

## **COLLABORATIVE RESEARCH AND INNOVATION IN THE GAS SECTOR**

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### **1. INTRODUCTION**

GERG is strictly a research and development (R&D) organisation and this paper begins with a brief outline of its rôle in the European Gas Industry. It goes on to detail some of the current pressures on R&D activity and argues the case for collaborative R&D as a fairly obvious solution.

It illustrates the breadth of the very latest R&D activity within GERG with a wide range of examples of current or recently completed collaborative projects, of great importance to the Gas Industry, none of which would have been possible without an R&D network or, crucially, financial support from the European Union.

### **2. GERG - THE EUROPEAN GAS RESEARCH GROUP**

#### *The History*

GERG, the European Gas Research Group, was founded in 1961 to strengthen the Gas Industry within the European Community and it achieves this by promoting research and technological innovation in all aspects of the gas chain. Established initially as a network to enable exchange of information between a select group of specialist R&D centres to avoid duplication of effort, it has grown steadily to its current size whilst retaining its original aims.

GERG members have developed a large European reservoir of specialist knowledge, which currently represents a high quality research resource numbering in excess of 2000, many of whom are international leaders in their fields. However, its priorities remain: networking; technical information exchange; and the promotion of collaborative R&D, as evidenced by its wide portfolio of projects, many with European Union funding, carried out by dedicated, multi-disciplinary Project Teams.

Membership currently stands at 15 members from 10 countries, each actively involved in natural gas R&D, and these members serve a European Gas Industry which has the responsibility of supplying in excess of 80 million domestic, commercial, industrial and power station customers. It's worth noting that despite, or maybe as a result of, the changes in the European natural gas landscape, GERG membership is growing steadily, with five new members in recent years.

Over the years, GERG has evolved, from the small, original group of Gas Industry R&D organisations run part-time by one of the members, to a considerably stronger organisation, located in Brussels to benefit from proximity to the institutions of the European Union (EU).

### ***How does it work?***

GERG operates at several levels, with a Board and Plenary responsible for strategic direction, operating within a structure designed to maximise high level networking. However, the success of GERG relies principally on the interactions within the Programme Committees, where groups of technical experts, drawn from the member organisations, meet on a regular basis. Their objectives are to exchange ideas, to explore the potential for collaboration and, most important, to establish GERG projects.

The whole activity is supported by a professional, full-time Secretariat based in Brussels, to underpin the activities of GERG and to maintain links with outside bodies, particularly the offices of the EU and Gas Industry organisations world-wide.

GERG operates as a project brokerage, based in the technical Programme Committees, and thrives on a steady flow of new project proposals. Members decide whether new proposals are of interest, whether they wish to support them and, in conjunction with the Secretariat, whether they could be eligible for external funding. Once projects have been initiated, they are run by dedicated Project Teams which can, and often do, include non-GERG members such as universities, manufacturers and, importantly, non-European natural gas organisations.

GERG has four Programme Committees (PCs), covering the Gas Industry's main areas of activity:

- PC General Studies;
- PC Transmission and Storage;
- PC Distribution;
- PC Utilisation,

- covering a very wide range of projects, some of which will be described later.

### ***What does it do for the Gas Industry?***

Probably the most important feature of GERG membership is that it facilitates participation in collaborative R&D projects with shared cost and shared risk. At times of reducing R&D expenditure and increasing short-term views, this single factor can enable R&D projects to take place when they otherwise may have failed to get off the ground.

## **3. THE EFFECT OF LIBERALISATION ON R&D**

In recent years, liberalisation of the gas market has fundamentally changed the structure of the Gas Industry in Europe leading, in many cases, to the creation of distinct, new companies with specific responsibilities for network management or for gas sales. However, its implementation across Europe is very different and, in some countries, liberalisation has been a tougher exercise than in others. With regard to R&D, the changes have generated a variety of outcomes, ranging from business as usual to virtually no business at all, with several permutations in between... and the evolution continues.

Inevitably, liberalisation of the gas market has had a negative impact on the amount of gas-related R&D being conducted within Europe. This is certainly the case for GERG members, amongst whom there is clear evidence of reduced availability of funds; a concentration on shorter-term projects; reduction in R&D staff levels and a more critical appraisal of cost and benefits.

Is it provocative to suggest that R&D is important, vital even, if the 'new' gas companies wish to progress? If they wish to stay ahead of the competition, won't it be necessary to retain or develop the know-how to comply with the Kyoto requirements or to make optimum use of the latest developments in materials, ICT, sensors, etc? It's easy to take the short-term view and to rest on one's laurels but there is a widely shared view that companies without some investment in R&D could be out of business within 10 years. It's clear then that an absence of R&D capability in the Gas Industry equates to a potential risk.

Of course, you would expect such views from a representative of an R&D organisation, but I would suggest that gas companies need to make a critical assessment of where they would like to be in 10 years - and in 20 years - and to follow this with a rigorous analysis of what needs to be done to achieve those ends.

Most important, they must recognise the key rôle that R&D has played in achieving the position we have today, the *status quo*, and that continued R&D will be essential in securing the future.

#### **4. GERG PROJECTS**

##### *The Good News*

GERG is bucking the trend, as it is increasingly seen as providing a viable option that enables R&D to continue in times when individual company funding is scarce.

It's true that there is pressure on members' budgets, but it is exactly in circumstances such as these when collaborative R&D becomes vitally important as it shares the risk, enables leverage of R&D funding, and gives life to projects which otherwise would not have got off the ground.

Indeed the figures illustrate, very simply, the activity within the GERG Programme Committees over recent years. A detailed analysis of the data is not necessary, as it is mostly self-explanatory, showing both that project numbers are as high as they were 10 years ago (pre-liberalisation) and that the value of the GERG project portfolio has more than doubled since 1998. However, it's clear that, without support from the European Union, collaborative R&D in the European Gas Industry would be in a poor state.

It should be clear therefore that, despite the current situation in the European Gas Industry with regard to company R&D funding, GERG members remain very active in running collaborative R&D projects. It's also true that GERG members continue to generate new proposals, with several important projects in the pipeline.

##### *The Projects*

It's important in assessing the value of GERG to consider the breadth and depth of R&D activity in which it is involved, so the following provides a review of some current, or recently completed, GERG projects, all of which have been co-funded by the European Union's Fifth R&D Framework Programme (FP5):

- **DEO: DOMESTIC ENERGY OPTIMISATION**

... a recently completed project which was set up about five years ago to demonstrate new energy-saving technologies, including a Stirling Engine micro-CHP system; gas-fired heat pumps; and solar-powered space heating - set up in individual residential dwellings. Its objective, over three years, was to demonstrate that custom packages of innovative, energy efficient technologies would be able to work in a range of domestic environments and the various climates across Europe.

- **MICROMAP: MINI AND  $\mu$ CHP – MARKET ASSESSMENT AND DEVELOPMENT PLAN**

... also recently completed, was a paper exercise which considered the potential for mini- and micro-CHP systems in an enlarged Europe. It evaluated the technologies, the markets and the players and examined both grid connection issues and the possible take-up in different countries to 2020. It assessed the potential for cost savings, for energy and CO<sub>2</sub> emission reductions and proposed routes by which the new technology could be exploited.

- **PRESENSE - PIPELINE REMOTE SENSING FOR SAFETY AND THE ENVIRONMENT**

...and views of earth available from satellites that are so familiar to us all these days. As we get better access to spin-offs from military developments, with their superior quality and resolution, we can see progressively more and more detail. And, with a little more R&D, it should be possible to derive images with sufficient resolution to pick out the locations of individual buried pipelines - as a means of detecting 3<sup>rd</sup> party interference; soil movement (landslip) and even methane leakage.

So, PRESENSE is a satellite-based remote sensing project for monitoring pipelines which, overall, should improve the safe and secure transmission of gas in Europe's high pressure system - a network of some 180,000 km. A range of sensors, including Synthetic Aperture Radar, LIDAR, infra-red and optical surveillance technologies, has been assessed, both for their ability to 'see' in a variety of atmospheric conditions and for their contribution to a data-fusion approach to image processing and recognition.

▪ **VOGUE: VISUALISATION OF GAS FOR UTILITIES AND THE ENVIRONMENT**

... has been developing sophisticated new tools to aid the processes of detecting and locating leaks from pipeline systems - on the street. Passive infra-red and active, laser-based, technologies are being developed so that dispersing natural gas clouds can be visualised as a means of pinpointing gas leaks from both high and low pressure gas pipelines.

▪ **GIGA: GROUND PENETRATING RADAR FOR HIGH PRECISION PIPE LOCATION**

...was a research study to inform and enable the design and build of a new, dependable Ground Probing Radar (GPR). Its eventual objective - in a subsequent phase of the project - is a system specifically designed to provide the precision and high resolution required to enable no-dig installation of gas pipelines in association with Horizontal Directional Drilling. It is hoped that, given EU support, the second phase will begin during 2005 to develop what we believe to be the next generation of GPRs.

## **5. THE FUTURE**

The decade ahead will be a time of great change for the natural gas industry in Europe. The demand for natural gas is set to grow and the development of safe, well controlled, and reliable natural gas networks will be essential if optimum performance is to be achieved.

Historically, the requirement to deliver benefits to shareholders in newly privatised companies has implied short-term cost savings and, almost inevitably, this has meant reductions in R&D expenditure. However, at the same time, there will be an increasing requirement to address the problems associated with energy efficiency and emissions. Although natural gas is the preferred fossil fuel as it offers a clean and efficient energy source, there will still be a demand for high quality R&D if a continuing contribution is to be made.

Clearly, there are certain projects which can not or should not be taken on by individual companies, because of cost, because of risk, or because there are benefits to be gained from developing systems that can be applied more universally, and three relevant areas are outlined below.

### ***(i) Hydrogen***

Looking well ahead to what is a major plank in the European Union's 'bridge to security of energy supply' brings us to the 'Hydrogen Economy'. There is no doubt that hydrogen can play a major rôle in bringing about clean energy conversion in the longer term and the slide, reproduced courtesy of the European Commission's Directorate-General on Transport & Energy, is an illustration of how the hydrogen future is perceived by some in Europe: - dominated by renewable energies, electrolysis and fuel cells.

According to the European Union, natural gas will have only a minor rôle to play. I'm not so sure, and, for me, this diagram clearly illustrates that, between supply and demand, there will be a key rôle for the pipelines that deliver the gas, whatever it is - and the associated pipeline companies.

Hydrogen will become important, but there are barriers to be overcome associated with storage, distribution and, not least, perceptions of reduced safety. If serious progress is to be made towards the development of a European hydrogen system, a practical interim strategy must be adopted within the context of the existing natural gas system and this brings me to NATURALHY.

The European Gas Industry which, unquestionably, is better qualified for the task than most in Europe, is working together with key players in Europe in an EU-funded Integrated Project to examine the barriers that exist to, and the advantages that might accrue from, the addition of hydrogen to the natural gas transmission and distribution system. Clearly, the environmental advantages could be significant with respect to the Kyoto targets - even if the distributed mixture contains no more than 20% hydrogen. However, this is not a trivial exercise and it will require both considerable R&D effort and significant external funding.

Inspired by Gasunie in the Netherlands and set up within the GERG framework, the NATURALHY project represents a large, integrated body of work that could lead to the widespread delivery of hydrogen in Europe within the next 20-30 years and, therefore, make a significant contribution to an enlarged Europe's environmental aspirations whilst, at the same time, providing a logical stepping stone to the feasible, but distant, hydrogen future in Europe. The slide is an illustration of the scope of the project which will examine aspects across the whole of the natural gas system. It is a 5 year project, which began in May 2004 with 39 partners spread across Europe; it is valued at €7 million, €1 million of which is provided by the European Commission.

Without doubt, one of the most important aspects of the project will be changing the perception amongst the general public of reduced safety associated with hydrogen. As a consequence, a major part of NATURALHY will be associated with safety and dissemination of information in an attempt to dispel the common view of hydrogen which results primarily from memories and images of the Hindenberg disaster.

### ***(ii) Energy efficiency***

Energy consumption in the European Union is increasing, and this is expected to continue and, as a consequence, Europe is importing more and more energy products. If no measures are taken, in the next 20 to 30 years 70% of the European Union's energy requirements - compared to the current 50% - will be met by imported products. As enlargement looms, and European Union membership heads towards 30, there is growing concern in Brussels about a potential, long-term energy shortfall. Consequently, the European Union has decided to take better control of its energy destiny to try and free itself from what it sees as an increasing energy dependence.

And, it's not difficult to follow the logic:-

- the European Commission estimates a potential for energy efficiency improvement of more than 18% of present consumption - that's equivalent to more than 1900 TWh, or roughly the total final energy demand of Austria, Belgium, Denmark, Finland, Greece and the Netherlands combined, and;
- if the proposed target for improvement of energy intensity is met, this could realise two-thirds of the potential savings by 2010 and would result in avoided carbon dioxide emissions of almost 200 Mt/year or around 40% of the European Union's Kyoto commitment.

As a consequence, this has spawned both pan-European and national initiatives to reduce energy usage but it's difficult to see how gas companies can continue to make significant contributions to such initiatives, over and above what they currently provide, without some investment in relevant R&D.

### ***(iii) Hi-tech solutions, with uses beyond the gas industry***

Network operators are constantly striving to improve the overall management of their networks and technological progress makes this possible by the introduction of new or improved equipment to enhance operation and maintenance in areas such as ground penetrating radar, satellite remote sensing or infra-red laser-based leakage detection. In addition, advances in mobile computing, GPS technologies and sensor-fusion could be used to complement the traditional skills associated with important areas such as pipe location and leakage detection.

For projects such as these, where the technology moves very fast and where there are major benefits and few drawbacks from developing systems that can be applied equally outside the developer's own organisation, several points are obvious:

- they will need significant R&D activity;
- they should be carried out on a collaborative basis because they will be very expensive;
- their implementation could have significant advantages beyond the gas industry, indeed for all those utilities involved in, for example, transmission network monitoring, street works and leakage detection.

It's worth noting that, with European Union support, GERG members have extended the technological boundaries in these areas in successful FP5 projects such as *GIGA*, *PRESENSE* and *VOGUE*, described earlier.

Crucially, these projects offer significant benefits with regard to security of supply, safety, emissions reduction and quality of life for citizens.

## 6. CONCLUSIONS

Given the key rôle of natural gas in both primary energy supply and in achieving EU environmental objectives, it is vital to ensure that the Gas Industry's R&D capability is maintained so that the benefits of gas are fully exploited. The examples I have given, which are ambitious and expensive R&D projects - GERG projects - have illustrated that there are gas companies which consider it essential to be involved in R&D that will deliver solutions that are important for their business and, crucially, for their future survival.

In Europe we are facing significant reductions in R&D funding - amongst other liberalisation-induced pressures. In such times, many agree that it is essential to maintain involvement in organisations and events, such as this, that allow, even promote, collaboration in R&D - to ensure that mechanisms exist for shared cost and shared risk activities - in a period when short-term business thinking has become increasingly prevalent. It's quite evident that the GERG members, including many major European gas companies, understand clearly the many obvious, and not so obvious, benefits of collaboration in R&D activities.

The members of GERG represent some of the most expert technical performers in the international natural gas R&D community, combining to contribute key skills and experience that would be impossible to resource at the purely national level. The combination makes for a very strong organisation, significantly stronger than its individual parts, which is well-equipped to undertake energy sector research and technological development.

GERG has been fortunate; it has been active in catalysing such activity over the past 40+ years. Recently revitalised, it continues to attract fresh new members who increasingly see the benefits of gearing up their research euros by working with their peers and by seeking financial support from the European Union where - at a time of reduced R&D funding - they are winning unprecedented levels of external financial support.

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