

● Programme of the 23rd World Gas Conference

The preparations for WGC2006 are progressing well. The speakers for the opening ceremony, keynote speeches and midday addresses have all confirmed. Confirmations from the moderators for the strategic panels are well underway. The Committee sessions and expert forums have been allocated to the different time slots and conference rooms.

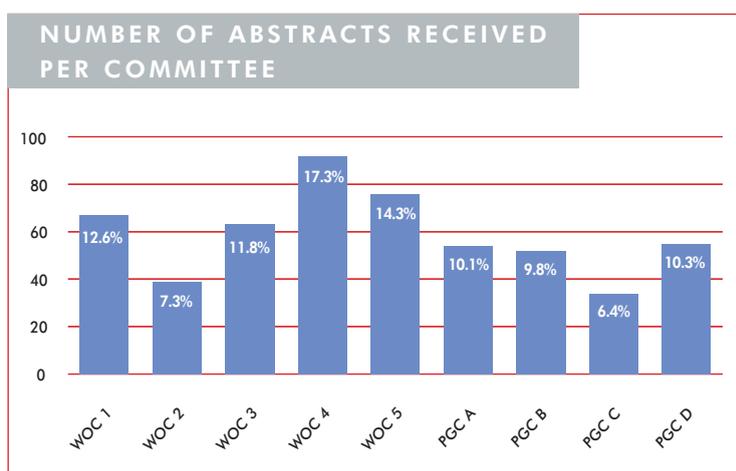
The preliminary programme was available for the Tianjin meetings following which 20,000 copies of the General Programme and Registration Handbook were printed and distributed around the world.

As mentioned in the last progress report, the call for papers was distributed to around 15,000 addresses and it was published on the website. The call for papers was a great success and the Committees received in total over 500 abstracts for evaluation. As more or less a law of nature the larger number of abstracts came in at the last possible moment.

The abstracts received by each Committee ranged from a low of 34 for PGC C to a high of 93 for WOC 4 (see Figure 1) allowing members to make a balanced and high quality choice of papers for the Conference.

A total of 46 countries submitted an abstract with 13 of them submitting at least 10. A breakdown is given in Table 2 and it is noteworthy that abstracts for papers were submitted by researchers from two non-IGU member countries, Colombia and Mexico, demonstrating the widespread acknowledgement of IGU's role as a platform for sharing opinions on natural gas.

After the process of online evaluation of the different abstracts was finalised, the Committees made their final choices and the results were



LEFT
Figure 1.

communicated to the authors. In total about 320 abstracts were accepted.

● Meetings and visits

The CC leadership participated in the following meetings between June and December 2005.

On June 10, CC Chairman Bert Panman attended the 11th Annual Conference and Exhibition of the European Natural Gas Vehicle Association (ENGVA), which was held in Bolzano, Italy. He then went to Eurelectric's Annual Meeting on June 13-14, which was held in Vienna, Austria. On September 15, he attended the biennial conference and EXPOGAZ exhibition organised by the Association Française du Gaz (AFG) in Paris, France.

On October 5 and 6 the second site visit was held at the Amsterdam RAI Congress and Exhibition Centre. Bert Panman welcomed the visitors on behalf of the WGC2006 organisation and gave an overview of the WGC2006 programme.

On October 6 a meeting was held with the team from the International Union of Technical Associations and Organisations (abbreviated as UATI from its initials in French), which was preparing the international seminar "Access to Energy for Everybody". Discussions covered the provisional programme and the IGU contribution to a half-day session on urban and rural energy by



Bert Panman, Professor Schoot Uiterkamp from the University of Groningen and Sebastian Moffatt, President of The Sheltair Group and coordinator of the "Bridging to the Future" project. At presstime the seminar was due to take place in Paris on March 16-17.

CC Secretary Rob Aptroot attended the R&D Task Force meeting in Hørsholm, Denmark on November 11, 2005.

Several conference calls were held with the Committee leadership to discuss the status of the work in the different Committees and to prepare the WGC sessions.

In conference calls with the incoming CC leadership and the Secretary General the preparation of the 2006-2009 Triennium was discussed and in particular the future of the ICT Task Force.

RIGHT
Table 2.

NUMBER OF ABSTRACTS PER COUNTRY			
Russia	83	Finland	3
Netherlands, The	73	Norway	3
Japan	53	Slovak Republic	3
Brazil	45	Belgium	2
Iran	36	Latvia	2
France	32	Malaysia	2
USA	30	Nigeria	2
Germany	20	Oman, Sultanate of	2
UK	19	Poland	2
China, People's Republic of	14	Saudi Arabia	2
Korea, Republic of	14	Serbia and Montenegro	2
Ukraine	11	Trinidad and Tobago	2
Algeria	10	Venezuela	2
Denmark	8	Bosnia and Herzegovina	1
India	8	Colombia*	1
Indonesia	8	Czech Republic	1
Italy	8	Israel	1
Spain	6	Mexico*	1
Argentina	5	Portugal	1
Canada	4	Singapore	1
Australia	3	Sweden	1
Austria	3	Turkey	1
Bangladesh	3		
Croatia	3	Total	537

(*not IGU member)

Gasum Launches the Balticconnector Study

As it strives to expand the market share for environmentally-friendly natural gas and to secure deliveries in a future liberalised market, Gasum is investigating the possibility of constructing an offshore pipeline between Finland and Estonia. It is now in the process of identifying pipeline route options through the archipelago to connection points on land.

The new offshore gas pipeline – the Balticconnector – will provide a convenient transport route for natural gas from the South, thus providing a robust ring-type connection encircling the Finnish Gulf with a direct connection to the large natural gas storage facility at Incukalns in the vicinity of Riga, Latvia. The Balticconnector transportation system will also include the connecting landlines in Finland and Estonia, and the necessary compressor facilities in Estonia.

Gasum has obtained a grant from the EU under the TEN-E-programme for a further investigation of

the Balticconnector. The work to be carried out relates to elaboration of technical concepts, offshore pipeline route surveys and an Environmental Impact Assessment (EIA) of the off-/onshore pipelines and land-based facilities. Gasum and Eesti Gaas will carry out the pre-engineering of the onshore pipelines and facilities.

Since 1974 Finland has been importing natural gas from Russia. Today the network extends for more than 1,000 kilometres and annual gas consumption is around 4,800 million cubic metres, equivalent to around 11% of Finland's total energy needs. More than 70 billion cubic metres of natural gas have been imported into Finland over the last three decades.

Since 1994 gas imports have been handled by Gasum Oy. Today gas supplies are based on a long-term contract, valid until 2025, between Gasum and OAO Gazprom.



Introducing Balticconnector

- A new vision of cooperation shared by the key natural gas companies in the Baltic Region
- Integration of existing transmission pipelines and underground storages in Latvia
- More opportunities to utilize the storage potential by several companies



Progress Reports from the Committees

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

● Working Committee 1 Exploration and Production

Last year was a busy one for WOC 1 with meetings in Belgrade, Serbia and Montenegro, and on the Island of Je-Ju in Korea. On both occasions the host countries made delegates very welcome which ensured that the time was well spent working and socialising hard.

The Committee is pleased to report that preparations for the World Gas Conference are proceeding as planned. During the second half of 2005 the WOC 1 assessment panel selected 15 papers for each of the expert forums, "Making the Most of Mature Gas Fields" and "New

Frontiers for Natural Gas". Of these, four or five papers will be selected for presentation orally in each forum. A survey to allow WGC registrants to express their views on the world's most significant gas fields has been finalised and will be carried out online via:

www.surveymonkey.com/s.asp?u=430731378773.

SG 1.1 has been busy producing its contribution to the WOC 1 report on the world's most significant gas fields. It will contain data sheets on gas giants as well as other significant gas fields and then an analysis based on our criteria of what makes a gas field "significant". All speakers are identified for the WGC. There will be four case studies: South Pars (Iran), In Salah (Algeria), Gorgon (Australia) and Bovanenkovo (Russia). Groningen (The Netherlands) is held as a reserve.

SG 1.2's remit covers new horizons for exploration, production and gas treatment. A draft version of its report has been circulated and

Committee members are assessing the content and providing feedback to the Technical Secretary. The report was due to be finalised at presstime.

The final meeting of the present Triennium was due to take place in Vienna, February 8-10, kindly hosted by Leopold Bräuer, ÖMV. Apart from finalising preparations for the WGC, it was also due to start preparations for the 2006-2009 Triennium.

● Working Committee 2 Storage

The fifth meeting of WOC 2 and its three Study Groups was held in Prague, October 3-7, 2005.



South Pars in Iran is the subject of one of WOC 1's studies of significant gas fields. Its gas is treated in this onshore plant at Assaluyeh.

Among other business, the Committee discussed the 40 abstracts received to date and decided to reject a few and ask some other contributors to combine their papers. The total number of presentations at the WGC in Amsterdam will be about 34.

A possible item for discussion in Amsterdam is the lead time for developing underground storage facilities to enhance supply flexibility. There are differing amounts of work and time involved in preparing depleted gas fields, aquifers and salt caverns.

As usual there was a workshop, which this time looked at numerical simulation in underground storage and in addition to Committee delegates had some external participants. The eight presentations have been collected on a CD-Rom and it was suggested that some of these could be used at the WGC. They will also form the basis of a future article for the IGU Magazine.

The sixth meeting was held in Paris, January 12-13, to discuss the final version of the Study Group reports. More detail of the work of WOC 2's Study Groups is given in the article on pages 164-168.

● Working Committee 3 Transmission

The fifth meeting of WOC 3 and three of its four Study Groups was held in Stavanger, September 12-14, 2005. SG 3.4 held its meeting a week later, September 21-22.

SG 3.1 presented the conclusions of the second questionnaire sent out in January 2005. The results of this work will be included in the Study Group's final report.

SG 3.2 organised a technical presentation given by Spetneftegaz from Russia, which operates a magnetic transverse flux inspection (TFI) tool for detecting stress corrosion cracking (SCC). The final report of the Study Group will summarise the state of the art in SCC detection.

SG3.3 presented the results of its January 2005 questionnaire on difficulties in creating onshore

infrastructure and Mr Hamre gave the latest progress report on offshore infrastructure.

WOC 3 received 64 abstracts for the WGC and a preliminary selection was made at an informal meeting of the paper reviewers in Bilbao on September 13, 2005.

The sixth WOC 3 meeting: was due to be held in Italy, February 27-March 1.

● Working Committee 4 Distribution

During the second half of 2005 WOC 5 met in Barcelona, September 18-21. There the Committee's paper selection group reviewed the presentations/abstracts and developed the overall programme for WOC 4 at the WGC. Three papers were selected to be presented on each of the Committee's three major topics, while 12 presentations/posters were selected for each of the two expert forums. This gave a total of 33, but subsequently five additional posters were accepted for a special poster session in the foyer of the forum.

Reports for the three WOC 4 Study Groups are summarised below:

SG 4.1 (Pipeline integrity)

While much work has been undertaken on transmission pipeline integrity, regulations and app-



Members of WOC 2 at their meeting in Prague in October 2005.



roaches to distribution pipeline integrity are still evolving and SG 4.1's report focuses on the latter issue.

The report finds that distribution networks are operated reliably and safely as network operators have extensive internal and external standards and procedures, which ensure the integrity, reliability and safety of these networks. The main risk identified in the area of distribution integrity relates to plant damage, with the single greatest issue contributing to this risk being improper operator excavations or "third party damage".

The report concludes that it is preferable to establish non-prescriptive regulations and legislation around distribution pipeline integrity compliance since this approach allows for the effective application of risk-based approaches in view of the diversity of age and condition of distribution networks. The report also concludes that skill-set upgrading of excavators can reduce plant damage and as such help protect the integrity of these networks.

SG 4.2 (Best practices)

This study seeks to determine leading practices for construction, maintenance and operation of the gas distribution system and how companies implement them, in order to improve safety and service quality, and achieve cost reductions whilst in compliance with all safety standards and regulatory requirements.

Surveys were conducted in the following areas to identify the leading companies and then to determine unique activities and how the practices were successfully implemented:

- Main and service pipes construction and replacement;
- Leakage survey and classification;
- Leak repairs;
- Emergency response;
- Damage prevention; and
- Pressure regulator operation and maintenance policies.

SG 4.3 (R&D in the gas industry)

Over the last few years the gas industry worldwide has been seeing a downward trend in its investments in research and development. This trend is particularly significant in research projects concerning distribution studies. The concurrent liberalisation drive has fragmented the value chain in gas industries.

The SG 4.3 report seeks to investigate whether these two circumstances are linked as cause-and-effect or whether they are two independent phenomena occurring at the same time, and also whether their impact is comparable in all geographic regions or whether it is focused on certain specific areas. The future of research and development in the gas distribution sector is also analysed, and potential pathways in developing future projects for the new context encountered in the sector are considered.

Meetings

WOC 4 will meet for the sixth time in Bratislava, Slovak Republic, March 28-31, to make the final preparations for the WGC and to discuss potential topics for the next Triennium. SPP is hosting the meeting, which will also include a joint workshop on integrity management with representatives of Slovak gas companies.

A final informal social meeting for WOC 4 in this Triennium has been arranged for Sunday evening June 4 in Amsterdam.

● **Working Committee 5 Utilisation**

WOC 5 had its fifth meeting in Prague, October 13-14, 2005, and its spring meeting will be held in Moscow, April 20-21. There are four Study Groups.

SG 5.1 Industrial utilisation – Howard Levinsky

Industrial end users are faced with substantial challenges arising from the drive towards sustainable development. They have to combine higher energy efficiency, to reduce CO₂ emissions and primary fuel consumption, with a major reduction



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In Spain: Sagunto & Mugardos



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In Spain and international
markets



in pollutant emissions to reduce the impact of the industrial activities on the environment. Moreover, they need to improve the quality, flexibility and reliability of their production processes to limit the consumption of raw materials.

The new target is to inventory the challenges that industrial gas utilisation faces (regulatory, economic, customer needs, sustainability, etc.) and the technological means to address them. To obtain the widest input, a questionnaire on international practices was developed in January 2005 and sent to all WOC 5 members and other parties who are intimately acquainted with the issues involved in industrial gas utilisation. Also included were questions regarding impediments to implementation for new technology, and ways to overcome them, as well as questions concerning technological R&D for this sector.

The response to the questionnaire was discussed in 2005 during the Study Group meetings in Paris and Prague. Preliminary analysis of the results highlights the interesting observation that, by and large, regulatory issues such as CO₂ (Kyoto) and NO_x emissions were not seen as substantial challenges for industrial utilisation, whereas more customer-related issues such as matching the combustion system to the production process and energy efficiency were seen as important issues. The results are being analysed further and will serve as input for the contribution to the WGC.

SG 5.1's contribution to WGC2006 will comprise a report and a round-table. The report will give a presentation of the background, method and results of the questionnaire. The analysis of the results obtained, particularly the international business perception of the challenges to industrial gas utilisation, will also be discussed. The challenges facing industrial gas utilisation will be presented as background for the round-table. The latter will be a panel discussion with a number of experts in the field, who will discuss the challenge given to them in the introduction. Tentative panel members include a director of R&D from a large industrial

end user of natural gas, a manager/director from a gas trading company, a director of research from a natural gas research centre and an independent expert on the transition to sustainability.

SG 5.2 Domestic and commercial utilisation – Jean Schweitzer

The utilisation of gas for the domestic and commercial markets represents about 10% of the total gross energy consumption worldwide and this share is growing. The development of the gas market is one of the most effective solutions for saving energy and reducing CO₂ emissions. The Study Group's work has been influenced by the changes that are seen every day in the new energy market: the appliances of tomorrow will be multi energy and most of the gas companies will also sell electricity or other forms of energy.

The targets are to: assess the potential and impact of new gas technologies in the domestic and commercial sectors; assess the potential of gas-powered air conditioning (with a case study); look at installation costs; and establish a permanent database of installed domestic appliances in coordination with Marcogaz, the European Gas Research Group (Groupe Européen de Recherches Gazières – GERG) and possibly other organisations that have data and that can share their market knowledge.

The database already existed as a result of the work of SG 6.1 in the previous Triennium, but is being completed and verified/fine-tuned. It will be a valuable tool and will avoid the duplication of work and questionnaires in IGU and the other organisations. The database is developing with external help as well (e.g. Germany's Association for the Efficient and Environmentally Friendly Use of Energy – Arbeitsgemeinschaft für Sparsamen und Umweltfreundlichen Energieverbrauch ASUE) and can be found at: http://gergpc.dgc.dk/public/Appliances_database/index.htm.

SG 5.2's contribution to WGC2006 will comprise a report and a round-table. The report is

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being finalised and for the round-table the Study Group has started discussions about preserving and reinforcing the presence of gas in the domestic and commercial sectors when facing new challenges. One of the questions in the heating sector is whether there will be stand-alone central heating boilers in the house of the future. Tomorrow's customer might also need cooling and may want to produce his own electricity. There is certainly a future for those multi-generation systems based on gas or gas with renewable energy. At the same time we are working on posters that will illustrate different scenarios for gas in the house of tomorrow.

SG 5.3 Natural gas for vehicles (NGV) – Davor Matic

The objective of the project called "Global Opportunities for Natural Gas as a Transportation Fuel for Today and Tomorrow" is to demonstrate key long-term factors for development of natural gas as a transportation fuel. It will also highlight the implications and risks for the gas industry of future development and investment programmes in NGVs. Targeted forms of CH₄ utilisation that will be observed more closely are: compressed natural gas (CNG), liquefied natural gas (LNG), biogas and hydrogen produced from natural gas.

The final report will provide:

- An overview of the existing fuels and technologies and analysis of future development;
- Country reports;
- Overviews of existing technologies used in each country;
- Trend analysis;
- Worldwide coverage of NGV market development schemes and strategies, reasons and key drivers – "from scratch" until today;
- A strength, weakness, opportunity, challenge (SWOC) analysis;
- A scenario matrix (recommended actions and strategy along the development path); and
- Clear recommendations to stakeholders (gas industry and decision makers) to help to

stimulate the market in a positive way and to identify what actions should be avoided (to learn from previous mistakes).

A fruitful discussion was held at the last meeting in Prague, when Study Group experts provided a scenario matrix for the expected development and commercialisation of methane as a transportation fuel. This covered market development, technology development (equipment supply), fuelling infrastructure development and government activities (legislation/regulation). Separate (but consistent) scenarios for CNG, LNG, bio-methane and hydrogen produced from natural gas have been prepared for the following time periods: market development phase (2005-2015), mainstreaming phase (2015-2025) and market sustainability (2025+).

As regards country reports, Iran has been updated and two new reports on Brazil and Chile are now available, providing better coverage of Latin America as an important NGV region. A total of 23 reports have been collected and are available on the WOC 5, SG 5.3 section of the Collaboration Portal (together with a technical database and trend analysis sheets).

Following the distribution of a draft version of SG 5.3's report with added scenario matrix tables and conclusions and recommendations to IANGV, ENGVA and Russian NGV Association (NGVRUS) experts and other partners for their review, the final version has been prepared. This report will be the basis for the Study Group's work in the 2006-2009 Triennium as a pathway towards an integrated global NGV strategy.

Meanwhile, the Study Group's work has been presented at GasSUF 2005, the Russian conference and exhibition on gas supply, distribution and usage, which was held in Moscow, September 27-30, 2005, and a round-table on gas use in transport in Zagreb on January 19.

SG 5.4: Distributed energy generation: from CHP to micro co-generation – Samuel Bernstein
Combined heat and power (CHP) is one of the

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from europe

to asia





most efficient gas technologies. It has been well developed in Europe, Japan and North America and represents a major key issue for gas markets.

CHP research and development is focused on two main issues: improving technologies and installation rules for medium- and small-scale co-generation. Medium and small CHP has faced some difficulties in entering the market and developing sales. The investment price, operation and maintenance costs are still too high for commercial or small industrial plants. New technologies, such as microturbines, or technology improvements, such as catalysts, new engine designs and regulation systems, could improve the situation. Packaging will also be a very relevant topic. Standard rules for installation, and especially electrical connection to the grid, must be defined. Last but not least, incentives and barriers must be analysed, in order to allow structured and coordinated lobbying at a regional level.

Sizing down by using emerging technologies may allow micro co-generation to enter the residential market. To analyse that trend and share answers, WOC members have been studying distributed power generation and CHP plants in their own country from the technical, economic and legal points of view. The synthesis will enable the drawing of some general conclusions on the future of distributed generation development.

Members of SG 5.4 prepared a paper "Prospects for Gas Markets and the Implications for Co-generation Worldwide" for the magazine *Cogeneration and On-site Power Production*, which was published in the July/August 2005 issue. They also prepared an article for this issue of the IGU Magazine (see pages 172-182).

The work of the Study Group includes: ongoing discussion/exchange in distributed generation applications, site visits, development of a database on the technologies, a status report and Internet links (which will be reviewed by experts). Finally, plans are being formulated for a round-table at the WGC.

The next meeting is scheduled for April 13-14. A detailed discussion on distributed power generation in Russia is planned for that meeting.

● Programme Committee A Sustainable Development

Representatives of 10 countries attended the fifth meeting of PGC A in Oslo, October 13-14, 2005.

The Committee received 54 abstracts of which approximately 80% dealt with issues such as global climate change and good housekeeping, and 20% with sustainability, economics and life cycle analysis. Only one abstract was submitted on local air quality.

In making its selection the Committee took care to ensure a global balance and all continents will be represented in the presentations of the PGC A sessions at the WGC. Some 23 papers have been selected of which nine will be presented orally in Committee sessions with 14 as poster presentations. Three alternate abstracts have been identified in case one or more selected authors are not able to attend.

The next step is to finalise the Committee report, which will have two main chapters. One covers life cycle analysis related to sustainability. The second concentrates on the sustainable development aspect, mainly dealing with NGV, CHP and good housekeeping. The report was due to be released at presstime.

The next meeting of PGC A will be hosted by E.ON Ruhrgas in Germany (exact venue to be decided), April 27-28. Business will include finalising the Committee's WGC programme and running a series of training workshops for members who will be moderators or panellists. The aim is to ensure that the panel sessions run smoothly and efficiently.

PGC A sessions at the WGC

The first Committee session will be held on June 6 with the title "Natural Gas, Hydrogen and Renewables". In this session we will present five

papers and the final report of SG A.1. There will also be an expert forum on this day where seven posters will be presented with time afterwards for discussion.

The other session will be held on June 8 with the title "Natural Gas a Real Option for Emission Reduction". Here four papers and the final report of SG A.2 will be presented. In this case we will invite a special speaker from Iran. Again there will be an expert forum where seven posters will be presented and discussed.

● Programme Committee B Strategy, Economics and Regulation

PGC B held its third plenary meeting and parallel meetings of the three Study Groups in Buenos Aires, November 20-22, 2005.

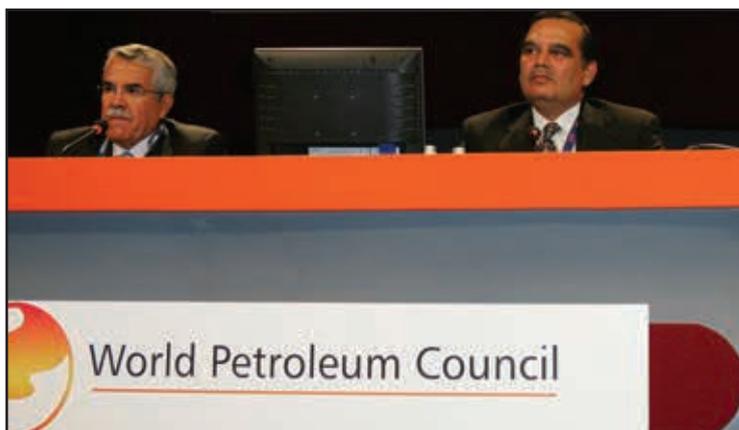
A first draft of the Committee report had been circulated prior to the meeting. Its basic content was agreed on by all members, although further refining was requested. Further, it was agreed to reverse the order of appearance of the Study Group reports, i.e. to start, after the general introduction, with the report of SG B.3 on gas demand, then to follow with SG B.2's report on gas supply and to conclude with the report of SG B.1 on regulation, strategy and economic issues. Mr Fulwood, Committee member from the UK, agreed to give the report a final editorial check-up before sending it the CC.

Currently, no further plenary meeting is planned. However, to organise the last issues for the WGC in Amsterdam, the Committee and Study Group Chairs will meet in May, most likely in Bonn, Germany.

Technical programme for WGC

The posters and presentations have been selected in accordance with the result of the call for papers, the panel parties for the sessions have been fixed and the speakers have accepted their invitations.

The expert forums will look at aspects of supply and demand with the first concentrating on the gas



TOP AND ABOVE

Both PGCs C and D participated in the 18th World Petroleum Congress, which was also addressed by IGU President George Verberg.

industry in Europe and neighbouring regions, and the second on the rest of the world i.e. North America, South America and Asia.

A stand-alone statistical paper will be produced under the responsibility of the leaders of Study Groups B.2 and B.3.

● Programme Committee C Developing Gas Markets

PGC C participated in the 18th World Petroleum Congress (WPC) in Johannesburg (September 25-29, 2005). The PGC C Secretary took part in a round-table, jointly organised by IGU as a preview of WGC2006, on the topic "Key Success Factors for a Developing Gas Market – West African Gas



During its autumn 2005 meeting PGC D inspected the progress of work on the Snøhvit LNG project.

Pipe Line: A Case for Gas”, and also gave a short presentation on the progress of the Committee’s activities.

PGC C held its fifth meeting in Rio de Janeiro, October 6-7, 2005, and 14 members from 12 countries participated. The main topics addressed during the meeting were:

- Finalisation of reports for the four case studies (1. China; 2. Egypt and the Mediterranean Basin; 3. Brazil; 4. Further market development in countries under transition in Europe);
- Selection of papers to be contributed during the expert forums at the WGC; and
- Preparation of the PGC C contribution to the WGC.

All four Study Groups, according to the requirements approved in the previous meeting in Noordwijkerhout, presented the content of their respective reports. The final version will be reviewed by the secretary and will be forwarded to the CC by the official deadline.

The structure of the working sessions at the WGC was agreed on the basis of earlier proposals. The main sessions will be devoted to the presentation of the four case studies (grouped in twos), followed by round-tables with the participation of experts from different companies and organisations. Some of the invited speakers have already confirmed their participation; contacts are underway to complete the panels. In addition, 12 papers were selected for oral presentation and 10 papers for “poster” presentation within the expert forums.

The last PGC C meeting of the Triennium was due to take place in Lisbon, March 9-10.

● Programme Committee D LNG

PGC D held its autumn 2005 meeting in Hammerfest, October 4-7. The principal aims were to make significant progress on the Committee’s report, finalise the selection of abstracts from the 56 received and organise the PGC D sessions for the WGC. In addition, there were preliminary discussions on the topics for the 2006-2009 Triennium, and the opportunity was taken to visit the first European LNG export plant, Snøhvit, which is now under construction.

During the Hammerfest meeting the draft of the PGC C report giving an overview of the LNG industry and marketing from 2002 to 2004 was presented, as were drafts of each Study Group’s report. All reports were subsequently completed and then approved at the PGC D steering meeting in Paris on January 18. Other coordination meetings will be organised if necessary one day before the WGC.

SG D.1: Standardisation LNG qualities

The contents of the report are:

- Proposed description of LNG:
 - Wobbe, HHV (“Interchange ability diamond”)
 - Impurities: nitrogen, oxygen, H₂S, COS, mercaptans;
- LNG quality debate in importing countries;
- Quality adjustment options at export and import;

SPP, joint stock company

- 150-year-old history of gas industry in Slovakia
- the largest natural gas transmission company in EU
- purchase and sale of natural gas
- transmission, distribution, treatment and storage of natural gas and its delivery to customers
- international transmission of natural gas
- services related to the sale of natural gas



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- Recommendations and outlook; and
- Appendices on unit conversion, standards, ageing of LNG and interchange ability issues.

The report reaffirms the commitment to simplify the LNG trade, through clear and more uniform LNG standard qualities. It also calls for a comprehensive review of both economic and technical factors influencing the decisions of individual participants in the LNG trade with regard to decisions affecting the LNG quality that can be produced or received at their facility.

SG D.2: Safety and technology developments in LNG terminals and vessels

During the Hammerfest meeting the final draft of the Study Group's report was presented and reviewed. It was subsequently completed and then approved at the PGC D Steering Committee meeting in Paris on January 18. The contents of the report are:

- Safety in LNG plants, vessels and receiving terminals;
- Technology of import and export terminals; and
- Technology of vessels.

SG D.3: The future of the LNG spot market

The main contents of the report are:

- Definitions – "What is the LNG spot?" and "What is the role of spot cargo in the LNG market?";
- Data – statistical approach;
- Analysis;
- Market changes;
- Physical constraint – value chain (1) liquefaction (2) shipping (3) re-gasification; and
- Contractual changes (1) former (2) current (3) flexibility (4) price formula etc.

Other organisations

PGC D took part in the 18th World Petroleum Congress in September 2005 and led a round-table on LNG.

During the Hammerfest meeting Dr Acton presented a document with the main activities and contact persons of GIIGNL, Gas Infrastructure Europe (GIE), the Society of International Gas Tanker and Terminal Operators (SIGTTO) and other organisations.

PGC D Chairman Dr Chawki Rahal and IGU President George Verberg attended the GIIGNL General Assembly in Lisbon, October 10-11, 2005.

The 2006 coordination meeting with other organisations is planned just before or during the WGC.

WGC2006

A sub-committee of 14 members reviewed the 56 abstracts submitted and selected 27 for presentation at the WGC with an additional five as reserves. Subject to last-minute changes (please check on the www.wgc2006.nl website) the programme is as follows:

- Session 1, June 6, "Growth and Globalisation of the LNG Markets: The Challenges Ahead". During this session the reports of PGC D and SG D.3 will be presented as well as other papers.
- Session 2, June 8, "How Will Existing and New LNG Facilities Respond to the Challenges of Mature and Rapidly-expanding New LNG Markets?". During this session six papers will be presented.
- Expert forum 1, June 7, "LNG Quality: Technological and Economic Aspects". During this session SG D.1's report will be presented together with other papers and posters.
- Expert forum 2, June 7, "Safety and Technology Developments in LNG Terminals, Vessels and Installations". During this session SG D.2's report will be presented as well as other papers and posters.
- Expert forum, June 6. This forum will be mainly for poster presentations.
- Strategic panel, June 8, "Will the LNG Industry Respond to the Challenges?".

Association of Hungarian Gas Distribution Companies

The Association of Gas Distribution Companies (GE) was founded by its members in 1991. The EU-compliant Law on Gas Supply came into force on January 1, 2004, and created suitable conditions for opening up the natural gas market in Hungary. In 2005 the Hungarian Parliament modified the Law on Gas Supply in line with EC 55 Directives. The regulatory authority is the Hungarian Energy Office.

GE has the following member companies:

Southern Lowlands Gas Supply Co.
(DÉGÁZ Rt.)

South Transdanubian Gas Supply Co.
(DDGÁZ Rt.)

North Transdanubian Gas Distribution Plc.
(ÉGÁZ Rt.)

Budapest Gas Works Co.
(FÖGÁZ Rt.)

Middle Transdanubian Gas Supply

Private Company Limited by Shares
(KÖGÁZ ZRt.)

MOL Natural Gas Supply PLC
TIGÁZ Gas Distribution Private Limited
Company of the Region over River Tisza (TIGÁZ ZRt.)

In Hungary the annual primary energy consumption exceeds 26 million tonnes of oil equivalent (MTOE).

Natural gas plays an important role in energy supply and its share in primary energy consumption exceeds 45%. The bulk of natural gas (80%) is imported, mainly from Russia. In Hungary natural gas consumption exceeds 14 billion m³ per annum and more than 95% of this is re-sold by GE's member companies.

In Hungary there are 3.2 million natural gas consumers, 97% of which are partners of GE's member companies.

The Association of Gas Distribution Companies formulates a coordinated

opinion regarding professional questions connected with the activities of its member companies in the gas industry. Closely cooperating with the Ministry of Economy and Transport, the Hungarian Energy Office and organisations for consumer protection, GE takes an active part in the gas industry legislative procedures. GE is represented in several international professional organisations (IGU, Eurogas, DVGW, GEODE, Marcogaz).

In compliance with EU Directives, the different types of activities of natural gas companies have been separated. The gas distribution companies have obtained licences for public utility supply, natural gas distribution and trading and access to cross-border transmission pipelines. MOL Natural Gas Supply PLC has licences for public utility wholesale, trading and access to cross-border transmission pipelines.



HUNGARIAN ASSOCIATION OF GAS DISTRIBUTION COMPANIES

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Progress Reports from the Task Forces and Special Projects

This chapter contains information from IGU's two Task Forces and three Special Projects.

● **Task Force Research and Development**

The R&D Task Force met on November 11, 2005, in Hørsholm, Denmark, and was due to meet early in 2006 in Paris. The meetings will focus on preparation of a final report including analysis and conclusions to be drawn from a comprehensive questionnaire on technology priorities for the future.

The questionnaire was prepared to seek views on the relative priority for over 50 specified technological developments, ranging across the gas chain from exploration and production to utilisation, which might contribute to the future business success of the industry, either in the long or short term. It was designed to take no longer than 10-15 minutes to complete and was sent out in September 2005 via Gasunie research to over 600 identified contacts in IGU, accompanied by a letter of support from the President. Results from the questionnaire will also enable differences of view, between different industry and geographical sectors, to be identified.

Progress has been made in the organisation of a Strategic Panel debate on R&D scheduled to be held at WGC2006. Peter Lehmann (formerly Commercial Director of Centrica UK and member of the Board of Directors of Gaz de France) has accepted an invitation to moderate the debate. IGU contacts have been used to seek high profile panellists from Japan and the USA who confirmed their participation informally. Formal invitations to participate in the debate to these and other panellists from Europe have now been sent out. The WGC debate will be preceded by a

presentation on the work of the Task Force by Chairman Bob Harris, which will include the conclusions from the technology questionnaire.

Task Force members Marc Florette (Gaz de France) George Tenley (Pipeline Research Council International) and Christian Beckervordesandforth (E.ON Ruhrgas) took part in a strategic debate on R&D innovation and financing held during the AFG conference in Paris September 15, 2005. The President of IGU also participated as a panellist and the discussion was chaired by Bob Harris. The views expressed were summarised for discussion at the next meeting of the Task Force and lessons learned from organisation of the debate will be used to help plan an effective format for the WGC debate.

● **Task Force Information and Communication Technology**

In the last progress report the ICT Task Force reported on the proceedings of ICT2005 in Busan, Korea. Here the findings of the Congress and the lessons learnt from organising it are highlighted.

The findings of ICT2005

- Deregulation induces tremendous changes for energy companies and ICT has become a critical enabler, a tool for competitive advantage instead of only a supportive tool.
- Market opening: in a competitive environment with supplier choice the customers become one main focus of attention for energy companies.
- Companies have to reduce their operating costs. The latest IT developments can help contain costs while maintaining a high level of efficiency.
- Standardisation is the most efficient way to handle growing complexity and can be achieved by measures such as cooperation between companies and by using off-the-shelf tools.
- Time scales are shortening, moving energy companies towards a real-time model.
- The safety of infrastructures and integrity of data

remain very important issues in the energy business and transparency requirements from stakeholders will continue to rise.

- Energy companies will succeed only if they know how to drive large transformation programmes, adapt their organisation and processes and upgrade their employees' skills.

Conclusion: Does ICT create value? Yes, it can, but only if it is integrated in the corporate strategy and handled by the highest level of management.

Organisation

For any conference organiser the key issues are location, the cost of attendance and competition from other events. Most participants tend to come from the host country and neighbouring countries; many companies are restructuring and facing cost reductions, which prevent them from sending people to expensive events; and there are many conferences in the IT field.

In general the organisation was of high quality and a success on all points. The Task Force Chairwoman, Véronique Durand Charlot, would like to thank: Olga Solařikova from the Czech Republic, who provided valuable experience gained from organising the previous ICT Congress; Eric Dam and Eleanor Hyde from Gasunie; and from the Korean National Organising Committee (NOC) Dr Lee (Chairman), Peter Shin (Secretary) and Mr Lee of Korea Gas Corporation and Mr Choi of SK-Enron (members).

While the contacts between the Task Force and the NOC team were always very pleasant and fruitful, it is recommended that a unified organising team be set up in future. Moreover, the ICT Task Force was formed quite late and a longer lead for preparations would be better. There should also be a stronger commitment from the involved countries and companies.

Budget and sponsorship were a continual worry. Time was very short to settle requirements for sponsorship and the separation between the NOC team and the Task Force did not help. Global IT

companies seem to be the most relevant sponsors for this kind of event and we think that they should be involved in a long-term partnership rather than having to search from scratch each time. This will help in finding high-level speakers.

One of the intentions of ICT2005 was to cover the whole gas chain and to address industry executives as well as IT specialists. This goal was achieved with difficulty. While plenty of technical papers covering infrastructure issues came in, there were problems collecting papers related to the commercially-sensitive sales and trading areas. On the positive side the CEO forum was really worth the effort and the Korean cultural breaks provided a useful balance to the Congress.

In conclusion, the current Task Force is convinced that there is a risk for the future if there is no change in the organisation process and two options have been considered.

Option one: it is agreed that ICT congresses dedicated to gas are less and less viable for a



Kyu-sun Lee, who was then President of the Korea Gas Union, addresses the opening ceremony of ICT2005.



variety of reasons including cost pressures on companies, a high number of competing events and overlap with the World Gas Conferences. In that case the ICT issues should be addressed only in a dedicated session of each World Gas Conference.

Option two: we continue with triennial ICT congresses but they are managed on a long-term basis as a series rather than one-off events. There should be partnership with permanent sponsors from the IT world, with WEC and WPC, and a stronger support by the IGU organisation for the constitution of the Task Force.

IGU and especially the incoming Argentine Presidency will carefully review the recommendations put forward by the ICT Task Force.

● Special Project Gas to Power

There are two key objectives for the Special Project Gas to Power. One is to learn what is going on in the corridors of power and the other is to engage the power industry and governments in discussing the future realisation of the full potential of gas-

fired power generation. *Figure 1* shows the flow of work.

The reports on South America and Europe have been distributed and the contents have already been played back into other forums and conferences. The report on North America will be circulated shortly. In the meantime a study on Russia has been carried out with the help of Gazprom. That report is now in its final draft form and will be issued shortly.

As far as Asia is concerned it was considered that the region is too large and consists of too many sub-markets to address in total. Therefore it was divided into various parts: a report on Japan is being developed; a report on China was prepared by a former IEA expert, now employed by BP, and is now ready for circulation; a report on India is in preparation by the IEA; and a report on the other parts of Asia is being prepared with the help of Shell.

As regards Africa the World Bank is preparing a report on the situation and prospects there.

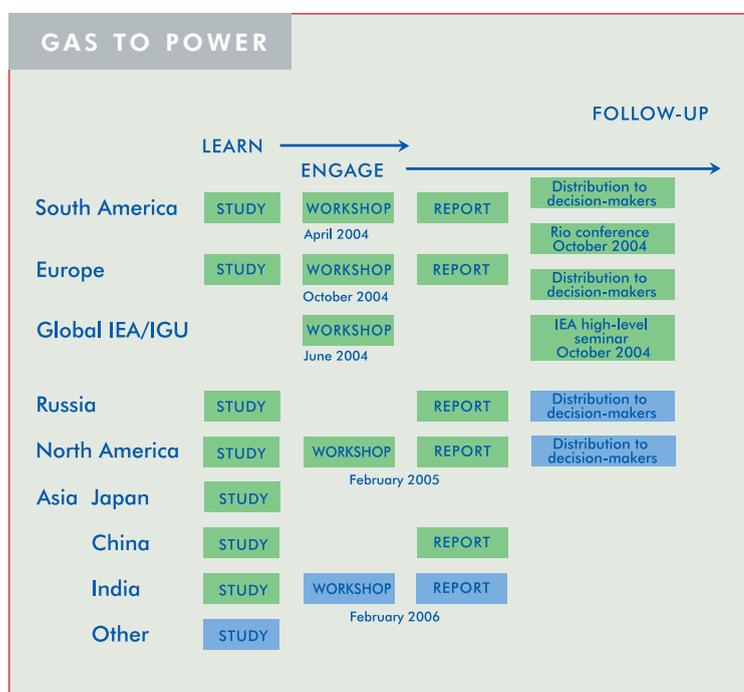
The Special Project's work has identified the main issues in gas and power to be those related to the environment and what are termed "price and prejudice" issues.

Price and prejudice issues

In South America we found that there is great potential for an integrated Southern Cone gas market. Unfortunately the political climate at the moment is not very favourable to fully exploiting this potential. In North America we see over-capacity in gas-fired generation and an under-supply of gas at the same time, which results in serious concerns on price and gas availability. As a consequence the Bush administration appears to be leaning towards coal-fired power generation more than before.

Europe is divided. While there are a few EU countries going all-out for gas fired power generation, others have different preferences: France is still in love with nuclear and Germany likes coal.

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Figure 1.





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Cameroon is a member of the Extractive Industries Transparency Initiative (EITI), an international forum created to achieve transparency in the management and judicious utilisation by governments, of revenues derived from extractive industries. It is also a member of the Monitoring Committee to implement the principles of this initiative in Cameroon.

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BROADENING HORIZONS IN PERU**





RIGHT
Figure 2.

MID-TERM SCHOOL REPORT			
	Gas Industry	Power Industry	Government Public Inst.
South America	+	+/-	--
North America	--	-/+	-/+
Europe	-/+	+/-	-/+
Russia	+	+	-/+
China	+	+/-	--
India	+/-	-/+	-/+

Overall the EU is concerned about price and about the fact that on the continent gas prices are still oil indexed and most power generators do not like oil-indexed prices.

The main issue in Russia is that gas prices are so low today that gas is competitive with coal on a marginal cost basis, which of course distorts the economics. This situation has to be adjusted over the course of the next couple of years and the process will significantly change the competitive position of gas in the market.

In India the necessary energy policies are not yet in place. There is an excessive difference between domestic and international gas prices and the question of the appropriate market structure is still under discussion and has not been resolved.

The key issue in China is the absence of a policy allowing gas-fired generation to find its place in the market, particularly base load gas-fired generation. Since this is a necessity for the successful development of LNG imports, the expectation is that that such a policy will be implemented in the near future.

Altogether we see an eroding confidence in the price competitiveness of gas-fired generation. That applies to virtually every market. In terms of prejudice there is a concern about security of supply or availability of gas in the power industry. Most

governments are now wringing their hands on this issue but so far they are not really coming up with any constructive measures or policies.

Environmental issues

These represent a two-edged sword. On the positive side the need for clean air helps and supports gas-fired generation. Furthermore, in Europe we see the CO₂ emission costs rising to as much as \$30 per tonne, which supports natural gas as a competitive fuel.

On the negative side the concerns about CO₂ emissions lead to a revival of nuclear, an option that is now on the table again in many countries where it was not before.

In the "mid-term school report" (see Figure 2), we have given mid-term marks for the extent in which each of the three stakeholder groups are contributing to realising the potential for gas-fired generation in each of the regions we have reviewed to date. It shows that the dialogue between the stakeholders needs to be further encouraged in various regions, particularly if the potential for gas-fired generation is considered to reflect the most economic and sustainable future for society at large.

● Special Project Regulation

On December 12-13, 2005, IGU organised a high level workshop on North American regulation in Washington DC. The Dutch Embassy kindly hosted this workshop. In four sessions the main topics were debated in an open atmosphere under Chatham House rules. The EU and US regulatory regimes were compared and experiences exchanged. Representatives were present from all stakeholders in the US debate on regulatory issues including federal and state regulators, the industry, the Department of Energy, gas producers, interstate pipeline operators, academics, lawyers and consultants.

The topics in relation to the regulatory framework were:



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Is within vertically integrated oil and energy company INA, part of Naftaplina - Exploration and Production Division. Commercial and Trade Sector is engaged in the domestic and import gas supply business as well in wholesale of natural gas to all consumers in the Croatian energy market. Our Vision is to maintain our position as a leader in the Croatian wholesale natural gas market and to expand our activities to become a significant player in the region. Our Mission is to promote the use of natural gas aiming at environmental protection, to provide excellent and reliable service to meet our customers needs and expectations so to earn their permanent trust.

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- Emerging global gas market and security of supply;
- Investments for the future;
- Rate design and access conditions; and
- The dynamics of regulation.

The workshop was followed by a joint IGU/IEA conference on regulation of natural gas markets in Paris on January 26, and a final workshop is planned in Asia.

A report on the regulatory developments in the globalising gas market is being finalised by the Clingendael International Energy Programme (CIEP) sponsored by EnergieNed on the basis of discussions and input from all the above events, and a summary will be presented at the World Gas Conference in Amsterdam. In the meantime a draft has been published on the Collaboration Portal.

● **Special Project Sustainability**

The main progress made in this Special Project relates to the report written by Professors Jepma and Nakićenović. However, more work is needed, especially on the chapter with the four storylines.

This chapter was discussed in two workshops, the first on the occasion of the Energy Convention Groningen, which was held in that Dutch city, October 26-28, 2005. Here the storylines were evaluated as regards suitability and consistency. The second workshop was held at the International Institute for Applied Systems Analysis (IIASA) in Vienna on January 10, and concentrated on the recommendations which have to be taken out of the storylines and brought to IGU's attention.

The report was due to be finalised at presstime and will be discussed at the WGC in June. By autumn the aim is to update IGU's Guiding Principles for Sustainable Development.

Storylines

The first storyline deals with transition. Environmental aspects are the key priority. This results in market-based incentives that provide a very good basis for gas as a real transition fuel to the sustain-

able energy world. This is the positive storyline. We have completed three more because although we think the outlook is good, there are some serious dangers for the gas industry, dangers which have to be confronted and tackled.

Thus the second storyline deals with security of supply. In the next decade there will be increasing international concern about dependence on oil and gas imports. Political issues will be at the forefront and attention will be diverted from the environmental aspects of natural gas. The gas industry, producing countries and consuming countries need to work together to overcome the security of supply issue.

Then storyline number three looks at competing fuels. Natural gas may be the cleanest fossil fuel, but its competitors are alive and well. The coal industry is very active, especially in respect of CO₂ capture and storage. Moreover, there is much discussion of reviving the nuclear industry. Technological innovation could undermine the advantages of natural gas. And then gas becomes a cross-roads fuel.

The fourth storyline is about underinvestment. With uncertainty in the gas market, and especially uncertainty as regards the actions of governments, there is a risk that companies will not be able to make proper investments in time. Lack of investment undermines market share and natural gas could lose its very favourable starting position.

The overall conclusions of these four storylines can be formulated in terms of strong factors and weak ones.

Natural gas is by far the cleanest fossil fuel with abundant resources, the main issue at the moment is access to these resources. Natural gas also has a high energy efficiency and the introduction of distributed power generation could increase that substantially. At the household level distributed power generation means that one machine efficiently supplies heat, electricity and even in the longer term cooling. A more decentralised energy system also gives great opportunities for links between

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natural gas and sustainable fuels, especially solar and wind energy and biomass, which could be inserted into the energy sector at a local level.

The weak factors are: international dependence in terms of security of supply; the current high gas price; competition from other energy sources, especially nuclear and coal; and a substantial risk for underinvestment in the gas chain.

All in all, there is a bright future for natural gas but it can not be taken for granted. We have to work hard as a gas sector to achieve this bright future and that means that we must be pro-active and that we must tackle sustainability. Progress has to be made on improving the efficiency of gas applications and the efficiency of conversion technology, especially for distributed power generation. We have to be in the forefront of CO₂ capture and storage; maybe we have to work together here with the coal industry. Finally, we have to work very hard on the introduction of green gases, biomass and hydrogen into the natural gas sector.

Bridging to the Future (Sustainable Urban System Design)

Good progress is being made on the follow-up to the Sustainable Urban System Design (SUSD) competition of the 2000-2003 Triennium, which takes the form of an international collaborative project called Bridging to the Future (Btff). Focusing on five locations, it aims for a vision of integrated urban and energy planning to manage the difficult transition to sustainable energy systems with a time horizon of 30 years.

Teams based in Canada, China, India, Japan and The Netherlands are participating in Btff. Collaborating provides them with new perspectives, alternative planning tools and increased opportunities for both learning and leadership. The

¹ A charrette is an intensive, multidisciplinary workshop of a couple of days that provides design sketches. It means "cart" in French and its use is said to originate from the École des Beaux Arts in Paris during the 19th century, where proctors circulated a cart ("charrette") to collect final drawings while students frantically put finishing touches to their work.

charrette¹ is one of the planning tools shared by the teams. A manual on the website (www.bridgingtothefuture.org) provides a description of how to organise a charrette for long-term, integrated systems planning, and examples of how to orient the participants and present the results.

One of the most unusual aspects of the Btff charrettes is the 30-year time horizon, which is much longer than typical long-range plans for urban systems. Although looking so far forward increases complexity and uncertainty, it also provides potential benefits. The most significant benefits of the long-term approach are:

- A process that is based more on values than on protecting interests, and that is consequently more inclusive and positive;
- An ability to consider major changes to slow-moving elements of regions, such as land-use and infrastructure, and to find more elegant and efficient solutions at the "whole system" level;
- Life cycle costing for long-lived investments such as transportation corridors;
- Clarification of major trends that are reshaping energy systems and ultimately creating major threats and opportunities for cities (such trends include the decarbonisation of energy sources, increased flexibility and control, and dematerialisation);
- The identification of major forces that are largely external to the regional plans, but that are likely to impact regional plans (such forces include climate change, demographics, globalisation and resource scarcities); and
- The opportunity to "backcast" a pathway to sustainability, by first defining specific end-state conditions or goals, and then describing critical – but manageable – transition steps, starting today.

The long-term pathways and projects for four locations will be showcased as part of workshops and combined presentations at the World Gas Conference in June.



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- ▶ *Leading LNG player – among the top 3 in the world*
- ▶ *Growing gas distributor – No. 1 in the UK, No. 2 in France*
- ▶ *Benchmark power expertise – co-generation*

▶ Natural gas

Natural gas is expected to post the strongest growth of all fossil fuels over the next decade—an average of around 3% a year globally—driven by demand from the power generation segment.

Leveraging more than 60 years' experience in natural gas, Total is a leading global operator with recognised expertise all along the gas chain from exploration and production, liquefaction and regasification, and transportation to storage, trading and marketing, and power generation.

In an environment of gas and electricity market deregulation, we are pursuing a strategy aimed at capitalising on our natural gas reserves—which account more than a third of our total reserves—and identifying markets for new potential resources. In line with this, our Gas & Power business is strengthening its positions at all stages of the chain.

Involvement in all segments of the gas industry makes Total a preferred partner for a large number of gas projects worldwide.

▶ LNG

Total helped to pioneer the LNG industry in the 1960s and is today a partner in five of the world's largest liquefaction plants, which account for around 40% of global capacity.

More than a quarter of our gas production is already valorised as LNG and we continue to strengthen our positions along the LNG chain, aiming for growth of 10% per year by 2010. Total has new projects in Yemen, Angola, Norway and Iran as well as plant extensions in Nigeria and Qatar. We are also a front-runner to

partner Gazprom in the huge Shtokman venture in the Barents Sea.

At the consumer end, Total has acquired interests in three regasification terminals to ensure additional markets for production from the Middle East, the Gulf of Guinea and, in the future, Northern Europe. India's Hazira terminal was inaugurated in April 2005 while the terminals at Altamira (Mexico) and Fos Cavaou (France) are due to begin operations in 2006 and 2007 respectively. And from 2009, Total will also have capacity in the Sabine Pass terminal on the US Gulf coast. By 2010, we plan to have a regasification capacity of 17.7 million tonnes per year and a balanced spread between Asia-Pacific and the Atlantic Basin.

Total also has long experience of LNG shipping, placing great emphasis on safety. We devote considerable energy to checking that vessels are maintained to the highest standards and ensuring that crews are properly trained. Total's expertise includes tanker design; the Group is a partner in GazTransport & Technigaz, which develops membrane technologies for LNG carriers. More than 90% of carriers on order today deploy these technologies.

▶ Pipelines

Total has contributed significantly to developing a Western European gas pipeline network to carry our North Sea production. We now have interests in 11,000 kilometres of high-pressure pipeline in Europe and operate close to 5,000 kilometres of pipeline in France.

More recently, Gas & Power has expanded its presence in South America with the acquisition of substantial interests in pipelines (9,400 kilometres in all) in Argentina, Chile and Brazil.

▶ Natural gas storage

Storage is a critical logistics tool for gas distribution, ensuring security and adjustment of supply to meet sharp seasonal variations in demand. It also enables optimisation of upstream investment, in particular in transmission and production infrastructure.



Total owns and operates two underground storage facilities in France, with an aggregate capacity of 5.4 billion cubic metres, and we plan to increase this by nearly 20%. By developing underground storage facilities in France we help create major gas hubs, ensuring market fluidity and boosting growth by making natural gas more competitive in Europe.

We also have a stake in Géostock, which specialises in designing, building and operating underground storage facilities.

▶ **LPG storage**

Total has now acquired broad experience in liquefied petroleum gas (LPG) storage. In November 2003, we signed an agreement with Hindustan Petroleum Company Ltd, India's third-largest refiner, to build an LPG import and storage terminal in the port of Visakhapatnam. The facility, with a capacity of 60,000 metric tonnes, is expected to begin commercial operation in 2006.

▶ **Gas marketing & trading**

Gas market deregulation is moving forward worldwide, and especially in Europe. Against this backdrop, Total is strengthening its positions in marketing natural gas to industrial and commercial (I&C) consumers.

We have gained considerable experience in the United Kingdom, the first EU market to be deregulated, beginning in the late 1980s. Total is one of the I&C market leaders, with over 50,000 gas customer sites and sales in 2005 of over 5 billion cubic metres, giving a market share of around 20%. Total also supplies electricity to I&C consumers.

As deregulation advances, we are capitalising on this experience to expand our presence in continental Europe, especially Spain and France. A key asset here is comprehensive expertise that enables us to efficiently meet varied customer expectations. In France, we were the first to gain a foothold in the eligible customer market before the I&C market was fully deregulated and our target is to double our market share, from just

under 10%, within five years. We are currently the No. 2 operator in France with 16% of the overall natural gas market. Total's sales Europe-wide nearly doubled in 2004, reaching 13 billion cubic metres.

In the US, our gas sales grew 50% in 2004, reaching 15 billion cubic metres and we have also set up an organisation in South America to market our gas from Argentina and Bolivia across the Southern Cone.

Last but not least, Total boasts an experienced gas-trading team in London that lets us optimise flow management on a global scale, leverage our production and outlets, and secure margins thanks to hedging in markets.

▶ **Power generation**

Power generation is the main outlet for the gas chain. Gas-fired power stations already account for 40% of demand for natural gas and this could be nearly 50% by 2030.

With a view to enhancing integration here, Total is a partner in several gas-fired power projects in South America, Asia and the Middle East, while also operating smaller co-generation plants at Group refineries in Europe and the US.

We operate more than 5400 MW of installed capacity. Our commitment to co-generation is reflected in the 2003 commissioning of the Taweelah A1 facility in Abu Dhabi, UAE. Rated at 1430 MW and with a seawater desalination capacity of around 385,000 cubic metres per day, this is one of the largest co-generation plants in the world, and is 35% more efficient than a conventional power plant. With this highly successful project, Total has set an industry benchmark.

In Latin America, via our interests in Central Puerto SA and Hidroneuquen, we operate gas-fired power plants with an aggregate capacity of 2165 MW and a hydro power plant with a capacity of 1400 MW. And in Thailand, Total has a 28% stake in EPEC, which commissioned the 350 MW Bang Bo combined-cycle power plant in March 2003.



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75TH ANNIVERSARY

To mark IGU's 75th anniversary we are publishing a special section containing articles on the Union's foundation, the development and early years of the gas business, the gas system in The Netherlands, which currently holds IGU's Presidency, and Japan's development into the world's largest LNG importer. Then we look forward to the outlook for gas on IGU's centenary.



The Foundation and Early Years of IGU

By Mark Blacklock

1 From October 2001 the Institution of Gas Engineers and Managers.

2 When the French gas industry was nationalised in 1947, the Union Syndicale was abolished.

3 Later the Association Technique and from November 2000 the Association Française du Gaz.

International collaboration has been a feature of the gas industry since it started to develop in the 19th century. Initially the primary use of gas was for lighting and the International Light Measuring Commission was set up in 1900 to coordinate standards. With the development of electric lighting this body evolved into the International Commission on Illumination in 1913, but international collaboration on other uses of gas continued. The European and North American national gas associations regularly invited foreign representatives to

attend key meetings as observers, and also to conferences and exhibitions.

By the late 1920s there were two schools of thought as to how relations should develop, either by maintaining the existing informal liaisons – an approach favoured by Great Britain’s Institution of Gas Engineers (IGE)¹ – or by setting up a formal international union, an approach promoted by the Union Syndicale de l’Industrie du Gaz en France, an umbrella body for the various French gas organisations².

The French initiative took shape in September 1929 when Auguste Baril, President of the Association Technique de l’Industrie du Gaz en France³ suggested to the Union Syndicale’s President Robert Ellissen that the possibility of founding an International Gas Union should be floated with their



The early 20th century was the era of manufactured gas. The picture shows retorts (heated anaerobic vessels in which coal was broken down into its volatile components) being drawn by hand in the South Metropolitan Gas Company in London.

colleagues in other national gas associations. The idea was to provide a centre for the acquisition, collation and distribution of technical and other information concerning the gas industry and the promotion of its wellbeing generally. Baril started sounding out his foreign colleagues and the responses were encouraging enough to persuade the Union Syndicale's Council to approve the start of formal negotiations. The next step was the convening of a meeting at the Maison du Gaz in Paris on November 25, 1930.

While keeping a watching brief on the French initiative, the IGE, in line with its approach of developing international cooperation within the framework of existing national bodies, decided to devote one day of its 1931 Annual General Meeting (AGM) to international business and to invite overseas representatives. By coincidence the IGE and Union Syndicale invitations went out to national gas associations within 24 hours of each other at the end of October 1930.

● The Paris meetings

Apart from the French hosts, the meeting convened in Paris by the Union Syndicale was attended by representatives from Belgium, Czechoslovakia, Germany, Greece, Italy, The Netherlands, Switzerland and the United States. Czechoslovakia also had a mandate to represent Yugoslavia, while Spain gave Auguste Baril an official mandate to act on its behalf. Great Britain sent a memorandum but no personal representatives as the timing of the meeting conflicted with the IGE's autumn research meeting.

Significant progress was made and a provisional IGU committee was set up with Fritz Escher, a former (1922-26) President of the Swiss Gas and Water Industry Association (SVGW/SSIGE) and Director of the Zurich city gasworks as President, Vice Presidents from Czechoslovakia, Belgium, France (Auguste Baril), Germany and Italy and Pierre Mougins, Secretary General of the Union Syndicale, as Secretary General. The Union Syndicale also offered to host the provisional

secretariat at its Paris headquarters. After the first meeting work started on preparing the draft statutes and a second meeting was convened in Paris to finalise them on May 8, 1931.

At this stage Belgium, France, Germany, Great Britain, The Netherlands, Sweden and Switzerland were ready to go ahead with the formation of IGU and the second Paris meeting enabled them to settle some outstanding matters relating to the draft statutes. The British urged that only the national gas association of each country should be eligible to apply for IGU membership and this was accepted. Additionally the British, Dutch and French wanted the IGU Secretariat to include an office of statistics and documentation while the Germans opposed this. A compromise was reached whereby the statutes allowed for the possibility of creating such an office.

It was agreed that members would be entitled to nominate one or two representatives to the IGU Council, but that each delegation would only have one vote. Every three years the Council would elect a President and a minimum of three and a maximum of seven Vice Presidents. The President was given the power to fix the headquarters of the Union and appoint a Secretary General. In addition, it was agreed that the Union would hold conferences at intervals of three years and that the national association holding the presidency would host each conference. However, as part of IGU's inauguration it was agreed that the international conference organised by the IGE in conjunction with its forthcoming AGM should be recognised as the First International Gas Conference.

● IGU is born

At 1000 on Tuesday, June 2, 1931, the 68th AGM of the IGE and the First International Gas Conference opened at the Great Hall of the Institution of Civil Engineers in London and at 1715 the representatives of the seven founding members of IGU repaired to the IGE headquarters at 28 Grosvenor Gardens to hold the first meeting



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GAS STATISTICS FOR SELECTED COUNTRIES 1932 AND 2004

Country	Gas consumption (million cubic metres)		
	1932	2004	
USA	70,000	646,700	
UK	9,000	98,000	
Germany	3,500	85,900	
France	1,800	44,700	
The Netherlands	642	43,500	
Italy	560	73,300	
Belgium	500	15,500	
Austria	300	9,500	
Denmark	220	5,400	
Sweden	200	800	
Switzerland	140	3,000	
Poland	140	13,200	
Czechoslovakia	100	Czech Republic	8,800
		Slovak Republic	6,800
Hungary	100	13,000	
Norway	38	4,600	
Yugoslavia	13	Bosnia and Herzegovina	300
		Croatia	3,009
		FYR Macedonia	71
		Serbia and Montenegro	2,711
		Slovenia	1,094

Source: 1932 figures from the memoirs of Pierre Mougin; 2004 figures from the BP Statistical Review of World Energy June 2005, US Energy Information Administration (for Bosnia and Herzegovina), Croatian Gas Association, Makpetrol (for FYR Macedonia), Gas Association of Serbia and Montenegro, Geoplin (for Slovenia).

ABOVE
Table 1.

of the Council of IGU. They were accompanied by observers from Norway and the United States.⁴

The Council formally approved the IGU Statutes, the election of the IGE President Harold E. Copp as President of the First International Gas Conference and the election of Fritz Escher as IGU President for the following three years. Pierre Mougin was appointed Secretary General with the Secretariat based in Paris. Belgium, France, Germany and

⁴ While the USA joined IGU shortly afterwards, Norway did not become a member until 1950.

Great Britain were invited to nominate Vice Presidents. The annual dues were 500 Swiss francs.

The day was rounded off by a reception and dance at the Park Lane Hotel hosted by Harold Copp and his wife.

After the London celebrations, IGU got down to business with a meeting in Paris on October 17, 1931. Czechoslovakia's national gas association was welcomed as the eighth member and areas of technical study were allocated. Three countries were charged with looking at the development of gas usage: Belgium in the industrial field including hotels, Great Britain in the domestic field and Czechoslovakia in terms of pricing. France's responsibility was the coordination of methods for testing gas appliances and the unification of certification standards. Germany was responsible for the coordination and guarantee of methods for testing gas manufacturing equipment. Switzerland was given responsibility for reporting on gas installations.

Further new members from Italy, Poland, the United States and Yugoslavia were welcomed at a Council meeting held in Basle on February 26, 1932. This started preparations for the next conference and also raised the issue of the annual dues. It was acknowledged that Sfr500 might be too much of a burden for smaller countries and that this level should be reviewed. Canada joined the following year and also entered the dues debate. Along with The Netherlands, it suggested a reduction to Sfr200 and this was agreed in 1934.

● The early conferences

The Second International Gas Conference and the first to be organised under IGU's auspices took place in September 1934. Hosted by SVGW/SSIGE it was held in the Swiss Federal Institute of Technology, Zurich. On September 1 the IGU Council met and elected Auguste Baril as the new President and the following day the Conference opened with addresses from Fritz Escher and Baril. It ran until September 4 and attracted a total of 495 delegates and accompanying persons.

AN EXTRACT FROM THE MEMOIRS OF PIERRE MOUGIN

Pierre Mougin's memoirs, which were published in 1966, are an invaluable resource for those wanting to learn about IGU's early years. This extract covers the two Council meetings of 1934.

● Basle Council meeting

For the third consecutive time the spring Council meeting took place in Basle on March 10, 1934.

One unpleasant and nagging question that resurfaced at every Council was that of the subscription charge (500 Swiss francs), which appeared low to the larger associations and never failed to draw complaints from the associations of smaller countries.

In order to evaluate the matter, [IGU President Fritz] Escher had drawn up a table of the quantities of gas sold by the industries of different countries in 1932. This table clearly spoke for itself. [See *Table 1* supplemented with 2004 statistics to show the development of the gas industry since 1932.] Furthermore, the International Union had few costs, at most a few postal charges, since all secretarial and travel costs were paid for by the Union Syndicale [the French host].

Thus the budget only required a few large associations to pay their fees, and it was accordingly agreed that the Czech, Polish and Yugoslavian associations, which only consisted of a sole member, would each pay Sfr200.

However, Canada and The Netherlands requested that their situation also be reviewed and it was suggested that perhaps it was necessary to go even further and to reduce all the subscriptions to Sfr200.

The decision was postponed until the following Council.

● Zurich Council meeting

The second World Gas Conference was the first to be organised by the International

Union and it opened on September 1, 1934 with a meeting of the Council at the Federal Institute of Technology in Zurich.

The whole Council was present, with the President of the American Gas Association, Clifford E. Paige, also representing Canada. The former British Vice President Harold E. Copp, who had resigned, was replaced by Valon Bennett.

Following the discussions that had taken place during previous meetings and the preceding Council on the subscription amount, it was unanimously decided that it should be reduced in future for all members to Sfr200.

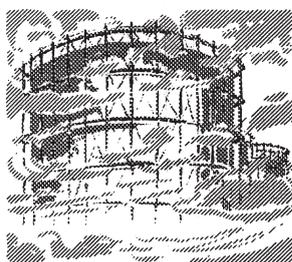
President Escher reached the end of his mandate at the end of the Conference: on the recommendation of H. Müller, and with Escher's support, Auguste Baril was unanimously elected.

The other Vice Presidents were immediately re-elected and it was agreed that each association could substitute one representative for another at any time, even during the course of a mandate.

Before closing the meeting, the Polish delegate Konopka, on behalf of the Polish, Czech and Yugoslavian associations, asked that the International Union extend its activities to water issues, since these three associations dealt with both gas and water.

The question was postponed for study at the next Council, but Clifford Paige quickly took an opposing position, basing his argument on the fact that in America, the gas and water companies were completely independent of each other, and that the Union's objectives were already broad enough without extending them further.

Alexander supported this point of view on behalf of the British association and the question was consequently all but buried.



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The associations of Belgium, Czechoslovakia, France, Germany, Great Britain and Switzerland presented reports on the areas of technical study for which they had responsibility and individual papers were given by Clifford E. Paige of the US on "Coordinated Research and Coordinated Rate Making", Professor G. A. Brender à Brandis of The Netherlands on "A Contribution to the Study of Coal", Italy's Michelangelo Böhm on "The Use of Electricity for Manufacturing Town Gas" and Poland's K. Żardecki on "The Use of Natural Gas". The latter was particularly forward looking as at the time, of course, most gas used commercially was manufactured and it would be many years before the industry switched to natural gas.

Social activities included a banquet in the Grand Hotel Dolder, an outing to Mozart's "The



ABOVE

A group photograph taken during the 68th AGM of the IGE and the First International Gas Conference, June 1931. In the centre of the front row are Auguste Baril (11th from the right), Harold Copp (12th from right) and Fritz Escher (13th from right). Pierre Mougin is further along (16th from right).

PROGRAMME FOR THE FIRST TWO DAYS OF THE SECOND INTERNATIONAL GAS CONFERENCE

Samstag, 1. September.	
10.00 bis 12.00 Uhr	61. Jahresversammlung des Schweizerischen Vereins von Gas- und Wasserfachmännern im Auditorium III der Eidg. Techn. Hochschule, Hauptgebäude. Geschäftliche Traktanden und Vortrag von Herrn Prof. Dr. P. Schläpfer: «Die wärmetechnischen Grundlagen des Ofenbetriebes. — Rückblick und Ausblick.» Alle Kongressteilnehmer sind zu dieser Versammlung eingeladen.
14.30 Uhr	Extrazug nach Schlieren ab Hauptbahnhof zur Besichtigung der Gaskokerei der Stadt Zürich in Schlieren.
17.35 Uhr	Abfahrt Werk Schlieren, Industriestrasse.
17.45 Uhr	Abfahrt Bahnhof Schlieren; Ankunft in Zürich 18.00 Uhr.
14.30 Uhr	Für die Damen: Ausflug zum Rheinfall bei Schaffhausen. Abfahrt beim Landesmuseum.
20.30 Uhr	Begrüßungszusammenkunft im Kursaal. (Strassenanzug.)
Sonntag, 2. September.	
10.00 bis 12.00 Uhr	Eröffnung des Kongresses der Internationalen Vereinigung der Gasindustrie im Auditorium Maximum der Eidg. Techn. Hochschule. 1. Ansprache des Präsidenten der Internationalen Vereinigung der Gasindustrie. 2. Ansprachen der Behörden. 3. Ansprache des neugewählten Präsidenten der Internationalen Vereinigung der Gasindustrie. 4. Ansprache des Präsidenten des Schweizerischen Vereins von Gas- und Wasserfachmännern. 5. Vortrag von Mr. Clifford E. Paige (U. S. A.): «Coordinated Research and Coordinated Rate Making».
Nachmittag frei.	
19.30 Uhr	Bankett im Grand Hotel Dolder, Tanz und Abendunterhaltung (Abendkleid, Smoking). Die Festkarte berechtigt zur Benützung der Dolderbahn vom Römerhof (Tramstation) zum Grand Hotel Dolder.

Marriage of Figaro" at the Stadttheater and a trip to Lugano on the day following the closure of business.

IGU work between the 1934 and 1937 conferences concentrated on developing technical research. Apart from the existing study areas new ones were added looking at butane, propane, the problems of small gasworks and industry promotion in terms of advertising and public relations. It was also decided to put the study of pricing on a special footing by setting up an international committee rather than leaving it to one member association. This committee also worked on agreeing a



vocabulary of gas terms in English, French and German.

At the end of his three-year term as President, Auguste Baril hosted the Third International Gas Conference, which was held in Paris from June 12-16, 1937 in the Arts and Crafts Engineers Hall.

By this time Austria, Australia and Hungary were members and a total of 705 people attended.

An IGU Council meeting was held immediately prior to the start of business at which H. Müller of the German Gas and Water Industry Association was elected President and Colonel H. Zollikofer of

PRESIDENTS OF IGU SINCE 1931

<i>From/To</i>	<i>President</i>	<i>From/To</i>	<i>President</i>
For the duration of the First International Gas Conference in June 1931	H. E. Copp	1967-1970	A. I. Sorokin
1931-1934	F. Escher	1979-1973	G. Robert
1934-1937	A. Baril	1973-1976	L. G. Clark
1937-1940	H. Müller	1976-1979	J. W. Kerr
1940-1946	During WWII IGU was dormant	1979-1982	Eric Giorgis
1946-1949	Col. C. M. Croft	1982-1985	Christoph A. Brecht
1949-1952	M. Brabant	1985-1988	John Kean Sr
1952-1955	R. W. Hendee	1988-1991	Herbert Richter
1955-1958	Mario Boselli	1991-1994	Luigi Meanti
1958-1961	B. M. Nilsson	1994-1997	Hans Jørgen Rasmusen
1961-1964	J. Van Dam Van Isselt	1997-2000	Claude Détourné
1964-1967	G. Düwel	2000-2003	Hiroshi Urano
		2003-2006	George H. B. Verberg

LEFT
Table 2.



Switzerland was appointed Secretary General, with SVGW/SSIGE hosting the Secretariat in Zurich. The Conference then received reports on the technical study areas and approved the vocabulary of gas terms. Individual papers were presented by A. Bazille of France on "The Development of Gas Manufacturing Methods", Dr Hoffman of Germany on "New Methodologies for Gas Pricing in Germany", R. N. Lefevre of Great Britain on "Technical Service for Gas Consumers", Professor Ribaud of France on "Establishing Combustion Temperatures", Professor Dr Schlöpfer of Switzerland on "A Study on the Formation of Nitrogen Compounds in Gas" and H. C. Widlake of Great

Britain on "Electrolytic Corrosion of Gas Conduits". Two additional papers prepared by Dr K. Bunte of Germany on "New Methods for the Reclamation of Benzol" and by Mario Levi of Italy on "Asbestos Piping" were presented in their absence.

The official banquet was held in the gas pavilion of the International Exposition being held that year in Paris and other social activities included visits to the Château de Méry and Royaumont Abbey.

In November 1937 the first meeting of the German Presidency was held in Freiburg and Colonel Zollikofer took up his duties. It was agreed that the international pricing committee would be disbanded and the technical work programme was

streamlined into four areas: production (Germany), distribution (Switzerland), use (France) and promotion (Great Britain).

The last Council meeting before the outbreak of World War II took place in Stockholm in June 1939 and among other matters fixed the dates of the Berlin conference for June 18-21, 1940. In the event, Berlin had to wait another 50 years to be a host city. When the World Gas Conferences were resumed in 1949, London was the first post-war venue.

Mark Blacklock is the Editor-in-Chief of International Systems and Communications. This article was originally written for the IGU publication Seven Decades of IGU launched at WGC 2003. It draws on the memoirs of Pierre Mougín and archive material from the Association Française du Gaz, the Institution of Gas Engineers and Managers and the Swiss Gas and Water Industry Association.

BELOW
Table 3.

IGU SECRETARIES GENERAL SINCE 1931

From/To	Secretary General
1931 – 1937	Mr P. Mougín
1937 – 1949	Col. H. Zollikofer
From 1946 to 1949, Dr W. T. K. Braunscholtz: Secretary to the President of IGU	
1949 – 1971	Mr R. H. Touwaide
From 1967 to 1971, Mr A. G. Higgins: Deputy Secretary General	
1971 – 1979	Mr A. G. Higgins
From 1975 to 1979, Mr Bernard Goudal: Deputy Secretary General	
1979 – 1988	Mr Bernard Goudal
From 1985 to 1988, Mr Jean-Paul Lauper: Deputy Secretary General	
1988 – 1994	Mr Jean-Paul Lauper
1994 – 2000	Mr John F. Meeder
From 1998 to 2000, Mr Peter K. Storm: Deputy Secretary General	
2000 –	Mr Peter K. Storm

What A. G. Higgins said in 1964 in an address to the IGE is still true today: "The Union has had during its 33 years of existence only three Secretaries, which must be regarded as a singularly fortunate matter for had the Secretaryship changed at the same rate as the Presidency – a distinct possibility in terms of the Statutes – it is very doubtful whether the Union would have become the efficient and effective organisation it now is. However able the Presidents... some continuity in the administration is essential for efficient operation."

Mr Higgins went on to become the fourth Secretary General and over IGU's 75 years a total of eight people have held the post.

THE WORLD GAS CONFERENCES

Conference	Date	Venue	Total of Delegates and Accompanying Persons
1st	June 2, 1931	London	23*
2nd	September 1-4, 1934	Zurich	500
3rd	June 12-16, 1937	Paris	700
WORLD WAR II			
4th	June 15-17, 1949	London	700
5th	June 16-19, 1952	Brussels	700
6th	September 26, 1955	New York	350
7th	September 25-28, 1958	Rome	850
8th	June 27, 1961	Stockholm	950
9th	September 1-4, 1964	Scheveningen	1,500
10th	June 4-8, 1967	Hamburg	2,000
11th	June 9-12, 1970	Moscow	3,100
12th	June 4-6, 1973	Nice	2,800
13th	June 7-11, 1976	London	2,800
14th	May 27-June 1, 1979	Toronto	2,300
15th	June 14-18, 1982	Lausanne	3,000
16th	June 23-28, 1985	Munich	3,700
17th	June, 6-10, 1988	Washington	3,800
18th	July 7-10, 1991	Berlin	4,300
19th	June 6-9, 1994	Milan	5,300
20th	June 10-13, 1997	Copenhagen	4,500
21st	June 6-9, 2000	Nice	4,300
22nd	June 1-5, 2003	Tokyo	5,200
23rd	June 6-9, 2006	Amsterdam	
24th	October 19-23, 2009	Buenos Aires	
25th	2012	Kuala Lumpur**	

* The figure is for overseas delegates only. The First International Gas Conference formed part of the 68th AGM of the Institution of Gas Engineers, which ran from the 2nd to the 4th of June and was attended by some 1,500 people in total.

** The precise dates of the 25th WGC have yet to be decided.



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Let There Be Light

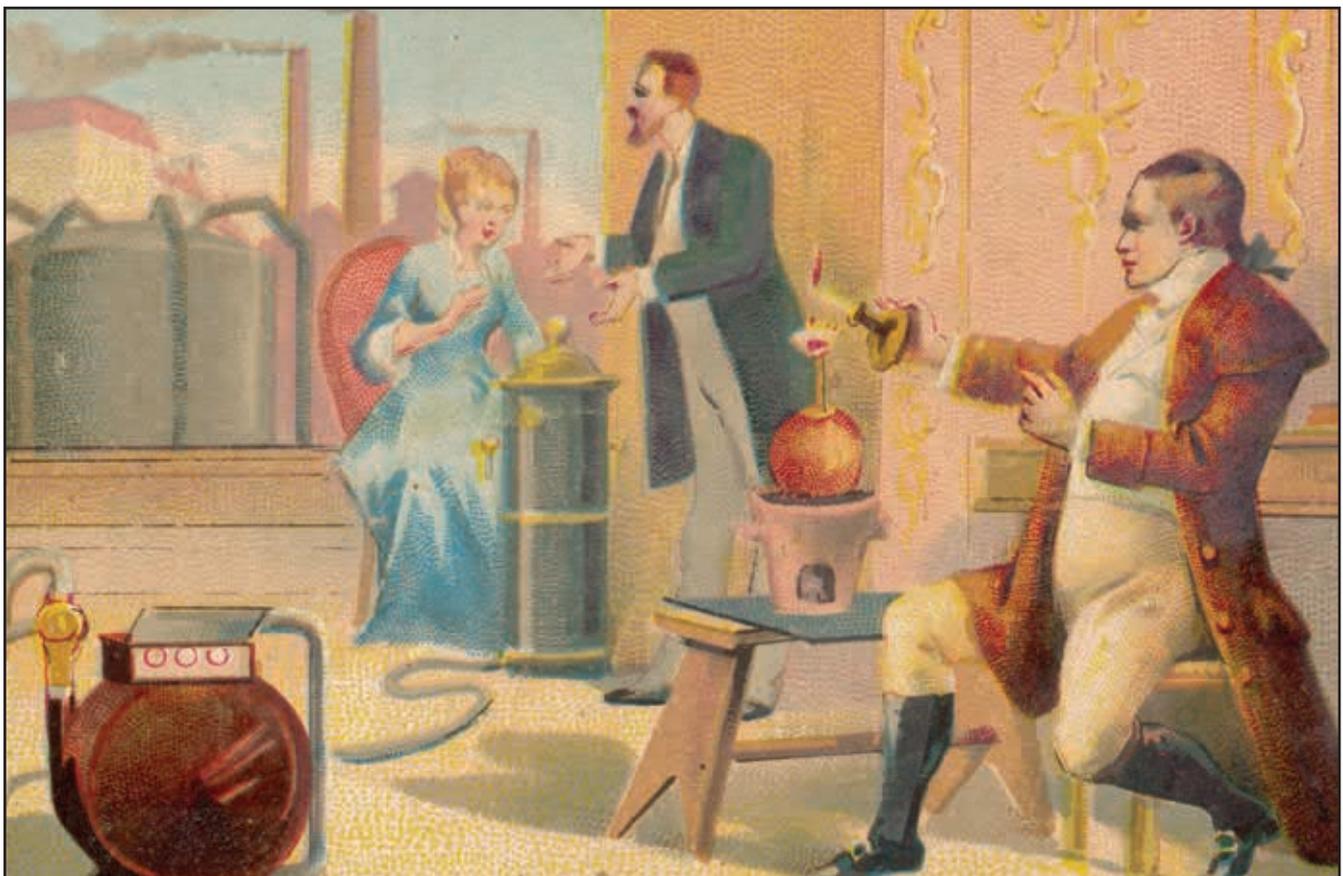
By Hanne Thomsen

Gas use dates back millennia with seepages of natural gas providing the fuel for the “eternal fires” of the Zoroastrians. But the credit for starting the gas industry goes to the Scottish engineer and inventor William Murdoch (1754-1839), who developed gas lighting in 1792. Most inventors in the early days of the industrial revolution tried to use coal as motive power for steam machines. Murdoch was the first to see the potential in producing gas with the particular purpose of using it for lighting instead of the traditionally used whale oil.

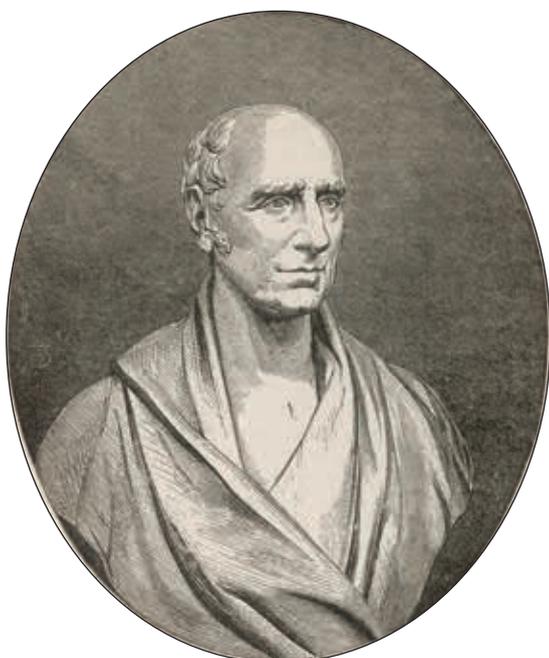
William Murdoch moved to England in 1777 to work in the innovative environment of Birmingham, where he joined the firm of Boulton & Watt which later transferred him to Cornwall.

Murdoch spent a lot of time experimenting both at his employers and at home. He worked at developing steam pumping engines, he invented a steam-powered vehicle, and he obtained patents for a process to produce coal tar dyes and for extracting paint from coal. Then in 1792 he heated coal in a closed iron retort connected with a hollow pipe. The gas which he produced from the heated coal ran from the retort through the pipe to the end where it burned with a steady flame.

Murdoch lit his home in Redruth, Cornwall with gas in 1794, supplying it from a small gasworks in his garden. It was the first practical system of gas



Philippe Lebon worked in Paris on the problems of carbonisation.



William Murdoch pioneered the modern gas industry.

lighting in the world. In a possibly apocryphal story he is also said to have astounded the locals by crossing the moors at night in a gas-lit carriage.

In 1798 Murdoch moved to Smethwick to manage Boulton & Watt's Soho Foundry, where he built a gas plant and storage facilities sufficient to provide regular lighting for several of the offices. In 1802 Murdoch installed two gas lamps outside the Soho Factory and on one occasion that year the whole plant was illuminated by gas.

It did not take long before all large factories were using gaslights. While Murdoch was interested in illuminating individual buildings, each with its own gas production, others saw the possibilities of lighting many buildings, whole streets or even towns by gas mains, fed with gas from large gasworks.

● Lebon and Winzler

It was not only in England that ideas had been developed for using gas for lighting. Philippe Lebon worked in Paris on the problems of carbonisation and by 1799 he had made sufficient progress to

obtain a patent for his work on producing fuel for heating and lighting. In 1801 Lebon demonstrated gas lighting publicly in Paris. Lebon was interested in producing gas from wood, and with this he wanted to light Paris, but he did not gain much support from his compatriots.

The results that Murdoch and Lebon had achieved were spread far and wide in Europe. In 1802 the Czech Friedrich Winzler read a French summary of a lecture given by Lebon about gas lighting in Paris. Winzler went to see Lebon and he managed to absorb sufficient knowledge of Lebon's process of producing gas; afterwards he



Natural gas provided the fuel for the "eternal fires" of the Zoroastrians.

THE DEVELOPMENT OF THE GAS METER

In the very early days of the gas industry customers paid for a specified period of use rather than the actual quantity of gas supplied. It was Samuel Clegg, Chief Engineer at the Gas Light and Coke Company in London, who invented the first efficient gas meter. Clegg's initial experiments with dry meters failed, but he was much more successful with the wet meter he patented in 1816.

When wet gas meters were introduced some of the less honest consumers soon found out that by punching a hole in the case so as to let out some of the water they could obtain a more generous supply of gas, without increasing the size of the bill. This became so widespread a practice that meter inspectors had to be employed. Another problem with the wet gas meter was that in very cold weather the water would freeze.

The first satisfactory dry meter was developed by Nathan Defries in 1840 and the prepayment meter, which helped to expand the residential market for gas to poorer sections of society, was patented by T. S. Lacey in 1870.

RIGHT
A range of meters on display in the UK's National Gas Museum.



set himself up as an authority on gas and, realising that there was no more to be gained in Paris, he left for England.

In 1803 Winzler arrived in London where he anglicised his name to Winsor. He obtained a patent for a gas lighting system and soon afterwards began to flood the capital with pamphlets advocating gas lighting. In 1807 he demonstrated the use of gas, and later on he lit parts of Pall Mall with lamps connected by lead pipes to his gas-works. The experiment was a complete success, nothing like it had ever been seen before. However, the indoor lectures were not very successful

on account of the violent headaches which afflicted the audience due to the use of unpurified gas. Moreover, there were still several difficulties with the production of gas. Despite these problems Winsor's practical work began to receive serious attention.

In 1807 Winsor announced the formation of a National Light and Heat Company, making extravagant claims and seeking a Royal Charter. This proved to be more difficult than he had imagined, and in 1809 a new application was made to Parliament for lighting only in London, Westminster and Southwark.

GAS BURNERS

Originally gas was lit directly from the open end of a pipe with no form of burner. The introduction of burners consisting of iron caps pierced with one or more holes improved the efficiency of gas lighting, but the cap corroded quickly and the luminosity varied greatly. These burners were known by the shape of the flame – rat-tail, cockspur, dovetail and batwing.

In 1858 William Sugg invented the steatite (soapstone) burner which would not corrode and let less heat escape from the flame. Despite this and other developments, the second half of the 19th century saw lamps burning mineral oil and early electric lighting challenging gas lighting until the invention of the gas mantle.

Gas mantles appeared on the scene in 1887 after Carl Auer, a chemist at Bunsen's laboratory in Heidelberg, discovered by accident that asbestos soaked in "rare earth" compounds gave an intense glow when heated by a gas flame.



A dovetail burner.

The early gas mantles were expensive, not very efficient and extremely fragile. The whole burner had to be sent back to the manufacturer if a new mantle was needed. However, the quality of gas mantles improved over the years and they were used in street lighting in London for the first time in 1895.

Even the revised project met with a great deal of opposition and it was not until 1812 that Winsor was successful in obtaining a Royal Charter. In 1812 he founded the first gas company in the world, the Gas Light and Coke Company and the company built the first gasworks in London. The company's Chief Engineer was Samuel Clegg, who was a former Boulton & Watt man and invented the first gas meter (see box *The Development of the Gas Meter*).

● Gas lights the world

Within a few years many other cities in the UK, the

rest of Europe and the United States had followed suit. Gas lights were lit in Paris in 1815 and in Baltimore – the first US city – in 1816. The expansion continued around the globe reaching Latin America (Buenos Aires) in 1823, Asia-Pacific (Sydney) in 1841 and Africa (Cairo) in 1863.

Hanne Thomsen is the Director of the Danish Gas Museum (www.gasmuseet.dk). Maurice Martin, Curator of the British National Gas Museum (www.gasmuseum.co.uk), kindly helped with information and pictures.



TOP
Gas lighting came to Sydney, Australia, in 1841. The picture shows a gas lamp at the corner of Dowling Street and Reid Avenue in the Woolloomooloo district in 1912.

ABOVE AND RIGHT
London was the first city to be lit by gas and still boasts gas lighting in certain heritage areas.