renewable gases and stepping up the gas advocacy campaign are necessary to highlight the eco-friendly image of natural gas.

Why should the gas industry promote new technologies and new gases?

Government and climate protection targets demand the introduction of fuels and technologies that reduce CO₂ emissions. Substituting gas for coal and oil can substantially contribute to the overall reduction of the emissions of CO₂ and particulates, while gas-fired power gener-
promotes renewable energy in all sectors. The agreement includes a ban on installing gas-fired installations in new buildings from 2013 onwards. To support this transition they provided a fund from 2012-15 for this conversion to renewable energy. As technology, electrical heating with heat pumps or local district heating are recommended.

What are the market changes facing the energy industry?

For decades, the source of natural gas supplies to given locations remained unchanged. Generally, distribution grids comprised one or possibly two sources of supply, based on long-term delivery contracts. However, we no longer have such long-term physical stability in the grids, due to the fact that in many parts of the world new sources of gas are entering our gas grid infrastructures. The situation has changed over the past few years and is continuing to change. The reasons for this are multiple:

◆ Increasing gas trading activities with a trend to short-term contracts with an impact on physical gas flows;
◆ Substitution of pipeline-based supplies by LNG;

Gas is competitive and abundant

The consideration of environmental as well as economic aspects plays an increasing role to further guarantee the continuation of the global natural gas growth success story.

The shale gas boom in the US, which was originally forecast to require increasing imports of LNG, has led to the switching of LNG cargoes to other markets where they have had a downward impact on wholesale prices. Wherever gas distribution infrastructures are available, natural gas is the most competitive fuel for heating and other domestic use. With recoverable conventional and unconventional gas resources increasing all over the world, no shortage for the next two generations is expected.

In addition, it is a fact that regions without gas distribution infrastructures have a fundamental competitive disadvantage in economic growth. Innovative technologies for efficient processes with low emissions due to efficient gas combustion are restricted in these regions. They need to be supported by political decision-making to further the geographical expansion of gas grid infrastructures and enable economic growth. However, an alarming example of governmental regulation can be seen in Denmark.

In 2012, the Danish Ministry of Climate, Energy and Building raised an initiative for more renewable energy in private buildings. With the Energy Agreement they obtained a political commitment to an ambitious green transition for Denmark that focuses on energy savings throughout society and
Growing diversification of gas quality combined with an increase of decentralised entry points;
Injection of renewable gases such as biomethane, bio syngas (hydrogen or synthetic methane) in a move towards a carbon-free future; and
Increasing injection of gases from non-conventional sources following the development of local gas fields (e.g. shale gas).
Gas distribution operators are thus increasingly challenged to manage significant variations of gas quality. Where gas quality limits are exceeded, the following possible measures have to be considered:

- Shut down the injection causing the problem and take the necessary technical measures to ensure that there is no reoccurrence. 
  
  Remark: can conflict with security of supply and possibly requires significant investments.
- Shut down of critical consumer.
  
  Remark: threat of losing customers and negative impact on the industry’s image.
- Improvement of the flexibility of the gas quality tolerances of gas installations.  
  
  Remark: can only be realised long term.

Despite the challenges mentioned above, it is vital that we as the global gas industry promote and enable the entry of renewable gases to our gas grid infrastructures and develop new technologies in order to carry forward the natural gas success story.

The work of WOC 4’s Study Group 4.2

SG 4.2 is one of three study groups in Working Committee 4 – Distribution and is looking at the diversification of gas quality and non-conventional sources in a carbon-free future. SG 4.2 is examining, from the perspective of a distribution grid operator, different options for the management of this diversification of gas quality. It has members from Austria, Croatia, Denmark, France, Germany, Japan, Poland, Serbia, Slovenia, Spain and Russia. Beyond Europe, Asia and the expertise of other WOC 4 members, e.g. from Brazil, are employed to give a global view on the individual market situations and experiences gained.

One of the critical factors for success will be to recruit members from markets such as North America, with experience in shale gas, to round up the team results. So we would be happy to welcome “new blood” with shale gas experience to one of our next meetings.

Analysis of the challenges of gas quality diversification

In several markets commercial and industrial gas use has a long history before natural gas was introduced. First coke gas or wood gas were already invented in the late 18th century and utilised for illumination. The proportion of hydrogen in town gas exceeded 50%. In the following years the gas composition was characterised by a broad range. After initial gas discoveries in Europe with local use more than 100 years ago (Hamburg-Altengamme, 1910), the first large natural gas fields in Europe were developed from 1959 onwards (Slochteren, The Netherlands) and this then replaced the town gases.
Due to this history the gas industry gained substantial experience in the treatment and management of different kinds of gases; and we as the gas industry should not hesitate to actively take the challenge to upgrade natural gas with renewable gases. Based on the experience gained in numerous markets, the upgrading of natural gas to biogas, biomethane, hydrogen, synthetic gases or shale is manageable from the technical standpoint.

Also the change between pipeline-based supplies and LNG-based supplies offers additional opportunities as the gas treatment at LNG terminals can be done as a large-scale industrial application at lower costs.

Finding new solutions for the introduction of renewable gases and new technologies to manage the changes in the distribution grids

Besides technical feasibility, the economic aspect of feasibility needs to be considered. In the end customers need to pay for every kind of innovation and we have to ensure that gas will defend its role as a competitive fuel. Therefore, it is of significant importance to analyse the acceptable admixture rates of the individual renewable gases. This is one of the biggest challenges SG 4.2 is faced with to elaborate tolerable ranges for the individual regional markets. This is increased by a number of industrial gas applications which have relied on an extremely stable local gas supply quality for decades, e.g. the ceramics and glass industries. In most cases an extensive analysis needs to be conducted to identify the most critical applications in the particular gas grid infrastructures.

A good example can be seen in the German market as a tremendous increase in renewable electricity capacity originated from wind and solar has led to a situation in parts of the country where the daily renewable injection capacity often exceeds the demand. As electricity cannot be adequately stored, the gas industry took the opportunity to initiate the planning of a double-digit number of pilot plants for the conversion of surplus electricity into hydrogen or synthetic methane.

An accompanying research programme of the German Technical and Scientific Association for Gas and Water (DVGW), in cooperation with the German gas companies and representative application technology providers was conducted to find out acceptable hydrogen concentrations in natural gas for individual installations and other gas applications.

From the first results and corresponding analysis in SG 4.2, it can be concluded that the most sensitive installations are:

- Natural gas turbines which are used in gas compressor stations for transmission and storage, but also in industrial plants;
- Natural gas vehicles, where mainly the on-board high-pressure steel tanks for the gas, but also engine technology tolerate only limited hydrogen proportions;
- Underground pore storages such as aquifer storages where the potential impact of hydrogen on the geological structure needs to be researched; and
- Metering technologies for gas chromatography need to be developed for an accurate measurement of enlarged gas quality compositions.
Next steps

In the forthcoming study group work the following aspects will need to be considered:

◆ Standardisation of specifications for gas quality in the individual markets;
◆ Standardisation of application technologies in cooperation with the providing industry in order to develop efficient but flexible installations;
◆ Evaluation of the expected change between pipeline-based and LNG-based supplies;
◆ Evaluation of shale impact on gas qualities of gas distribution infrastructures;
◆ Introduction of gas quality tracking technologies on distribution level at economical prices;
◆ Develop R&D projects such as “Power to Gas” to support mature technology implementation;
◆ Cooperation with new market participants (e.g. biogas producers, hydrogen industry, etc.) is necessary to ensure gas quality compliance at affordable prices;
◆ Develop gas quality standards for distribution systems and implementation schemes for these to allow for the adaption of the new supply conditions and the gas utilisation structure;
◆ Develop an advanced regulatory framework to cover the investments in gas grid infrastructures (regulatory tariff) and guarantee stable investment conditions; and
◆ Develop a marketing concept for promotion.

By now it already seems clear that the “diversification of gas quality and non-conventional sources in a carbon-free future” will for many reasons be characterised as a “green gas evolution” instead of a “revolution”. We have no doubt that this will be a very important process that will help us to continue the global natural gas success story.

Peter Flosbach of Westnetz GmbH (an RWE company) is the leader of Study Group 4.2 in Working Committee 4 – Distribution. Uwe Klaas of DVGW is WOC 4’s Secretary.

It is seen as relatively uncritical to accept up to 2% hydrogen in natural gas on today’s given quality standards. More hydrogen concentration seems to be realistic but demands a detailed view on the individual situation.

Scenario assessment and evaluation for the introduction of renewable gases

It also became apparent, that for a global view on this, a scenario impact assessment and evaluation of the individual renewable gases needs to be developed for the individual markets. The wider we can define concentration tolerances, the less investment to upgrade our grid infrastructures needs to be made and consequently the more competitive our “green” gas fuel will be. This is one of the major challenges we face.

Therefore it is necessary to elaborate ways that distribution companies can address the growing challenge to:

◆ Manage the increasing complexity of a stable gas composition in alignment of the market standards and specifications;
◆ Secure stable gas supplies for their customers in order to guarantee security of supply for their distribution system; and
◆ Guarantee economic competitiveness of natural gas versus other fuels.

A scenario assessment and evaluation for the individual markets will be developed as a global approach in the course of the next working sessions.

Development of a recommended plan for the “smartening” of distribution grids (plan for implementation)

Before going into detail regarding a plan for implementation, a global strategy needs to be developed. Therefore, it is vital to understand the individual market mechanisms and gas quality standards. The preliminary research on gas infrastructures including acceptable gas quality compositions, possible technological and regulatory measures and timelines will provide us with a good basis for decision making.
VERSATILE.

Always a leading innovator, ROSEN not only supplies pipeline customers with the latest diagnostic and system integrity technologies but also offers flexible solutions and all-round support for plants & terminals.

www.roseninspection.net
Zapolyarnoye Becomes Russia’s Most Productive Field

By Ekaterina Litvinova

Commercial production from the Zapolyarnoye oil, gas and condensate field started in 2001 and has now reached its full design capacity with annual gas production of 130 bcm. Operated by Gazprom Dobycha Yamburg, it is the largest Russian gas project to have come onstream since the turn of the century and supplies 20% of the country’s gas.

The Zapolyarnoye field is in the Nadym-Pur-Taz region of the Yamal-Nenets autonomous area and was discovered in 1965. It has a relatively small area of about 9,000ha and gas reserves of 3.5 tcm, together with 80 million tonnes of gas condensate and oil.

Raw hydrocarbons are produced by five gas treatment units – three tapping Cenomanian deposits and two Valanginian deposits. The former were developed first and field capacity reached 100 bcm in 2004. Gas production from the deeper Valanginian deposits started in 2011, and the field’s overall capacity was increased to 130 bcm at the beginning of 2013.

Gas from the Zapolyarnoye field is transported via the Zapolyarnoye-Urengoy gas trunkline system (GTS) which is nearly 190km long. The GTS has four pipeline strings with a diameter of 1,420mm and three compressor stations with aggregate capacity of 834 MW.

Zapolyarnoye’s attainment of full design capacity was celebrated in January 2013 when the fifth gas treatment unit and a third unit at the Zapolyarnaya main compressor station (MCS) were officially inaugurated. The celebrations were attended by Russia’s Prime Minister, Dmitry Medvedev, Alexey Miller, Chairman of the Gazprom Management Committee and other officials.
**Technical innovations**

To develop Zapolyarnoye, Gazprom has applied cutting-edge engineering solutions, such as directional drilling with sub-horizontal boreholes and online control of well operations, and introduced advanced fail-safe equipment designed for severe climatic conditions.

The Zapolyarnaya MCS is one of the most productive in Russia with a capacity of 354 MW. High-technology gas compressor units (GCUs) with centrifugal superchargers based on rotor magnet suspension are installed at the station.

All slave devices are provided with a remote control and a self-diagnostics system. Advanced engineering design has made it possible to reduce maintenance downtime considerably, while the GCUs are environmentally friendly with low nitrogen and carbon oxide emissions.

**Further development**

Zapolyarnoye is one of several major projects for Gazprom. Elsewhere in the Nadym-Pur-Taz region, production from the Bovanenkovo field on the Yamal Peninsula started in 2012, while large fields in Eastern Russia and the continental shelf are set to be developed.

*Ekaterina Litvinova of Gazprom is a member of Working Committee 1 – Exploration and Production.*
Barbara Jinks, who was the leader of study groups 3.3 and 4.3 in the 2009-2012 Triennium and is now Vice Chair of PGC E, has been named one of Australia’s 100 Women of Influence in recognition of her IGU work. She is one of five women working in the country’s gas industry who have been honoured.

The other women are: Yassmin Abdel-Magied, Measurement While Drilling Engineer, Schlumberger; Becky Lumlock, Vice President Central Asset Management, QGC; Karen Moses, Executive Director Finance & Strategy, Origin Energy; and Vanessa Torres, Vice President Group Planning at BHP Billiton.

The Financial Review and Westpac Group 100 Women of Influence Awards were launched in June 2012 to recognise the achievements of Australia’s women, across diverse industries and backgrounds.

“We know how important it is for women to have strong role models and I hope these awards will go on to inspire and encourage more young women to be leaders in their field,” said Australia’s then Prime Minister, Julia Gillard at the launch.

“We are delighted to be partnering with the Financial Review in these awards to recognise and celebrate talented women leaders, mentors and role models; women who are achieving change in their local communities, businesses and society more generally,” said Westpac CEO Gail Kelly.

Financial Review Group CEO, Brett Clegg added: “These awards are about identifying bold, energetic women, capturing the spirit of change and helping Australia shape a vibrant, inclusive future.”

Nomination
The winners were chosen from more than 350 nominations in 10 categories: Board/Management; Diversity; Emerging; Global; Local/Regional; Innovation; Philanthropy; Public Policy; Social Change/Enterprise; and Young Leader.

Barbara, who started as a pipeline engineer and now works in global strategy and business development in the gas industry, was nominated in the global category for her work on IGU’s technical committees since 2006 as well as for encouraging more Australian companies and gas industry professionals to become involved in the Union’s activities.

Barbara works as a consultant to organisations in the areas of business development, client relationship management and project development.

Expanding role in IGU
Australia originally joined IGU in 1936 and rejoined in 1954. Today, Australia has a seat on the Executive Committee, representatives on 12 committees/task forces and three Associate Members – the Australian Petroleum Production & Exploration Association (APPEA), Origin Energy and Woodside – in addition to the Charter Member the Australian Gas Industry Trust (AGIT). The country hosted LNG 12 in 1998 and will host LNG 18 in 2016.

Ho Sook Wah, who chaired IGU’s Coordination Committee during the 2009-2012 Triennium, was one of the people who nominated Barbara. “I believe that Barbara has contributed significantly to the promotion of the gas industry, not only in Australia but in many parts of the world, through her active work in IGU,” he said.
Barbara commented that her work with IGU, generously sponsored by AGIT, had become a large part of her working life and had helped shape her career. “IGU is the only association dedicated to advocating for the gas industry on a global scale and is essential to connecting gas organisations and individuals around the world,” she said. “It quickly became a priority of mine to work with IGU to assist collaboration between countries and to do as much as I could to promote the gas industry in Australia.

I love working with the men and women who make up IGU and plan to do so as long as I can.”

The winner of each category and the top 100 women were announced at a ceremony in October 2012 at the Museum of Contemporary Art in Sydney. The 2013 awards will be announced later this year.

Mark Blacklock is the Editor-in-Chief of International Systems and Communications.
GTL Gathers Pace as a Gas Monetisation Option

By Mark Blacklock

Mozambique is the latest country to evaluate a gas-to-liquids (GTL) project, front-end engineering and design (FEED) is underway for plants in the US and Uzbekistan and the delayed Escravos plant in Nigeria is due to start up at the end of the year.

While these projects have different drivers – Nigeria wants to reduce gas flaring, Uzbekistan and Mozambique are seeking energy self-sufficiency and in the US the disconnect between oil and gas prices has opened up arbitrage possibilities – the common factor is extracting greater value from abundant natural gas resources. Meanwhile, small-scale GTL developments also offer interesting gas monetisation potential.

As reported in the April-September 2012 issue of the IGU magazine, the problems of building Escravos GTL in the Niger Delta have caused long delays and cost over-runs. The plant was originally expected to cost $1.7 billion and be in service by 2008 but has ended up five years late with a price tag of $9.5 billion. However, at current oil prices the plant will generate large cash flows from its sales of high-quality diesel, naphtha and LPG, while its feedstock will be some 3.3 bcm/year of gas that would otherwise have been flared. According to the latest figures from the World Bank’s Global Gas Flaring Reduction partnership, Nigeria flared 14.6 bcm in 2011 so when Escravos is in full operation it will achieve a reduction of over a fifth.
Sasol announced in December 2012 that it was starting FEED for an integrated 96,000 b/d GTL plant and ethane cracker in Lake Charles, Louisiana. With an estimated cost of $16-$21 billion this is set to be one of the largest foreign direct investment manufacturing projects in the US and is supported by a range of fiscal incentives from the State of Louisiana. Depending on the timing of the final investment decision, the

Escravos is a joint venture of Chevron and Nigerian National Petroleum Corporation which uses Sasol’s slurry phase distillate (SPD) process. While its design capacity is 32,400 b/d, the similar Oryx GTL plant in Ras Laffan, Qatar – a joint venture of Qatar Petroleum and Sasol – has reached 34,000 b/d with a target of 35,000 b/d and Escravos will draw on the operating experience of Oryx.

Qatar has become the top GTL producer by building on its gas resources and infrastructure, and developing international partnerships. Apart from Oryx, the industrial city of Ras Laffan is also home to the Qatar Petroleum and Shell joint venture Pearl, which is the world’s largest GTL plant and uses the Shell middle distillate synthesis (SMDS) process. Expansion of Qatar’s GTL activities will depend on whether the moratorium on new gas developments is lifted and current efforts are focused on improving operational efficiency. Both plants recorded 90% availability in 2012.

In the US, the abundance of unconventional gas is set to make the country the number two player in GTL as companies seek to use cheap gas to produce higher-value products.
GTL Gathers Pace as a Gas Monetisation Option

Shore oil fields and aims to include a modular GTL plant on floating, production, storage and offloading (FPSO) vessels. This would produce a syncrude for shipping with the main crude production to be refined elsewhere. The capacity of each module would be 200 b/d and the overall capacity of the plant would be adjusted to match the declining flow of associated gas throughout the life of the oilfield by removing modules for refurbishment and re-deployment elsewhere.

CompactGTL has proved its technology in a demonstration plant at the Petrobras research centre in Aracaju, while a trial of the Velocys technology is underway at the Petrobras refinery in Fortaleza. Both companies are looking at other on- and offshore applications with a range of companies.

CompactGTL has worked on studies with Gazprom and Total, while the Velocys technology has been selected by Calumet Specialty Products for a proposed 1,400 b/d GTL unit at its Karns City site in Pennsylvania, USA and Solena Fuels for a biomass-to liquids (BTL) plant in the UK called GreenSky London. Solena Fuels is working with British Airways on the BTL project to produce 1,100 b/d of jet fuel and 1,100 of diesel and naphtha. It is in FEED with a targeted start-up in 2015.

Meanwhile, the Russian company Infra Technology claims significant productivity and catalyst performance benefits from the proprietary process it has developed to produce light synthetic oil and is working with Gazprom on a 100 b/d pilot plant.

The GTL sector is a small proportion of the overall market for refined petroleum products but is growing in importance. More and more companies around the world are looking at GTL as a gas monetisation option and we can expect some interesting developments by the time of the next World Gas Conference in 2015.

Mark Blacklock is the Editor-in-Chief of International Systems and Communications.
THE NATURAL GAS MARKET. BELOW THE SURFACE.

For over a century, Platts has produced news, analysis and market data for the commodity markets. People up and down the natural gas supply and demand chain require information that is transparent, unbiased and totally independent. So we dig behind the day’s headlines to bring our customers the full story, and spot and forward price natural gas assessments that are the respected standard around the world.

For the latest natural gas news and analysis visit platts.com/igu
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:

c/o Statoil ASA
Box 3
NO – 1330 Fornebu
Norway
Tel: +47 51 99 00 00
Fax: +47 67 80 56 01
E-mail: secrigu@statoil.com

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
- 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)
IGU Events and Other Major Gas-related Events 2013-2015

For the IGU Secretariat
Secretary General: Torstein Indrebø
Director: Carolin Oebel
Senior Advisors to the Secretary General: Mats Fredriksson, Ksenia Gladkova
Communication Manager & Webmaster: Sjur Bøyum
Finance Director: Karin Hawksley
Special Projects Director for IGU: Nigel Ruddin
Publications Director: Nigel Ruddin
Copy & Picture Editor: Georgia Lewis
Art and Design Director: Jonathan Unsworth
Printed by: Buxton Press Ltd

IGU Members and Organisation: IGU (24), French Presidency of IGU (69 upper, 137), Gazprom (200 & 201), Audi AG (203), Shell Photographic Services (184), Solar Sister/www.solarsister.org (185).

IGU Work Recognised in Australia’s Women of Influence Awards: Lucas Jarvis/ Fairfax Media.

GTL Gathers Pace as a Gas Monetisation Option: ExxonMobil (38), Repsol (46), Total (110, 112).


The Advancement of Key Carbon Capture Technologies: CO2 Technology Centre Mangstad.

Life Cycle Assessment as a Tool for Decision-making in the CO2 Technology Centre Mangstad.

Sustainable Energy for All: UN Foundation (181), Shell Photographic Services (184), Solar Sister/www.solarsister.org (185).

IGU Work Recognised in Australia’s Women of Influence Awards: Lucas Jarvis/Fairfax Media.

GTL Gathers Pace as a Gas Monetisation Option: ExxonMobil (38), Repsol (46), Total (110, 112).


The Advancement of Key Carbon Capture Technologies: CO2 Technology Centre Mangstad.

Life Cycle Assessment as a Tool for Decision-making in the CO2 Technology Centre Mangstad.

Sustainable Energy for All: UN Foundation (181), Shell Photographic Services (184), Solar Sister/www.solarsister.org (185).

Gas-related Events 2013-2015

Editor-in-Chief: For ISC
Khadija Al-Siyabi
Ksenia Gladkova
Senior Advisors to the Secretary General: Mats Fredriksson, Ksenia Gladkova
Communication Manager & Webmaster: Sjur Bøyum
Director: Carolin Oebel
Torstein Indrebø
Secretary General: For the IGU Secretariat
Acknowledgements

146 lower), LNG 17/Dave Rossman (142 lower, 144 upper, 147, 148 & 150), Mike Abernethy/BG Group (146 upper, Chip Simons (151).
LNG Financiers Pile In: Index (153), Australia Pacific LNG (154), Cheniere Energy (157) Photographic Services, Shell International Ltd (158).

Is FLNG the Future for Liquefaction? Royal Dutch Shell (160), WC1 2012 (161), Excelerate Energy (164).


Society for Gas as a Marine Fuel Launched: Karl Gabot/AGA Gas AB.

Q&A with Ken Swenson, outgoing Managing Director of the GGGI Partnership: World Bank (176), Eni (177), Angola LNG Marketing Ltd (178), SOCAR (180 left), A.P . Møller – Maersk (180 centre), Pemex (180 right).

Sustainable Energy for All: UN Foundation (181), Shell Photographic Services (184), Solar Sister/www.solarsister.org (185).

The Advancement of Key Carbon Capture Technologies: CO2 Technology Centre Mangstad.

Life Cycle Assessment as a Tool for Decision-making in the CO2 Technology Centre Mangstad.

Sustainable Energy for All: UN Foundation (181), Shell Photographic Services (184), Solar Sister/www.solarsister.org (185).

IGU Work Recognised in Australia’s Women of Influence Awards: Lucas Jarvis/Fairfax Media.

GTL Gathers Pace as a Gas Monetisation Option: ExxonMobil (38), Repsol (46), Total (110, 112).


The Advancement of Key Carbon Capture Technologies: CO2 Technology Centre Mangstad.

Life Cycle Assessment as a Tool for Decision-making in the CO2 Technology Centre Mangstad.

Sustainable Energy for All: UN Foundation (181), Shell Photographic Services (184), Solar Sister/www.solarsister.org (185).
Why gas plants are different for every application is a question that baffles many. The functional requirement of a gas processing train is to meet a gas export specification, and that depends on the market, whether it is local power generation, pipeline transfer for industrial or domestic use, reservoir reinjection, liquefaction to LNG or as feedstock for a variety of GTP uses. There are liquid products too. Condensate will invariably be produced, but LPG and sometimes ethane may also be required, dependent largely on the local market.

Typically, a process engineer will be asked during the conceptual phase of the project to meet the gas export specification using the minimum processing steps, i.e. what are the minimum requirements for hydrocarbon liquid removal, maybe including aromatic compounds, to meet a dew point specification and a heating value? There may be economic benefit in recovering ethane and propane from the gas stream too, and if so, to what degree and what degree of recovery, complexity, and flexibility should be designed for. So having ascertained the basic process requirement in terms of hydrocarbon processing, the next step is to determine what level of contaminant removal is required.

Typical non hydrocarbon contaminants are $\mathrm{H}_2\mathrm{~S}$, $\mathrm{CO}_2$, organic sulphur species, mercury, and water, and the level to which their removal is required is determined by the sales specification or downstream processing requirements.

These two requirements, for hydrocarbon processing and contaminant removal, are not independent, and plant configuration must be considered holistically to determine the optimum solution.

We at WorleyParsons understand the necessary differences between gas plants, and we work with our customers to maximize their return on investment. Let us help you achieve your business objectives.
HUMAN INGENUITY + LEADING EDGE TECHNOLOGY + GREEN MINDSET = POWER FOR SUSTAINABLE FUTURE

Thanks to our broadening knowledge base, PTT GROUP is unwaveringly determined to create and develop innovative and green technologies for a sustainable future to benefit every life.

www.pttplc.com