

RESEARCH AND TECHNOLOGICAL INNOVATION IN THE GAS SECTOR: THE VIEWS OF THE EUROPEAN GAS RESEARCH GROUP¹

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1. INTRODUCTION

GERG is strictly a research and development (R&D) organisation and this paper briefly outlines both its rôle in the European Gas Industry and its activities in Brussels. Against this background, it highlights the difficulties that exist in the new gas regime that is evolving in Europe and the importance of, and the potential for, continued R&D activity as part of a collaborative framework with like-minded, forward-looking organisations. To illustrate the breadth of activity within GERG examples will be given of recent and current successful collaborative projects, none of which would have been possible without an R&D network and financial support from the European Union. Finally, the paper will look ahead to a range of potential R&D projects which can only exist within a collaborative framework and where there are significant additional benefits to be gained from working with others.

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 13 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 some 75 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 four new members in recent years and more set to join in 2004.

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). Correspondingly, more emphasis is placed these days on maintenance of links with the EU, lobbying for recognition of the importance of natural gas-related R&D and providing support to members applying for EU funds for collaborative projects.

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How does it work?

Like any successful organisation, 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 primarily 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 EU 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 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,

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

What does it do for the Gas Industry?

The GERG Secretariat was relocated to Brussels in 1996 so that it would be better placed to work with the organisations of the EU, to aid in the development of gas research programmes of value to Europe and to increase the allocation of funds for natural gas R&D. GERG has adopted a pro-active approach to external funding by maintaining an awareness of external funding opportunities and by stimulating the development of EU-funded GERG R&D projects.

To support this initiative, the GERG Secretariat attempts to provide members with a path through the maze which is European funding by offering a service which includes advance information on Calls for Proposals and access to a network of Commission staff for advice. Strong links are maintained in the European Commission to ensure a two way flow of information, so that the Commission is aware of major Gas Industry R&D issues and that GERG members fully appreciate the fine print of Commission Calls for Proposals to increase their probability of success.

Probably the most important feature of GERG membership is that it facilitates participation in collaborative R&D projects with shared cost and shared risk, with or without EC funding. At times of reducing R&D expenditure and increasing short-term views, this can enable R&D projects to take place when they otherwise may have failed to get off the ground. It's also clear that the pro-active approach adopted by GERG towards EU funding has provided access to considerable additional leverage on project funding in recent years, increasing income from the European Commission from 10% to ~ 40% of the GERG budget.

3. THE EFFECT OF LIBERALISATION ON R&D

The 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. Clearly, this has resulted in a situation which is not homogeneous throughout the EU and is, therefore, contrary to the spirit of liberalisation itself, as it can be seen to be creating a situation in which some countries are in a weaker position than others.

Inevitably, liberalisation of the gas market appears to have 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; and a more critical appraisal of cost and benefits. This has also manifested itself, for example, in the relatively small number of gas-related project proposals being submitted to the European Commission's Fifth R&D Framework Programme (FP5) when compared with previous initiatives.

Is it provocative to suggest that R&D is important, vital even, if the 'new' gas companies wish to progress? Isn't it obvious that organisations need to develop the expertise that will allow them to respond from a position of strength to demands from the Regulator or from the safety authorities? 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 that companies without some investment in R&D could be dead in the water within 10 years.

Of course, you would expect such views from a representative of an R&D organisation, but I would suggest that gas companies should 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. Perhaps even more important, Regulators need to be aware that their responsibilities in ensuring safe and cost-effective energy delivery to consumers will only be met in years to come if they recognise both the key rôle that R&D has played in achieving the status quo and that its continuation will be essential in securing the future.

Is there a rôle for R&D and, if so, will it be in-house effort? Will it be contracted out to organisations with neither a background in, nor a feel for, the Gas Industry? The resulting level of uncertainty leaves a partial vacuum in which there is potential for bodies not familiar with the Gas Industry and with no relevant experience to re-invent the wheel, to charge us for their progression up the learning curve, or worse, to exert an unwelcome influence to which it is difficult to respond. It's clear that an absence of R&D capability in the Gas Industry equates to a potential risk.

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 member budgets and, in the current climate, there are regular discussions as to whether GERG is as active or as effective in developing collaborative R&D projects as it was in the past, that is, pre-liberalisation.

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 the graphics are mostly self-explanatory showing, as they do, both that project numbers are as high as they were 10 years ago and that the value of the GERG project portfolio has more than doubled since 1998.

It should be clear therefore that, despite the current situation in the European Gas Industry with regard to R&D funding, GERG members remain very active in running collaborative R&D projects. It's also true that they are continuing to generate new proposals, with several important projects in the pipeline. There is, of course, a spread of activity across the membership, but it's worth noting that the influx of

new GERG members in recent years has brought an additional source of project proposals, partners and funds.

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 four 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 μ CHP – MARKET ASSESSMENT AND DEVELOPMENT PLAN**

... also recently completed, was a paper exercise which considered the potential for mini and μ 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 CO₂ emission reductions and proposed routes by which the new technology could be exploited.

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

We're all familiar these days with the views of earth available from satellites and, 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, as is clear from the photographs of an eruption from Mount Etna. And, with a little more R&D, maybe we can derive images like this with sufficient resolution to pick out the locations of individual buried pipelines - as a means of detecting 3rd 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, are currently being 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**

... is 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**

...is a research study which will inform and enable the design and build of a new, dependable Ground Probing Radar. Its eventual objective – in a later 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.

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.

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'. This is an ambition shared even by President Bush in the \$1.2 billion Freedom Fuel initiative launched during his State of the Union address earlier this year. 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 a rather busy 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. But, 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; a conclusion which echoes U.S. D.o.E. views, 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 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 will require both considerable R&D effort and significant external funding and, 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.

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, valued around €20 million, which should begin early in 2003 with more than 40 partners spread across Europe.

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.

Information technology

Information technology is a perfect example of an area:

- that moves very fast and where, to gain maximum advantage from its various developments, companies themselves must be smart, flexible, and prepared to accept and embrace change;
- where there are major benefits, and few drawbacks, from developing systems that can be applied equally outside one's own organisation.

In the new regulatory regime, there is increased pressure on network operators to improve the global management of their networks. It could be the case that recent progress in information and communications technologies makes this possible by the introduction of mobile computing and, perhaps, GPS technologies to complement the traditional skills associated with streetworks.

For a project such as this several things become clear immediately:

- it will need significant R&D activity;
- it should be carried out on a collaborative basis, because:
 - it could be very expensive;
 - its implementation will have significant advantages beyond the Gas Industry, indeed for all those utilities involved in Streetworks.

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 within Europe 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 in Europe who 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 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.

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 within Europe. Importantly, the resulting network guarantees access to external funding to leverage longer-term, essential projects and enable collaborative efforts in organisations where R&D activities are increasingly under pressure.

We have been fortunate. GERG 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.