The Iran-Pakistan-India Pipeline Project: Cross-border Gas Pipeline Challenges

This is the second of the case studies by the Task Force looking at Gas Market Integration to be presented in this issue of the IGU Magazine. Due to space constraints it is an edited version of the Task Force's full report, which will be published for the 24th WGC in October.

With the second largest fossil fuel reserves in the world, Iran has enormous potential to serve newly emerging gas importers such as Pakistan, India and China by pipeline and markets farther away by LNG. Just as Russia and Qatar have already embarked upon an expansion of their export capabilities, Iran has the potential to become a new supplier to both eastern and western markets. However, geopolitical issues, Iran's strategic intentions for LNG exports, escalating costs and a lack of clear leadership and decision-making combine to make the range of possible paths into the future numerous.

For Iran, the benefits of gas exports via pipeline to India include: 1) a major boost for job creation and economic prosperity of the provinces on the pipeline route; 2) the enhancement of Iran's strategic positioning and standing both regionally and on a global level; and 3) regional economic integration.[1] For the key topic of gas market integration, Iran therefore has centre stage with its massive resources and export potential to emerging markets nearby. However, despite all the potential for a deal on a long-planned pipeline from Iran

1 N. Ghorban, "Op-Ed: Monetizing Iran's Gas Resources and the Debate Over Gas Export and Gas-Based Industries Options", *Middle East Economic Survey*, vol. 49, no. 28, (July 2006), pp. 25-29.

ABOVE AND OPPOSITE Iran possesses the world's second largest gas reserves with 15.7% of the global total.

to Pakistan and India (the IPI pipeline), huge cross-border barriers and uncertainties have so far put off the IPI project. It is common knowledge that Iran holds the world's second largest gas reserves, after Russia. Yet a country such as Canada, with but one-seventeenth of Iran's reserves, produces nearly twice as much gas. Iran's lower production is due mainly to a lack of adequate planning, adherence to the old bureaucratic structure within its fossil fuel industry and ineffective gas pricing.

Countless initiatives and technical solutions have been put forward over the past decades in an effort to integrate these markets with Iran, yet none have been successful at getting the IPI pipeline past the drawing board, despite favourable supply and demand projections. A major factor complicating the overall equation is the geopolitical overhang, which usually accompanies these types of large-scale, cross-border gas projects. The case of Iran is a particular conundrum both at a regional level as well a global one. From a global perspective, Iran's resources remain vastly underdeveloped because of US and European sanctions designed to limit Iran's capacities to attract investments and to "isolate" it, only ensuring that these resources have no easy way of finding an outlet to an already tight energy market. The market is thus often forced to look for alternative means of gas market integration.

In addition, from a regional vantage point, Pakistan and India would have to come to terms with the long-term dependency relationship which the IPI pipeline is bound to bring. The IPI project is likely to continue to fail unless government-to-government cooperation is firmly achieved. It can only be achieved if the burdens of traditional commercial, technical and environmental risks such large-scale gas projects inherently impose on the potential partners are shared by all of them from the outset. Even before this can be accomplished, however, the geopolitical complexities involved will

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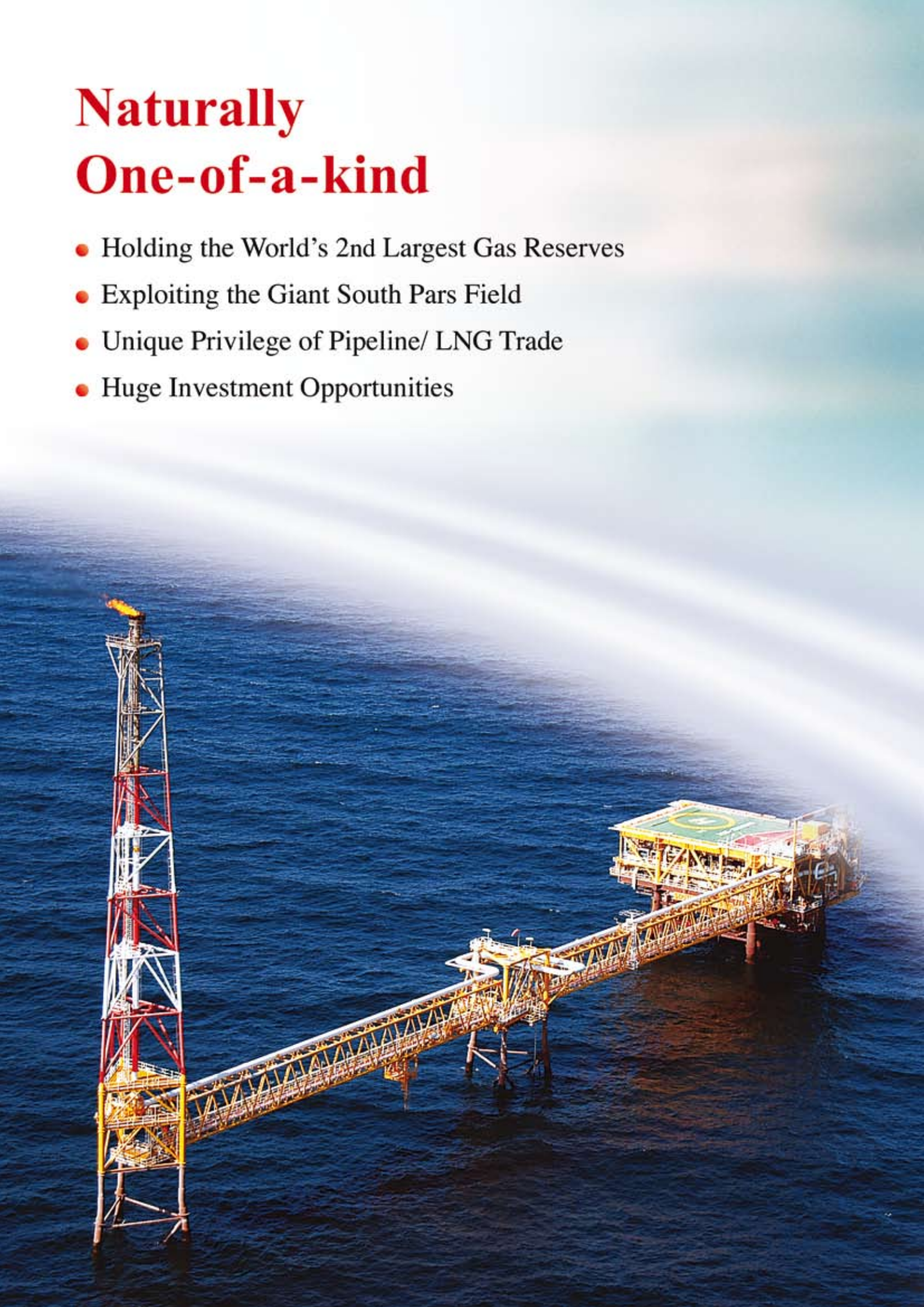
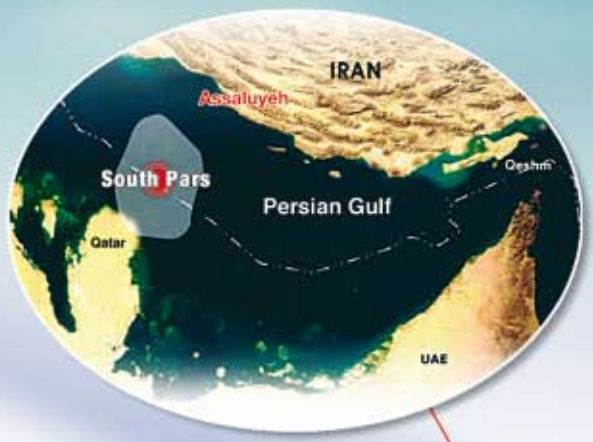


NIGC

National Iranian Gas Company



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This plant in Assaluyeh treats gas from the South Pars field. Assaluyeh is also the origin of the IPI pipeline.

have to be overcome on the basis of mutual trust and determination, and perhaps ultimately, through the sheer necessity imposed by the macro-economic fundamentals of import-dependency.

Historical background

Before delving into some facts and figures on supply and demand, it is instructive to review the historical developments preceding the current setting, regarding the IPI market integration project. The export of gas from the Gulf region to Pakistan was first considered in the early 1990s. Two projects were initially put forward: 1) a Qatar-Pakistan pipeline following an offshore route except for a small portion to be constructed overland through the UAE; and 2) a pipeline from Iran to Pakistan, i.e., the project currently on the table. In the former case, a time limit imposed by Qatar for the allocation of the gas came and went as the project was delayed and ultimately shelved, despite substantial work which had been carried out on surveys and design. The second option is now being negotiated between Iran, Pakistan and India.

Although Pakistan and Iran signed an agreement in 1995 for the construction of a pipeline to bring South Pars natural gas from the Persian Gulf to Karachi, new gas discoveries in Pakistan stalled the project for a number of years. During the visit of Pakistan's Prime Minister to Iran in 2003, the project was revisited and a bilateral Joint Working Group (JWG) was formed to realise the project. An overview of the project's route (and that of the competing Turkmenistan-Afghanistan-Pakistan-India pipeline) is provided in *Figure 1*.

It has long been a desire of the Iranian government to develop export markets for gas from the South Pars field. The problem in this respect has always been a conflict of interest and strategies within the Iranian energy establishment. Iran's Oil Ministry and the Majlis (the Iranian parliament) Energy Committee have traditionally disagreed over whether the country should become a major regional and international gas exporter on the one hand, or concentrate its gas resources mainly on oilfield reinjection and the development of the petrochemical and gas-based industries and other domestic demand, on the other. A pipeline to the Indian sub-continent offers a stable initial outlet for Iranian gas prior to any further ventures as a major gas exporter.

Hence the Iranian government filed a request with the Pakistani government for extension of the proposed gas pipeline to India. For Pakistan, the pipeline offers badly needed gas supplies and revenues from transit rights: 50% of the 22 bcm

BELOW
Figure 1.

THE IPI AND TAPI ROUTES

Source: US Department of Energy, Energy Information Administration.

per year would go to Pakistan and the other half to India.

The extension was acceptable to Pakistan, but it took India more than a decade to digest the idea of gas transmission over the territory of Pakistan, with which it has had various armed conflicts and an as of yet unresolved dispute over the area of Kashmir. India does not feel entirely comfortable with the idea of being dependent in the long-run on Pakistan. Thus even though there is an acute shortage of energy and especially natural gas in India, the Indian government still is not enthusiastic about entering into an agreement with Pakistan regarding gas transit. India thus began looking at yet another alternative means of attaining Iranian gas, through an offshore pipeline which would skirt Pakistani territory altogether. But after detailed Indian field studies highlighted several technical and geophysical issues, the offshore route was found to be unfeasible.

Despite Pakistan's willingness to extend the gas pipeline to India, Pakistan has maintained that it would proceed with the project even without India, should the latter lose interest. As a result of protracted negotiations, Iran and Pakistan signed a Memorandum of Understanding (MoU) in the middle of 2005 to go ahead with the project. Since then there have been a number of meetings between delegates from Iran, Pakistan and India to iron out the problems and to reach an agreement on the Gas Sales and Purchase Agreement (GSPA). The Indians actively participated in various meeting of the IPI gas pipeline project initially, but they did not attend any meetings on IPI from mid-2007 to March 2008. During this time, India was put under overwhelming US pressure to drop the GSPA as a civil nuclear deal with the US was being finalised. Meanwhile, in December 2007, Iran and Pakistan initiated the GSPA, which included a provision to add India further downstream at a later stage if India ultimately desires to join the project. Pakistan has also stated that it would be able to buy the gas volume allocated to India in the GSPA in case India is unable to join the project. There is hardly anything else Pakistan could have done to ensure the pipeline goes through, compelled to do so by its own energy demand forecasts.

Iran's gas resource base and potential

Iran holds the world's second largest gas reserves which, in 2007, amounted to 27.8 tcm or 15.7% of the global total. A most favourable feature of Iran's gas deposits is that around 62% are located in non-associated gas fields and have not been developed, meaning that the country has great potential for future gas development.

Iran's greatest concentration of resources lies in the South Pars gas field. Geologically an extension of Qatar's North Field, South Pars was first identified in 1988, and originally appraised at 3.62 tcm in the early 1990s. Current estimates are that South Pars contains 8 tcm or more (some estimates go as high as 14.2 tcm) of natural gas, of which a large fraction will be recoverable.[2]

A vital aspect regarding the future development of Iran's energy potential is Iranian energy policy, which must cope with the domestic needs, balancing them with the various export options the government has. Many members of the Majlis argue that, prior to undertaking any export projects, domestic gas needs and oil field injection must be satisfied first and override export options if necessary, particularly because the Iranian government must take into account issues such as domestic economic development and unemployment. Iran is the largest consumer of gas in the Middle East and growth in consumption in the last two decades has been substantial: some

2 In addition there are the 0.18 tcm, non-associated Khuff (Dalan) reservoir of the Salman oil field (which straddles Iran's maritime border with Abu Dhabi, where it is known as the Abu Koosh field); the 22.65 bcm Zireh field in Bushehr province; the 0.11 tcm Homa field in Fars province; the 0.4 tcm Tabnak field located in southern Iran, the 0.37 tcm Aghar and Dalan fields in Fars province, and the Sarkhoun and Mand fields. Iran has also discovered two new natural gas fields in the Persian Gulf, one at Balal and the other beneath Lavan Island, possibly holding 0.2 tcm.

GAIL (India) Limited

Spreading the Green Energy

GAIL (India) Ltd., is India's principal Natural Gas Company with activities ranging from Gas Transmission and Marketing to Processing (for fractionating LPG, Propane, SBP Solvent and Pentane); transmission of Liquefied Petroleum Gas (LPG); production and marketing of Petrochemicals like HDPE and LLDPE and leasing bandwidth in Telecommunications. The Company has extended its presence in Power, Liquefied Natural Gas (LNG) re-gasification, City Gas Distribution and Exploration & Production through equity and joint venture participations

GAIL is one of the leading public enterprises with a consistently excellent financial track record. Turnover during the last ten years has shown a compounded annual growth rate of 13%. The Profit After Tax (PAT) during FY 2007-08 was $650 million. The Company's turnover during FY 2007-08 was $4.5 billion.

GAIL owns and operates a network of more than 7000 km of Natural Gas high pressure trunk pipeline with a capacity to carry about 148 MMSCMD of natural gas across the country. GAIL's share of gas transmission business is 79% and the Company holds 70% market share in gas marketing in India.

GAIL, which is the only company in India to own and operate pipelines for LPG transmission, has an LPG pipeline network of 1900 km, 1300 km of which connects the Western and Northern parts of India and 600 km of network is in the Southern part of the country. The LPG transmission system has a capacity to transport 3.8 MMTPA of LPG.

GAIL owns and operates a gas based integrated petrochemical plant at Pata, Uttar Pradesh with a capacity of producing 400,000 TPA of Ethylene and 410,000 TPA of Polymers i.e. HDPE and LLDPE. GAIL is currently in the process of setting up a 280,000 TPA Assam Petrochemical Complex at an investment of $1.35 billion, through a Joint Venture (JV), Brahmaputra Cracker and Polymer Limited.

GAIL was the first company to introduce city gas projects in India. GAIL has formed eight Joint Venture companies in Delhi, Mumbai, Hyderabad, Tripura, Kanpur, Lucknow, Agra and Pune. GAIL has formed a subsidiary company, GAIL Gas Limited for pursuing CNG and city gas corridor projects. On the global front, GAIL has established its CNG and city gas presence in Egypt through equity participation in Fayum Gas, Shell CNG and Natgas, Egypt. It has also acquired a stake in China Gas Holdings for CNG opportunities in mainland China.

Leveraging on its pipeline network, GAIL has built up a strong OFC network of approximately 12,200 km for leasing of bandwidth as a carriers' carrier. GAIL's telecom business unit – 'GAILTEL' has a network, offering highly dependable bandwidth for telecom service providers across 175 locations in ten states.

In a move towards integration along the energy chain and for sourcing supply, GAIL has entered into the area of Exploration & Production. The Company holds a participating interest in 28 oil and gas exploration blocks, of which 25 blocks are in India, two are in Myanmar and one is in Oman. The GAIL consortium has a participating interest in three CBM blocks won in the latest round of bidding for CBM blocks in India.

GAIL has set up a wholly-owned subsidiary company, GAIL Global (Singapore) Pte. Ltd., in Singapore. GAIL is pursuing business opportunities in regions such as South/South-East Asia, West Asia, Russia and Central Asian Republics and the African continent in the areas of exploration and production, gas transmission, CNG and city gas distribution, LNG and petrochemicals. GAIL has formed a JV with China Gas Global Energy Holdings Limited. GAIL and China Gas are equal partners in this JV which has been registered in Bermuda. This is the first JV company of GAIL abroad. In order to have a long term association with China Gas and also to expand business in the fast downstream Chinese gas sector, the JV will pursue opportunities in CNG, City Gas, Pipeline, CBM, LNG and E&P projects.

THIS WILL TAKE 300 MILLION YEARS TO BECOME NATURAL GAS.

TILL THEN, LET'S PLEDGE TO USE WHAT WE HAVE, WISELY.

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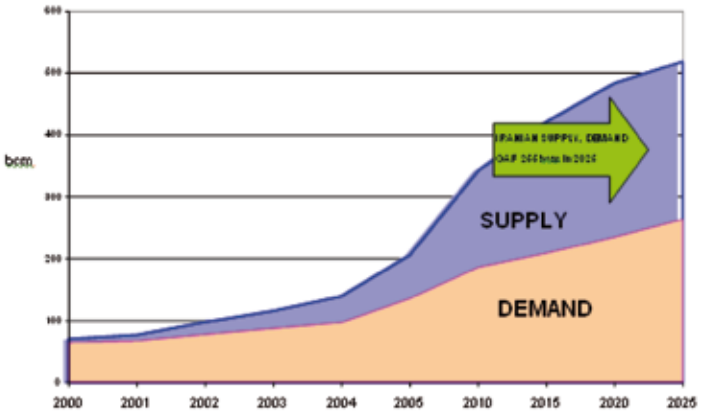
A FORECAST OF IRANIAN DEMAND AND SUPPLY OF NATURAL GAS, 2000 2025



ABOVE
Figure 2.

9-10% per annum since 1990. Those in favour of gas exports by pipeline and LNG argue that there is a limit to gas injection and using gas domestically in Iran can only utilise less than 40% of its reserves in the next 25 years. In addition, Iran incurs a significant opportunity cost by denying itself a fully fledged role in the international gas industry.

In other words, Iran can use its gas resources to develop a relative economic advantage. In order to live up to its potential and make full use of every cubic metre it can export without sacrificing domestic economic growth, Iran needs a strategy that enables the country to free up export volumes. However, this will take some time, according to Gholam Hossein Nozari, Minister of Petroleum.

Dr Narsi Ghorban has summarised four options available to Iran for its gas resource development: 1) domestic use of gas, including power generation; 2) gas used for oil lifting; 3) gas-based industries including petrochemical and GTL projects for internal use and export; and 4) gas export by pipelines and in the form of LNG.[3] The Majlis favours oil lifting, especially in a high oil price environment. For Iran to be able to manage these different choices effectively, he argues, Iran is in need of an NOC for oil as well as gas production such as Gazprom, Sonatrach and Qatar Petroleum, as well as a gas ministry parallel to its oil ministry. Iran has the potential to become a major driving force not only in the international gas market but also regionally within the Middle East and the Persian Gulf region.[4]

The last winter period has further proven that a more coherent and overall energy policy is required in order to avoid situations involving a potential breakdown in contracted supplies to Europe, and in particular to Turkey. Some type of "neighbourhood policy" could form the spearhead of Iran's external energy policy, which could manage energy relations with key potential customers and their regulators such as India and Pakistan, but also with significant Central Asian exporters Kazakhstan and Turkmenistan, as far as supply integration and transit is concerned. A sound, state-to-state, realistic and geo-strategically underpinned orientation is essential for any would-be Iranian energy policy. *Figure* 2 provides the projected forecast on availability of natural gas for export projects in Iran.

As far as major green field investments are concerned, Iran has the same path of possible development: a split between greenfield flows by

3 The economics of oil lifting and refining in Iran imply superior profitability for gas usage vis-à-vis pipeline and/or LNG exports of natural gas. IEA, *World Energy Outlook 2005*, (Paris: IEA/OECD, 2005), p. 365. In the case of oil lifting, most of the gas injected in oil fields can be recovered in the long run with the production of oil. N. Ghorban, Op. Cit., (July 2006). Even then, Iran will still have a massive 12 to 14 tcm for export after covering domestic needs and gas re-injection for 50 or more years. IEA, *Natural Gas Information 2007*, Paris: IEA/OECD, 2007, p. 144. Be that as it may, NIOC's plans call for some 100 to 115 bcm to be used for oil injection by 2010, up from 31 bcm per year in 2006. A. Flower, "Natural Gas from the Middle East", in *Natural Gas in Asia: The Challenges of Growth in China, India, Japan and Korea*, Stern, J. P. (ed.), 2 ed., (Oxford: Oxford University Press, 2008), pp. 330-370.

4 As a matter of fact, Iran is finalising an agreement with Oman to pump 28 mcm of gas to Oman and for the joint development by Oman and Iran of Iran's Kish gas field. Iran's gas will be brought to Oman and liquefied there for export.

pipeline and by LNG. In mid-2008, however, Repsol and Shell abandoned their negotiations with Iran over the Persian LNG project because they perceived the risk of US reprimands as too great to move ahead with business in Iran. Finding private international, or in any case Western investors, has been difficult and could prove to be in vain, in the end.

Pakistan: primary energy demand forecasts

For Pakistan, the need for the IPI gas pipeline project is propelled by the huge deficit in energy, especially in the natural gas sector. Pakistan's Planning Commission has prepared energy supply and demand forecast projections for the short, medium and long term, which forecast that the country will have to fill a natural gas supply gap of 1.5 bcf/day (roughly 42.4 mcm/day) by 2013 (see *Figure 3*). This is expected to be met by the proposed LNG terminal at Karachi and the first phase of the IPI pipeline. By 2025 the supply-demand gap is projected to amount to 10 bcf/day (283 mcm/day). Given the proximity of large natural gas reserves in neighbouring Iran, it would thus be logical and understandable for Pakistan to establish a lasting bilateral relationship with that country.

India: primary energy demand forecasts

Given the fact that long-term supply and trade commitments are vital for covering the long-run costs of the pipeline, it is important to take India as another potential customer for the pipeline into account. India consumed some 44 bcm of natural gas in 2007, which represents some 15% of its overall primary energy consumption. This figure is projected to grow to some 143 bcm per year by 2025, accounting for 20% of India's overall primary energy mix, according to GAIL. According to the IEA's World Energy Outlook 2007, which includes a special review of the Chinese and Indian energy sectors, Indian demand could indeed reach 123 bcm by 2030 based on the IEA reference scenario.[5] Though India appears keen on developing regional gas pipelines, its energy plans make no mention of or seem to take into account specific gas pipelines.

The potential routes of the IPI pipeline

The first phase of the project will have a design capacity to carry 2.1 bcf/day (60 mcm/day) from the gas delivery point at Iran-Pakistan border, planned to be commissioned in 2012. The volumes are to be shared equally by Pakistan and India. Under the auspices of the Iranian domestic energy policy, the first section of the pipe in the Iranian sector is to be executed as an IGAT-VIII project, which is basically designed to supply gas to the eastern provinces of Iran, supplying natural gas on the express orders of the Majlis. The second phase of the project will increase the design capacity of the pipeline to 150 mcm/day by laying a second pipeline, planned to be commissioned in 2017. Pakistan's share of the gas volumes would be some 60 mcm/day and India would receive 90 mcm/day.

The pipeline in Iran is to start in Assaluyeh, from where it will run up to the Pakistan-Iran border, and will have a length of 1,157 kilometres. In 2006 Iran started construction of a 902-km,

5 IEA, *World Energy Outlook 2007*, (Paris: IEA/OECD, 2007), p. 465.

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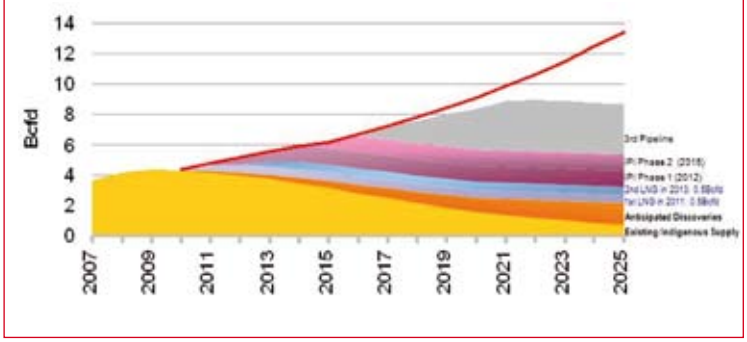
Figure 3.

GAS SUPPLY BALANCE IN PAKISTAN AND THE VARIOUS PHASES OF THE IPI LINE, 2007-2025



56-inch diameter underground pipeline from Assaluyeh to Iranshahr. Planners in Iran seem to have built extra capacity in this pipeline for that purpose. It appears that in this first stage, the 56-inch diameter main transmission pipeline is already being built in the province of Seistan. Iranian planning and design takes into account future possible interconnection between this section of the pipe and Pakistan and India. The pipeline has a capacity of 3.2 bcf/day (90 mcm/day) and about 40% of it was complete by the end of 2007. Iran has already started planning to extend this pipeline by another 255 kilometres to bring it to the Pakistan-Iran border where Iran expects to deliver 2.1 bcf/day (60 mcm/day) of gas for Pakistan and India in the first phase.

Pakistan has done extensive work to identify a suitable corridor to lay this pipeline over its territory, and is currently working on a route which traverses the Balochistan Province coastline and passes near the city of Nawab Shah before reaching the Pakistan-India border. The first section from the Iran-Pakistan border to Nawab Shah will be 795 kilometres long with a capacity of 2.1 bcf/day (60 mcm/day). Nawab Shah is the off-take point for the contracted gas volume for Pakistan where it will be connected to the existing gas network. If India decides to participate in the end, Pakistan will lay a second section of 240 kilometres from Nawab Shah to the Pakistan-India border having a design capacity of 1.05 bcf/day (30 mcm/day), which is to be provided to India under the agreement. From the delivery point for gas allocated to India at the Pakistan-India border, a pipeline will be laid to connect it to the existing Indian gas network (*see Figure 4*).

In a nutshell, the required financing to complete the IPI pipeline segment which Iran will construct (1,157 kilometres) amounts to an estimated cost of $3 billion. The Pakistani segment of the pipeline, having a length of 1,035 kilometres, is estimated to cost $2.2 billion. India must construct 300 kilometres at an estimated cost of $0.65 billion through its own territory to connect to its existing gas pipeline network. The figures given are all based on 2007 pre-feasibility studies, to be worked out in more detail depending on whether any commercial deal and/or GSPA will be established between commercial parties. However, it is estimated that the full cost of the overall project for the three countries to produce pipeline quality gas in Iran and to build transmission and distribution pipelines in India and Pakistan to bring the gas to their consumers will be more than three times as much. This availability of energy will attract huge investments in industry and power generation in both India and Pakistan, which they will need in order to maintain their projected economic growth.

● The IPI pipeline project: investors and funding

Initially, the plan was to have an international holding company with an internationally led sponsor for the construction of the entire length of the pipeline. This attracted many major companies and joint ventures including BHP, Petronas, Total, Shell, British Gas, Gazprom and a joint venture of Iranian gas companies. It has now been decided that the three countries will own and build the portions of the pipeline in their respective countries, which may have local and international participation in one form or another. This segmented approach was designed to avoid having to put together funding for one single large project, which in turn would have required funding from international institutions. As such, one of the project's main hurdles has been funding from major development banks, whose policies tend to go hand-in-hand with US foreign and development policies, meaning access to funding is subject to political conditions, which is something all three countries involved wish to avoid.[6]

6 The September 2008 credit crisis and the subsequent global financial market crisis are likely to further limit the role of international institutions and will make it more difficult for individual players to attain financing.

The IPI stakeholders

The stakeholder relationship involved in the potential IPI pipeline is complex, each party having its own proper ownership structure. Besides the governments of Iran, Pakistan and India, the following stakeholders are involved in the negotiations for the IPI gas pipeline either directly or indirectly:

- The National Iranian Oil Company (NIOC), which owns the gas fields in Iran, is negotiating a GSPA through its subsidiary, National Iranian Gas Export Company (NIGEC). The IPI pipeline segment in Iran will be owned and operated by the National Iranian Gas Company (NIGC), another subsidiary of NIOC.
- The Government of Pakistan has created a special purpose company called the Inter-State Gas System (ISGS) to handle the import of natural gas in Pakistan. ISGS is a wholly-owned subsidiary company of Sui Southern Gas Company (SSGC) and Sui Northern Gas Pipelines Limited (SNGPL), the two public sector gas utilities in Pakistan. SSGC and SNGPL own 51% and 49% of ISGS, respectively. ISGS is negotiating the GSPA from Pakistan's side.
- Gail India Limited (GAIL), which is a major gas utility in India, is negotiating the GSPA on its side and would also own and operate the Indian part of the IPI pipeline besides being the beneficiary receiving the gas.

Any attempt to construct a new pipeline, and/or new interlinking projects with Pakistan and/or India cannot be finally deemed feasible unless all energy policy frameworks are agreed to between the seller and the buyer. Most large-scale energy deals are seen as part of a high-level, bilateral government-to-government (G-to-G) agreement, followed subsequently by a business-to-business (B-to-B) execution of the agreement. Thus these B-to-B deals always link up to so-called G-to-G deals.

THE IPI GAS PIPELINE PROJECT, PHASE 1

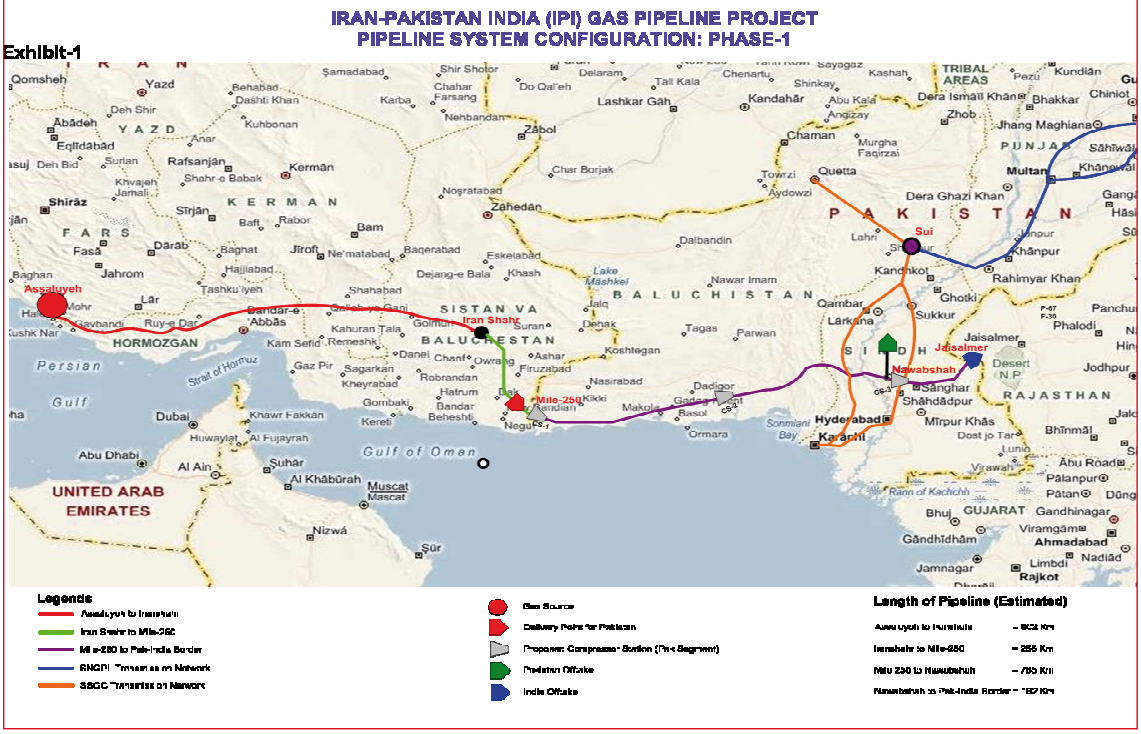


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Figure 4.

Kiwa Gas Technology: Partner for Progress

Kiwa Gas Technology offers gas technology services for gases, such as natural gas, LPG, hydrogen and biogas. Kiwa Gas Technology delivers the following services regarding gas supply, distribution and application: consultancy, engineering, training, product development and building of components, appliances and systems. We work for gas producers, gas network companies, the energy-consuming industry, the appliance industry, the machine building industry, the automotive industry, housing co-operations and governmental bodies. Nationally and internationally. The added value of our services lies in our unique formula and chain approach. Our market knowledge, product knowledge, extensive range of products and services, sector-wide network and our continuous drive to innovate makes Kiwa Gas Technology your Partner for Progress when it comes to gas.

Kiwa Gas Technology is an independent division of Kiwa N.V. The continuous improvement of processes, products, personnel and organisations as a whole is what Kiwa stands for. More than 650 professionals are involved with certification, inspection, research, consultancy and training activities in different markets. As well as the headquarters in The Netherlands, Kiwa has international offices in Italy, Germany, United Kingdom and China.

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International Reputation

In many projects all over Europe and in other parts of the world, Kiwa Gas Technology has already played a key role and has created added value for the customer. Some examples:

- BMW, Germany: Development & construction of a hydrogen boil-off safety system for the hydrogen fuel tank of the new 7 series model with hydrogen combustion engine (2006-2008)
- Liander, large Dutch network controller, and other DSOs: Implementation and set-up of Risk Based Asset Management business processes and supporting systems, according to PAS 55 or other accepted standards or methods (2007-2008)
- Mosgaz, Russia: Set-up and consultancy regarding a quantitative leak detection method for gas stations above ground in order to reduce methane emissions, including advice on repair techniques, training of local personnel and implementation of the detection method (2007-2008).
- Transitgas, Switzerland: Modelling of the gas transmission system, set-up of a theoretical gas balance, making uncertainty calculations on different levels and performing inspections of all gas measuring instruments involved (2007).

Kiwa Gas Technology also participates in several international networks of experts, such as IGU, ISO, European Gas Research Group (GERG), Marcogaz and CEN.

Engineering and Consultancy Services: Fields of Expertise

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- material selection & instrumentation
- process control and automation support
- gas load and demand management

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- gas pressure regulation station engineering
- asset management of gas networks (PAS 55)
- risk analyses & management
- quality and safety assessments
- pipeline material and components testing
- gas permeation measurements on pipes
- IRENE Pro network calculation & analysis software (www.irenepro.com)

Gas Appliances
- contract development & engineering
- heat pumps, fuel cells & micro CHP

Sustainable Gases
- engineering biogas and hydrogen feed-in installations
- biogas analyses
- biogas or hydrogen feed-in demonstration projects
- testing effects of biogas & H_2 on network materials
- feasibility studies & business cases

Project Support Services
- project management & administration
- procurement & cost estimations
- time scheduling and progress control
- supervision, quality assurance & control

Additional Services
- project development and feasibility
- design studies and analyses
- commissioning & testing
- network valuations
- technical due diligence

Operational Support
- optimisation of operation and organisation
- gas quality & quantity measurements
- emergency procedures & exercises

Maintenance Support
- gas turbine & gas engines diagnosis
- failure analyses & assessments
- condition & risk based maintenance planning
- corrosion analyses
- leak survey advice
- lifetime assessments & monitoring
- gas system approvals & inspections

Consultancy; General
- strategic and policy studies
- contra-expertise and second opinions
- safety of gas indoor installations, including multilayer and plastic piping systems
- consultancy regarding system certification (ISO 9001, PAS 55 etc.)

Training
- gas distribution, gas supply & gas utilisation
- custom tailored training programmes

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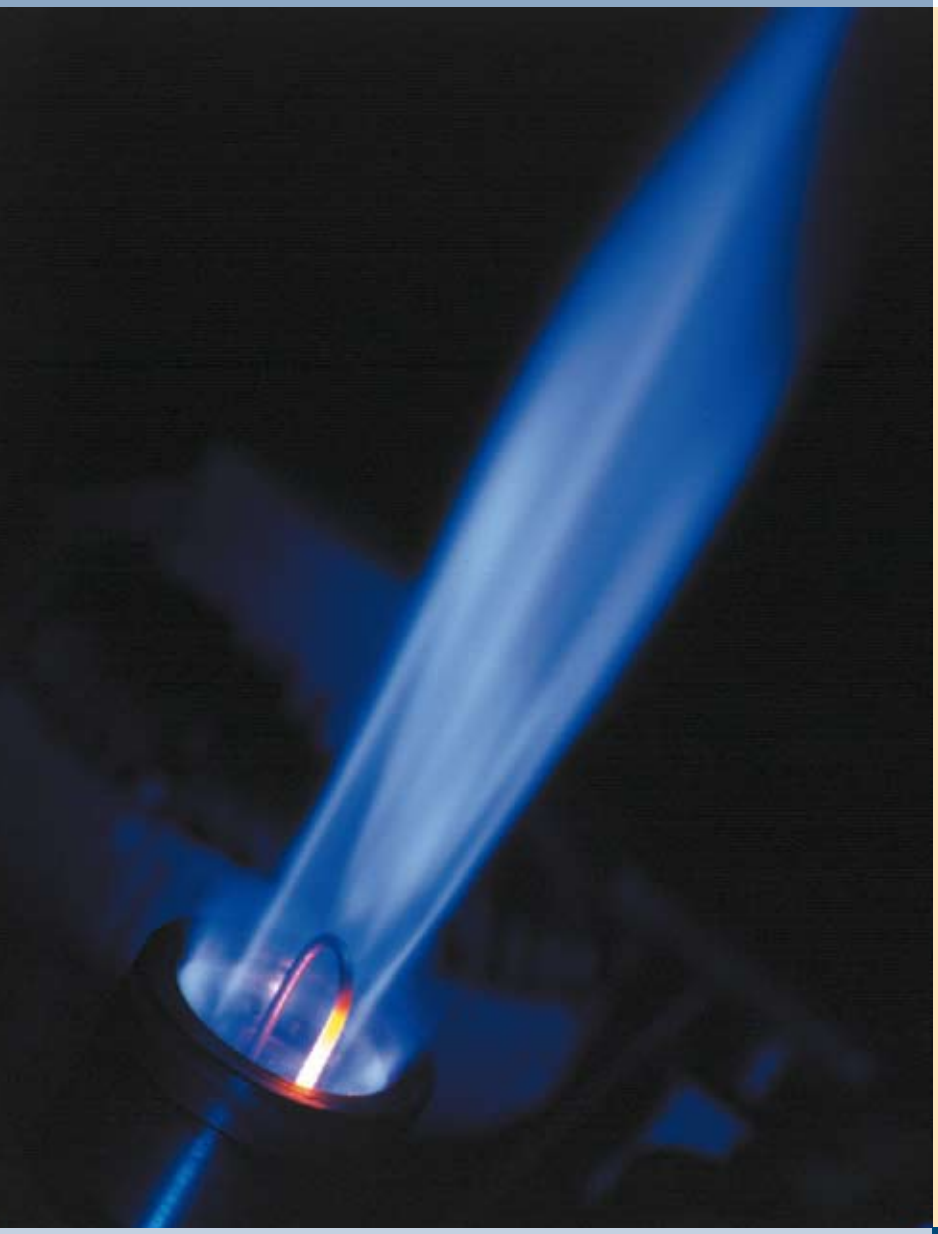
Your Centre of Excellence for Gas Distribution Technology



We create value with our wide range of services during the entire lifetime of your gas network:

Technical Consultancy
- Network Design
- Regulation & Standardisation
- Supervision during Construction
- Second Opinion & Technical Audit
- Risk Analysis & Management
- Data Management
- Gas Safety Control
- Pipeline Technology
- Maintenance Management
- Replacement Strategies
- Technical Due Diligence
- Gas Incident Investigations
- Risk Based Asset Management (PAS 55)
- Gas Quality & Quantity Measurements
- Biogas & Hydrogen Feed-In

Material Technology
- Material & Component Testing
- Residual Lifetime Assessment
- Damage Analyses

Network Software Tool
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It is remarkable to note that despite the fact that there is no B-to-B deal underpinning the project yet, the pipeline is already under construction in Iran, nearing the border with Pakistan, which is quite unlike the typical GSPA contracts which require commercial agreements long before actual construction begins.

The broader geopolitical context

In discussing the complexities surrounding IPI pipeline on a regional, bi-lateral and tri-lateral level, it is hard to do so without mentioning the broader geopolitical context, at the heart of which lies Iran, and America's geopolitical strategy to deal with it.

During the Cold War, US strategy was reactively concerned with containment of the Soviet threat, a policy which was given a renewed push during the Reagan years and finally led to the collapse of the Soviet Union as a capable adversary. This policy consisted of building and developing relationships with key allies in an arc around the Soviet Union, stretching from Europe to the Middle East and on to the Pacific and Japan. Since the collapse of the Soviet Union, however, America's strategy has become more proactive. In the early 1990s, there no longer was a major, singular geopolitical threat such as the Soviet Union; indeed, there was ample opportunity to expand US influence in the vacuum left by the collapse of Russia's influence. Central Asia quickly became a focal point for American foreign policy during the 1990s, an area which was now open to the outside world and was, next to Western Siberia, the Soviet Union's main production area for oil (mainly Kazakhstan) and gas (mainly Turkmenistan).

The freeing up of oil and gas resources in this region became the centre of a wider American campaign to secure oil and gas flows from it. Thus the new American strategy became focused on securing energy routes and securing the necessary countries in a US sphere of influence. The Azerbaijan-Georgia-Turkey corridor became the first pro-US exit valve for Central Asian oil and gas while, since 9/11, Afghanistan now offers the second. With a pro-US regime in place in Afghanistan, the US can "comfortably" control one of the most important potential gateways for energy flows from Central Asia to emerging economies such as India and China. At the same time, the US invasion of Iraq appears to have been a manoeuvre to secure a long-term strategic position in the Gulf region (with Iraq known to have the largest un-explored oil reserves in the world).

Having said the above, it is clear why Iran is a major threat to US policy: Iran dominates the Persian Gulf region and has gained enormous regional influence. From an American point of view, it casts a long shadow over the Strait of Hormuz, which is a crucial passage for some 40% of the world's oil flows (the US navy intensely patrols the Strait as well as the Gulf). Ever since the 1979 Iranian revolution US-Iran relations have been tense, at best, and diplomatic relations non-existent. Iran is considered by the US to be a major threat to its interests and therefore the US maintains economic sanctions against Iran.[7]

As regards the IPI pipeline, it thus becomes understandable why the US strongly objects to the building of the IPI pipeline and Pakistan's and India's dependence on a state the US deems as hostile to its interests. Already mentioned above is the isolation policy towards Iran, a major obstacle to the IPI project, especially as far as funding is concerned. One cannot escape the geopolitical

7 These sanctions were further tightened in 1995 by the Clinton Administration under the Iran Libya Sanctions Act (ILSA), which was aimed at Libya on the same grounds, namely that it funded terrorist organisations. In 2006, Libya was no longer seen as a threat and was thus moved from sanctions list but the Act was extended to 2011 and remained applied to Iran (it was thus renamed the Iran Sanctions Act). The original reasoning behind the Act was that sanctions would curb the strategic threat posed by Iran by hindering its ability to modernise its petroleum sector. American and foreign firms were thus basically barred form investing in Iran. See http://fas.org/sgp/crs/row/RS20871.pdf and Energy Information Administration, *Iran: Country Analysis Brief*, (Washington DC: US Department of Energy, October 2007), p. 4.

realities of the energy business and geopolitical factors should be factored into to large-scale, cross-border energy projects as business as usual . Although geopolitics is not the subject of this article, geopolitical issues have their bearing on an already difficult relationship. The discussion is incomplete without their mention and they continue to remain directly and/or indirectly the major cause of delays in the completion of the negotiation round of the IPI pipeline and other agreements related to the GSPA. These are bilateral and multilateral relationships between Iran and Pakistan, Iran and India and Pakistan and India. In these bilateral relationships, account must be taken of broader geopolitical issues such as the following:

- Iran's ability to directly influence factors on the ground in Iraq so as to make life difficult for US forces gives it a new role in the Persian Gulf region and Southern Asia.
- The US-led, NATO war in Afghanistan, which of course is mostly centred on energy interests and on the geo-strategic positioning of the US and its allies for the long run. If it should be successful, Afghanistan could become part of a safe route for energy flows from the Caspian region and Central Asia, which would then go on through the Baluchistan province of Pakistan to the Arabian Sea.
- Iran's efforts to play a role of its own in Afghanistan with the help of Afghan tribes and warlords sympathetic to Iran.
- Russia's Gazprom and France's Total have been among several parties willing to invest nevertheless in Iran's upstream potential.
- US pressure on India not to go ahead with the IPI project in view of the civil nuclear agreement being offered to alleviate India's energy problems.
- Nevertheless Iran has to deal, in the short term, with scarce investment capital and an unattractive buy-back system of contractual arrangements. Pakistan's role in the US-led war effort in Afghanistan could potentially have negative effects on a possible long-term relationship between Iran and Pakistan, in addition to regional instability.
- The differing politico-economic and social characters of the countries involved add their weight to tensions between them, while all three countries have to deal with significant internal strife and instability (e.g., poverty and social discontent, etc.).
- Pakistan's refusal to accept India's hegemonic attitude towards its neighbours.
- Last but certainly not the least, is the tense relationship between Pakistan and India over the border region of Kashmir, a strategically sensitive region to which both lay claim (owing to the legacy left by the British at the time of their exit from the Indian sub-continent). From a politico-religious standpoint, it should be mentioned that Kashmir's largely (95%) Muslim population is at odds with India's Hindu population, leading to deeper tensions across the board.

The importance of government-to-government relations

Given the aforementioned difficulties, it is understandable why a preliminary G-to-G framework is essential for the success of the IPI pipeline. Not only does it take state-backed efforts to overcome immense cross-border risks, state-backed efforts are also necessary to tackle broader regional tensions and prevent them from sabotaging a project in which all parties involved have a common interest. From a historical perspective, it is obvious that all kinds of technical initiatives have been made and put on the table, various options for a pipeline that could provide Iran with regional export markets and security of demand, on the one hand, and security of supply for Pakistan and India on the other. Given the difficulties experienced in the past, it would seem that a more gradual, step-by-step approach should be considered as a way forward for the IPI. Past

Reducing risks of metering errors

New designs of ultrasonic gas meters improve performance and reduce the risk of costly measurement errors

Gas metering systems vary in size and in the quantity of fiscal value of the product that they measure. At the high volume end, i.e. a border station or large power generation load, it is common to have a metering station measuring tens of millions of pounds of revenue per annum. In these cases it can be seen that a mis-measurement in tenths of a percent can result in high financial gains or losses for the buyers and sellers of the product. The biggest concern for a metering engineer is the risk of a measurement error. Ultrasonic technology has come of age and now, for the first time, the industry has access to a meter with fully automated Condition Based Maintenance (CBM).

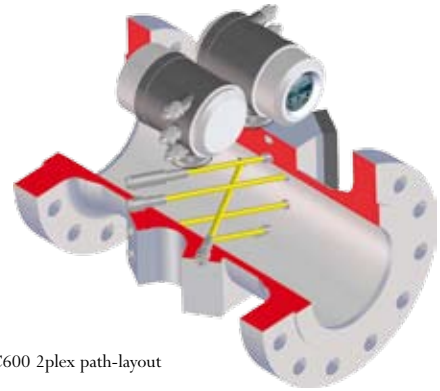
One major factor of metering errors is the design of the meter itself. Meter design and in particular the path configuration has a significant effect on the uncertainty budget and, therefore, on the meter performance. To reduce potential uncertainty factors caused by bouncing (long measuring path and reflector contamination), the 4-path direct configuration was chosen for the FLOWSIC600 meter.

The benefit of the direct path configuration is demonstrated in the signal level chart below.

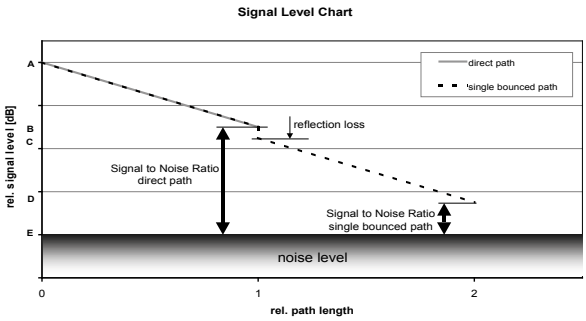
CBM (Condition Based Maintenance)

The promise of the ultrasonic meter was that the diagnostic information available would enable the user to determine if the meter was operating within specification. All the user wished for, was to be certain of that the meter was still accurate. And that they had a process in place which could demonstrate long-term stability to a regulatory authority. However the best diagnostics are of no value unless the user understands them. One early problem was that manufacturers gave users a lot of data rather than real information. This became the main driving force for designing the new CBM firmware and also the new concept of the 2plex design.

FLOWSIC600 2plex product photo



FLOWSIC600 2plex path-layout

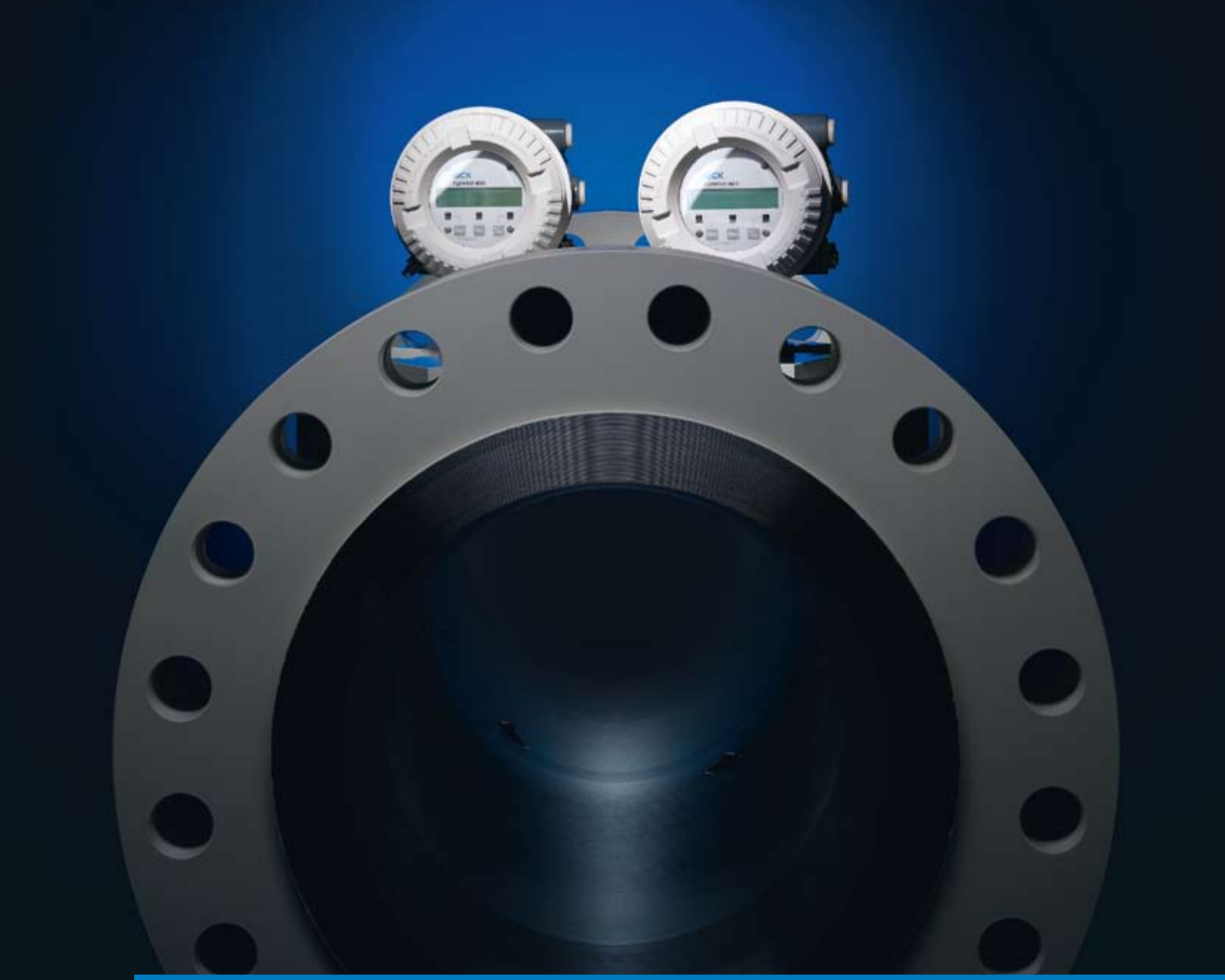


The FLOWSIC600 2plex concept

The 2plex meter design is based on the same proven design as the FLOWSIC600. In additon to the conventional fiscal 4-path chordal (Westinghouse path layout) ultrasonic meter an independent single-path meter is incorporated into the same meter body. The purpose of the additional path is to continuously check the fiscal 4-path meter's measurement results.

The FLOWSIC600 2plex will detect blocked flow conditioners, meter and pipeline contamination and pulsation.

One further benefit is that, due to having two totally independent sets of electronics, the single path meter may be used as a temporary redundant meter in the event of 4-path meter failing.



Big brother is watching you: FLOWSIC600 2plex.

The ultrasonic gas flow meter that monitors itself

Good engineers know that less is more. In the past, you needed a second flow meter to monitor the first one. Now, monitoring is included. One meter body combines two independent measuring systems: a fiscal and a diagnostic meter. You will be warned, long before affects from pipeline contamination or flow conditioner blockage could cause loss of revenue. Fiscal accuracy was never so reliable: FLOWSIC600 2plex.

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successful examples of cross-border pipeline projects across the world reflect the fact that starting negotiations on a bilateral G-to-G basis first maximises the chances of success for more complicated projects.

In this context, typical energy supply and transit issues such as transmission tariffs, border-crossing issues, fuel mix support, energy efficiency, etc., are best dealt with in an initial Pakistani-Iranian G-to-G relationship and discussion, before potentially expanding the relationship to include third parties. When all the most important issues have been dealt with at a state-to-state level, then the necessary foundations will have been laid to proceed with the B-to-B relationship between the national companies, the GSPA on the part of NIGEC being an initial step. Both governments could then meet regularly to support and further develop B-to-B activities in order to emphasise their political willingness to hammer out an energy relationship. Iran maintains that IPI is a supply contract; therefore there is no requirement for allocation of certain blocks of the South Pars gas field and no requirement for Iran to supply gas from South Pars or from elsewhere depending on Iran's domestic supply and demand balance as well as other contracts. All parties did agree in the initial stages on the gas volumes and Iran also allocated certain blocks from the South Pars field, but with the passage of time Iran kept changing its stance on the allocation of blocks, citing its difficulties and delays in negotiations related to the IPI pipeline. Iran now maintains that it would guarantee the supply of gas for the duration of the contract.

The IPI pipeline is a regional project involving cross-border commercial issues and barriers. Stable and predictable energy relations founded on and rooted in a mutual recognition of the immense common benefits to be gained are a vital precondition for success. Only then can most of the barriers to cooperation be removed, but the hard reality is that this will not happen overnight, it requires time and patience. Currently, the project is stalled because of a lack of political will and disagreements over transit tariffs and feed gas, even though Pakistan and India, for example, have already agreed on a broad range of issues after technical-level talks, subsequent to ministerial parleys which claimed to have reached consensus on basic issues.

● Broader, regional gas market integration

The issue of gas market integration is relevant not only to the case of Iran, Pakistan and India, but also to the vast region including the Central Asian producers and Iran, on the one hand, and India and China on the other. At one end of the region there are major potential gas exporters to Eastern Asia, namely Kazakhstan, Uzbekistan and Turkmenistan, whose export potential can be channelled through Afghanistan and Pakistan to East Asian markets. There is thus extensive potential for trade and win-win situations for both producers and consumers, despite the geopolitical problems involved. The IPI case demonstrates that starting from a simple outset; a producer and supplier need to agree on a G-to-G framework first, with regulatory agreements put into place at this crucial stage.

So, for example, Iran and Pakistan come to an agreement first, before integrating their own systems into neighbouring countries as import and transit needs rise. In a next step, the Central Asian producers likewise can link their infrastructure to that of Iran (or expand existing infrastructure between Turkmenistan and Iran),[8] so that eventually gas can be exported to East Asian markets through Iran. Thus gas market integration involves not only the IPI stakeholders but also the neighbouring countries in the Central and South Asian region. This scenario is what comes to mind when

8 In late September 2008, the Islamic Republic News Agency (IRNA) reported that Iran and Turkmenistan were finalising a deal over their gas price-setting mechanism with Iran seeking to import 9 bcm from Turkmenistan in 2009, up from 6 bcm in 2007.

considering the proposed, US-backed Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline.[9] However, on this issue, Russia's Gazprom maintains that the gas being proposed to be transmitted through TAPI pipeline is in fact owned by Gazprom through its agreements with Turkmenistan.

Conclusion

The important lessons learnt from the trilateral negotiations on the IPI pipeline reflect variance in legal, institutional, economic and trade laws and practices prevalent in the three countries. Above all, the project highlights the complexities of cross-border pipeline projects, ranging from a macro view in which geopolitical forces play a role to a micro view where cross-border technicalities and regulatory issue play a role and, ultimately, how these complexities influence the choices made by the parties involved. The IPI gas pipeline has thus suffered delays common to most other cross-border pipelines. These were mostly due to time taken by the three negotiating parties to understand each other's legal frameworks governing energy trade, laws that govern arbitration and disputes, policies of the regulatory bodies overseeing the energy business and pricing mechanisms for oil and gas products in each country. These issues become very important because of the bills which promptly become payable in accordance with contractual agreements; especially when these bills run into the billions of dollars. No seller would like to suffer a delay in its payments and no buyer can afford a resultant suspension of energy supply.

In essence, the nature of the difficulties faced by all parties involved underlines the fact that all of them, the supplier being Iran and Pakistan and India being the potential buyers, are operating in an embryonic market for gas in the region in question, thus the whole project has to start from scratch, regardless of any of the geopolitical obstacles involved. Security of gas supply is another area which is heavily influenced by technical, legal and political issues and needs to be understood clearly by the seller, the buyer and the transit country operators. Contractual agreements do provide remedies in terms of penalties but these appear to be so huge that instead of providing comfort, these open a Pandora's Box of dispute resolution and arbitration which in itself is a time-consuming and expensive process to undergo. This brings us to the importance of regional stability concerning institutional and economic aspects. All three countries have state companies which act as agents on behalf of the state, the equivalent of Independent System Operators (ISOs) in the European market.

It is obvious that the region of Southern Asia is fraught with geopolitical obstacles to such a large project as the IPI pipeline. While none of the countries involved exhibit any form of dependency on one another except for bilateral trade, the necessity in the gas industry of long-term agreements, which rest on stability and pre-arranged commercial parameters, confronts these sovereign nations with issues they are not accustomed to dealing with. This is primarily the case because of the nature of gas pipelines, which bring long-term dependency and involve both suppliers and consumers in an almost inescapable relationship. Broader geopolitical and regional political problems are thus bound to affect pipeline negotiations because of dependency as well as transit issues. Nevertheless, there is a need to develop standard formats and a modus operandi to avoid disputes and to enhance security of supply for the sale and purchase of energy under the umbrella of international protocols. Ultimately, this should help to improve natural gas market integration, which would help to promote economic development in the region and ultimately, in turn, social well-being.

9 The TAPI pipeline would be financed by the Asian Development Bank.

Höegh LNG AS

Background/History

Throughout the years, since the founding of the company in 1927, the size and diversity of the Höegh fleet has increased. In 1973 the company entered the LNG market with the delivery of the LNGC "Norman Lady" – the first Moss type LNG carrier ever built, a vessel still in operation. Since then, one generation of technical and commercial LNG competence has been accumulated within Höegh LNG Ltd. Providing for a centre of experience, competence and innovation in the LNG field.

Höegh LNG today

In June 2006 Höegh LNG Ltd. was established as a separate company, with the primary shareholder being Leif Höegh & Co Ltd. The main purpose of this separation was to allow the management of HLNG the freedom to focus solely on LNG and to give it the flexibility to grow the business.

Höegh LNG continues to operate successfully as an LNG carrier service provider, and it currently operates a fleet of four traditional LNG tankers. Most recently, in 2006 the company entered the Arctic arena by providing the Snøhvit LNG project with two state of the art LNG newbuildings. In addition, the company has two specialised SRV (Shuttle Regasification Vessel) under construction for delivery late 2009 and early 2010. However, recent market developments has encouraged the company to leverage its commercial and technical expertise to offer new and existing customers innovative business solutions within the complete LNG chain.

New Business solutions

As a result of a strategy of providing the industry with added value, the company has developed Shuttle- and regasification vessels (SRV) and Floating LNG Terminals, so-called Deep Water Ports (DWP), and is currently building two SRV's jointly with MOL at Samsung for the Neptune project offshore Boston. Further, Höegh LNG has under development two DWP and associated SRV's. One in the US, offshore western Florida, "Port Dolphin", and one offshore western UK, "Port Meridian". By these two DWP projects the company will be in a position to offer the industry overall access to the downstream natural gas market.

In May 2008 Höegh LNG entered into agreements with major contractors and formally started a FEED (Front End Engineering and Design) for its first LNG FPSO Unit (Floating Production Storage and Offloading), with the objective to design and construct the worlds' first LNG FPSO. This FEED consists of more than 130,000 engineering man hours and is intended to mature the design to a level where EPC contracts can be entered into.

"Our strategy is to develop Höegh LNG's business model from pure LNG transportation into offering also solutions for LNG production and floating regasification terminals," says Sveinung Støhle, President and CEO of Höegh LNG AS. *"With the LNG FPSO in place, Höegh LNG can offer a complete offshore LNG supply chain, production, marine transportation, storage, regasification and market access."*

Innovation

In order to pursue its growth strategy to the fullest extent, HLNG's policy is to develop projects based on in-house research, design & development, in addition to participating actively in what is defined as Joint Industry Projects (JIP). These JIPs involve several companies join forces to explore and develop new solutions to improve the technical solutions within the LNG industry. This currently includes the following innovative concepts:

Cryogenic hose – development of flexible cryogenic pipeline systems applicable for offshore ship-to-ship LNG transfer

Offshore Operability – development of methods and procedures to perform safe side-by-side operations for LNG vessels

HÖEGH LNG

production and liquefaction

OFFERING THE COMPLETE OFFSHORE LNG VALUE CHAIN

transportation

regasification

market access

FSRU

Snøhvit

Neptune

- A highly skilled organization with a wide range of competence gained through LNG operation since 1973
- Merging competence, innovation and technology development
- Currently operating a fleet of four LNG carriers and with two innovative Shuttle and Regasification Vessels (SRVs) on order
- A fully intergrated company with in-house fleet management

The Gas Historical Exhibition at the 24th WGC

By Jacob Fentz, Hanne Thomsen and Jens Utoft

The 24th WGC in Buenos Aires will be focused on the exciting future of our industry, but we are delighted that the organisers are also giving space to an exhibition celebrating the industry's heritage. Entitled "The Marketing of Gas from the 19th Century until Today", the exhibition will be prepared by the Global Gas Historical Network in cooperation with gas companies and museums from Argentina, Chile, Denmark, France, Poland and Sweden. More companies or museums may join in as well.

The Global Gas Historical Network first participated in a World Gas Conference in 2006, when the 23rd WGC was held in Amsterdam. With the help of a wide range of people and organisations we mounted an exhibition entitled "The History of Gas", which proved a great success and helped recruit additional members to the Network.

Our aim is that the host country and continent contribute the most important items to the exhibition, partly to ensure a variation of themes and exhibits, and partly to keep the costs down. In Amsterdam in 2006 the very fine items on display came from the host city's Museum Energetica and from Copagaz/Afegaz of France; there were also pictures and information from Denmark, France, Japan, The Netherlands, Russia and the United Kingdom.

Jacob Fentz, Chairman of the Global Gas Historical Network is seen (LEFT) at the WGC2006 exhibition with Robert Doets, NOC Chairman for WGC2006, Fritz Verweel, a volunteer at the Energetica Museum in Amsterdam, and Hanne Thomsen, Director of the Danish Gas Museum (RIGHT).

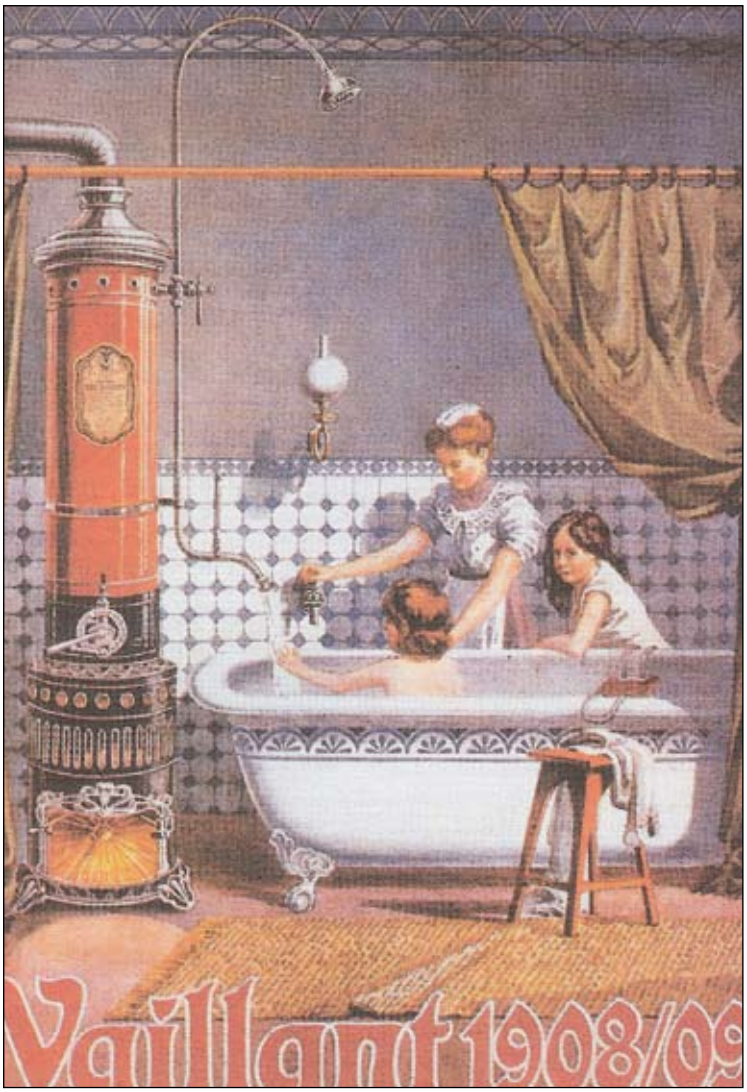
The exhibition at the 24th WGC will look at the history of gas from a marketing perspective. In the early 19th century gas explosions and accidents were quite common and many people doubted that the gas industry would develop. However, on the contrary gas went from strength to strength, from London where it all started in 1814 to Paris in 1815, Baltimore in 1816, Buenos Aires in 1823, Sydney in 1841 and Cairo in 1863.

The use of gas increased thanks to a series of technological innovations combined with a pricing structure differentiated according to end-use. In 1855, for example, the Bunsen burner greatly improved the calorific value allowing gas to be used for boiling, which meant that gas rings could be marketed and sold for various boiling purposes. The first gas water heaters were introduced, and gas was used for heating as well. In the 1870s the use of gas-fired engines became more widespread thanks to their ease of start-up, but they were still less powerful and more expensive to operate than steam engines.

A key development that stimulated gas use was the invention of the incandescent gas mantle by

The gas-lit foyer of the Dagmar Theatre in Copenhagen in 1883.

In the early 19th century gas explosions and accidents were quite common as this cartoon from around 1820 highlights.



An advertisement from the early 20th century promoting the convenience of Vaillant gas-fired water heaters.

Dr Carl Auer von Welsbach. Another advantage of the Auer lamps was that they did not burst at the high pressure needed for the increasing use of gas in the home for cookers and ovens.

Outside the home, gas illumination of streets made it safer to be outdoors at night and created a new type of night life which was popular with both citizens and police. In the early 19th century visits were mostly paid in the afternoon or the early evening; the night life of bars and taverns had a restricted clientele. With street lighting habits concerning social life and parties changed. There were more activities in places of entertainment and public places and a much wider range of citizens participated, making the streets less dangerous than before.

The exhibition in Buenos Aires will cover the marketing of town gas and natural gas, looking at how safety was the basis of gas marketing; the marketing of biogas and natural gas for vehicles; and renewable energy and gas. It will also show the history of the first catalogues and advertisements and their development to the present day, and there will be an exhibition of fine posters from the new gas museum in Chile.

The aim of the exhibition is to show how interesting and universal the history of energy is; indeed there are variations from one place to another and from one country to another, but it is also a common history shared by companies and countries, and our hope is that more and more people, museums and companies will join the Network.

Denmark took the initiative to set up the Network at the time of the 22nd WGC in Tokyo in 2003, and that is why it is based at the Danish Gas Museum, which is in charge of the update and the maintenance of the website www.gashistory.org and of the planning of the exhibitions in connection with World Gas Conferences. However, the Network is open to museums and companies all over the world, and we look forward to welcoming you at our exhibition in October in Buenos Aires.

At the moment the Global Gas Historical Network has around 50 contacts worldwide, and hopefully more will join. The aim is to showcase the history of gas and to gather together as many people as possible who are interested in that history.

Jacob Fentz, Hanne Thomsen and Jens Utoft are on the Executive Committee of the Global Gas Historical Network (www.gashistory.org).

LIQUIFIED GAS.
SOLID MARKET.
THIS IS BRAZIL.

Brazil grows and the oil & gas sector is strategic in this movement. In this strive for energetic autonomy which ensures development, the country will widen its gas pipeline network in over 50% in the next three years and is diversifying the natural gas supply sources, with the introduction of Liquefied Natural Gas (LNG) in the domestic market. The ANP - National Agency of Petroleum, Natural Gas and Biofuels - participates in this change by issuing new regulations for the construction and operation of facilities, supply, storage and regasification of LNG, as well as authorizing the construction and operation of new gas pipelines. Therefore, the ANP fulfils its role to regulate in the interest of the domestic supply and the Brazilian consumers.

anp
National Agency of Petroleum, Natural Gas and Biofuels

Ministry of Mines and Energy

BRASIL
BRAZILIAN GOVERNMENT

A Profile of New IGU Charter Member S.N.G.N. Romgaz S.A.

The history of natural gas production in Romania goes back to 1908 and the project for Well 2 at Sarmasel. Initially the purpose of the well was to produce potassium salts but when a depth of 122 metres was reached in 1909, a gas eruption occurred. The drilling carried on to a depth of 302 metres when works could no longer be performed due to a powerful and continuous gas eruption.

Following the discovery of the Sarmasel gas reservoir, the Romanian state explored other formations and by the eve of the First World War the presence of natural gas was proved in other fields within the Transylvanian Basin. In 1919 the Department of Natural Gas was established in Cluj and later, in 1925, it was transformed into the National Company for Methane Gas, known under the name of SONAMETAN.

This year marks the centenary of the discovery of natural gas in Romania.

In the 1960s increased geological survey and research activity resulted in the discovery of further gas reserves, and the maximum level of domestic production was reached in 1976 when a production of 29.8 bcm was obtained by means of 1,655 wells with an average flow rate per well of 49,000 scm/day and a maximum daily flow of 116 mcm.

Subsequently, a low discovery rate of new reserves resulted in a decrease in gas production which, together with an increase in consumption, required the import of natural gas from the former Soviet Union through Isaccea. Imports began in 1979.

Meanwhile, the first natural gas underground storage (UGS) facility had been developed in 1961. This used the depleted Ilimbav reservoir in the Sibiu area and had a working capacity of 50 mcm/cycle. In 1979 the first modern storage was built in a depleted reservoir at Urziceni, in order to ensure the continuous processing of imported natural gas during the year and to provide natural gas to Bucharest during the winter season.

After 1989, the changes that took place within Romanian society called for a series of reorganisations and restructurings in all industry sectors including the gas industry; thus, in 2001, S.N.G.N. Romgaz S.A. was established.

Romgaz: mission and place within the Romanian gas sector

Currently, Romgaz is a joint-stock company of national importance, natural gas production and storage being its main scope of activity. The Romanian state, through the Ministry of Economy, is the majority shareholder with 85% of the shares, the rest being held by Fondul Proprietatea. *Figure 1* shows the structure of the Romanian gas industry.

Romgaz is the most important natural gas producer and supplier in Romania, with a 41.2% supply share of the domestic gas market (Romgaz

production gas and directly imported gas), the rest being supplied by OMV-Petrom, other producers and importers.

Natural gas production and storage is performed by exploiting over 3,350 wells, 20 compression stations and six UGS facilities with a total capacity of 3.965 bcm of which 2.690 bcm/cycle is the working volume.

Since its foundation, the mission of Romgaz has been to produce and supply natural gas contributing to a reduction in Romania's energy dependence for the benefit of its citizens.

As the main national producer and market leader in the natural gas supply sector, Romgaz works constantly to cover the consumption demand (current production, storage and imports).

Due to changes in information and communication technology (ICT), the liberalisation of natural gas markets, increased freedom in the business sector and increased competition, Romgaz pays great attention to the innovations and creativity on which competitiveness is based.

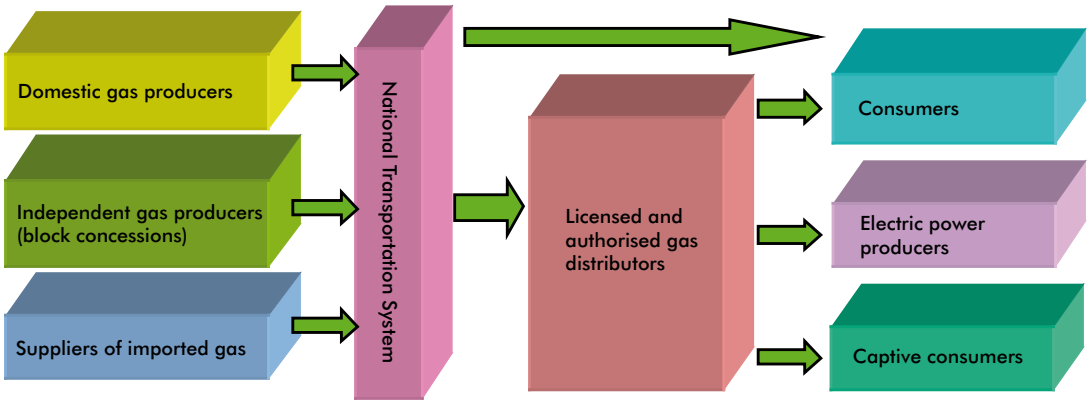
Romgaz managers and employees are aware of the importance of customer relations and strive to handle all the beneficiaries of its products and services in an equitable and correct manner. Our company is constantly seeking to improve the quality of gas and services in order to satisfy the social, economic and professional needs of customers.

The company and its employees acknowledge their responsibility to contribute to social welfare, with a positive impact on the lives of millions of people.

The major objectives of Romgaz:

- Rehabilitation of natural gas production in mature fields.
- Increasing reserves in order to maintain production at the same level by means of geological research.
- Increasing production optimisation and recovery factors.
- Ensuring continuity, safety and flexibility in natural gas supply by means of increasing UGS capacity in order to meet demand.
- Developing international cooperation.
- Increasing customer satisfaction.
- Increasing efficiency in the use of primary energy resources.
- Implementing ICT developments in management, operational and control systems.
- Improving the organisational structure and enhancing the value of human resources.
- Implementing a QHSE (quality, health, safety and environment) management system.

STRUCTURE OF THE ROMANIAN GAS INDUSTRY



LEFT
Figure 1.

Publications and Documents Available from IGU

As a non-commercial organisation promoting technical and economic progress in the gas industry worldwide, IGU offers its publications free of charge and you are invited to order the IGU publications currently available from the Secretariat. (All documents are A4 format unless stated otherwise and those that can be down-loaded from the IGU website are indicated.)

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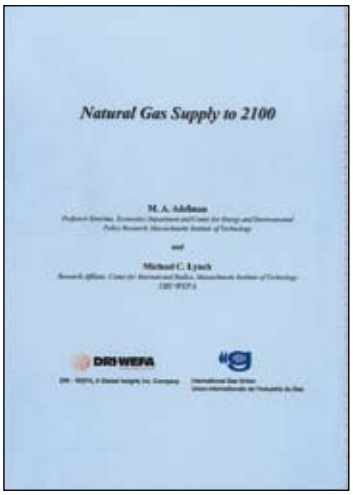
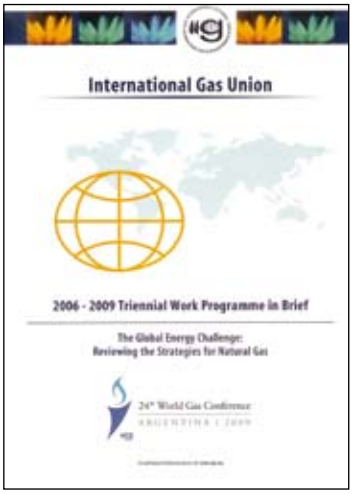
2006-2009 Programme

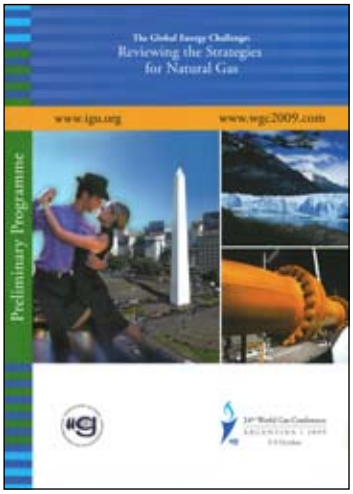
- Triennial Work Programme (full and in brief).
- Preliminary Programme of the 24th WGC, Buenos Aires 2009.

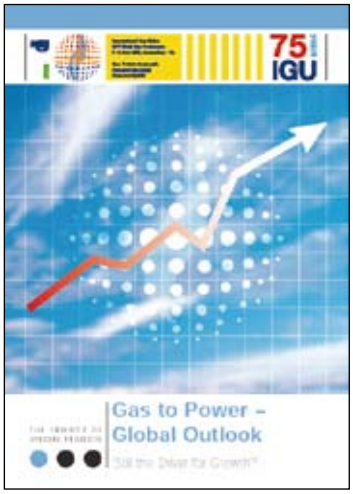


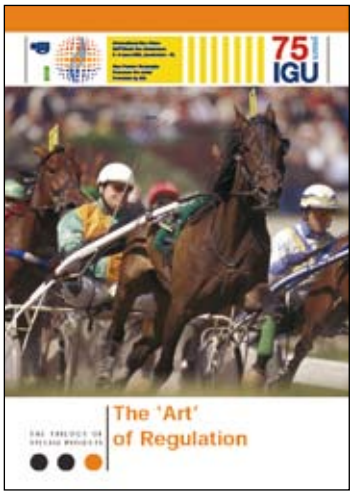
Scientific and techical papers and documentation

- Global Natural Gas Perspectives, Nebojša Nakićenović e.o., IIASA, IGU, October 2000 (71 pages). This booklet presents research-based arguments as to how natural gas appears to be suited to provide a bridge from the current energy system to a new era of more environmentally sound energy systems.
- Natural Gas Supply to 2100, M. A. Adelman and Michael C. Lynch, DRI-WEFA, IGU, October 2002, (51 pages 18 x 25.7 cm). This booklet outlines the authors' assessment of a long-term supply curve for natural gas.









- Proceedings of the 17th, 18th, 19th, 20th and 21st World Gas Conferences, (CD-ROM).
- Proceedings of the 22nd World Gas Conference, Tokyo 2003, (available on www.igu.org).
- Proceedings of the 23rd World Gas Conference, Amsterdam 2006, (CD-ROM).
- Worldwide Underground Storage (UGS) database, (available on www.igu.org).
- Gas to Power Global Outlook, (brochure, 12 pages).
- The Art of Regulation, (brochure, 8 pages).
- International Gas, ISC. All issues of the bi-annual IGU Magazine from 2004-2008.

IGU organisational information

- IGU Articles of Association, (A5, 28 pages).
- IGU Guiding Principles for Sustainable Development, October 2003, (A5, 12 pages).
- News, Views and Knowledge on Gas – worldwide, (3 pages). This general brochure gives a concise introduction to the organisation together with its Vision and Mission.
- IGU Organisation Chart 2006-2009, updated June 2008, (4 pages).

Individual publications from WGC 2006

- Gas to Power Africa
- Gas to Power China
- Gas to Power Europe
- Gas to Power India
- Gas to Power Japan
- Gas to Power Korea
- Gas to Power North America
- Gas to Power North East Asia – Taiwan, China
- Gas to Power Russia
- Gas to Power South America
- Gas to Power South East Asia and Australasia
- Sustainable Development and the Role of Gas
- The Paradigm Change in International Natural Gas Markets and the Impact on Regulation
- Micro CHP in Perspective

IGU Events and IGU-related Events 2009-2010

2009

May 6-7
GIE Annual Conference
Groningen, The Netherlands

May 14-16
Eurogas General Assembly
Antalya, Turkey

June 3-5
IGU Executive Committee
London, UK

June 18-19
7th European Forum Gas
Madrid, Spain

September 29-October 3
IPLOCA Annual Convention
San Francisco, USA

October 5
IGU Council Meeting
Buenos Aires, Argentina

October 5-9
24th World Gas Conference
Buenos Aires, Argentina

October 27-29
3rd Biennial Conference and Exhibition of the Asia-Pacific NGV Association (ANGVA 2009)
Donghae, Korea

December 3
Eurogas General Assembly
Brussels, Belgium

December 7-18
15th session of the Conference of the Parties to the UNFCCC
(COP 15)
Copenhagen, Denmark

2010

April 18-21
LNG-16
Oran, Algeria

June 8-10
12th World IANGV Conference and Exhibition (NGV 2010)
Rome, Italy

September 12-16
World Energy Congress
(WEC 2010)
Montreal, Canada

You can find links to many of the above events by visiting www.igu.org.

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Cover: flame – David Parker/Science Photo Library; man welding pipeline section – Nord Stream; gas pipeline in Tierra del Fuego – Wintershall AG; LNG tanker – KOGAS; Buenos Aires – IAPG.

Messages: IAPG (11), IGU (14), OPEC (15).

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From the IGU Secretariat: Trond Isaksen (32), V. Hardeland/StatoilHydro (32 upper), OPEC (32 lower), Erik Gonder (34), Hans Riddervold (36), IGU (38 & 40).

IGM: IGU.

The First IEF-IGU Ministerial Gas Forum: Erik Gonder (46 left), OPEC (46 right, 47 & 48).

A Busy Council Meeting in Korea: Korea Gas Union.

IGU Awards: Bosch Thermotechnik (65), Osaka Gas (66).

News from Organisations Affiliated to IGU: GIE (71), IPLOCA (72).

IGRC: Cédric Faimali via GDF SUEZ.

24th WGC: IAPG (82), www.sectur.gov.ar (83 & 84).

Progress Report: IAPG (90 upper), Korea Gas Union (90 lower), Harald M. Valderhaug/StatoilHydro (94), IGU (96, 97, 100, 104, 106 upper, 112, 114 & 124), Jean Schweitzer/www.energypicturesonline.com (106 lower & 107), Atlantic LNG (118), Petronas (120), Cédric Faimali via GDF SUEZ (126 & 128).

From Poznan to Copenhagen – Combating Climate Change: International Institute for Sustainable Development (140, 141, 142, 143 & 146), StatoilHydro (147).

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Natural Gas for Decentralised Power Generation – A Global Opportunity: Shagun Mehrotra/World Bank Group (194), Raveendran/Staff/AFP/Getty Images (196), WADE (198).

Unlocking the Value of Flared Natural Gas: Love Krittaya (201), World Bank (206/7).

Oil for Development: StatoilHydro (210), Madagascar Oil (211), Tullow Oil plc (212), Øyvind Hag/StatoilHydro (213).

Gas Market Integration in the Southern Cone: Wintershall AG (216).

The Iran-Pakistan-India Pipeline Project: Cross-border Gas Pipeline Challenges: NIGC (234, 235 & 238).

The Gas Historical Exhibition at the 24th WGC: Global Gas Historical Network (256, 257 lower & 258), Paul Yunnie Collection (257 upper).

A Profile of New IGU Charter Member S.N.G.N. Romgaz SA: Romgaz.

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