

OPPORTUNITIES FOR THE NATURAL GAS INDUSTRY ON THE ROAD TO SUSTAINABILITY

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INTRODUCTION

It's difficult to say something fresh in a paper so close to the end of a conference of this type, where the emphasis throughout has been on '...an eco-responsible future.' So, this short presentation is a specific, personal view from Brussels which takes into account the European Union's drive for sustainability and its recent Green Paper on security of supply.

The World Gas Conference is not strictly a research conference but GERG is, of course, strictly an R&D organisation. So, I will start by briefly outlining the rôle of GERG in Brussels, the aims and objectives of the EU and, against this background, will highlight both the difficulties that exist and the potential for financial support from the European Union's R&D Framework Programmes, with reference to recent, successful examples. I will identify key technologies and highlight some inconsistencies in the European Union's thinking. Finally, I will conclude with reference to the flagship hydrogen delivery project, NATURALHY, which is currently seeking EUROPEAN UNION support.

GERG - the European Gas Research Group

- is focused on supporting the European Gas Industry and achieves this by promoting research and technological innovation in all aspects of the gas chain;
- was set up more than 40 years ago to develop high quality collaborative R&D projects in the European Gas Industry and has established itself as the network for R&D information exchange;
- currently has 13 members from 10 countries, each actively involved in natural gas R&D;
- these members serve a European Gas Industry which has the responsibility of supplying some 75 million domestic, commercial, industrial and power station customers;
- members have developed a large European reservoir of specialist knowledge and currently support a high quality research resource numbering in excess of 2000 staff;
- projects are initiated by dedicated technical Programme Committees and carried out by specialist, multi-disciplinary Project Teams, which can include academics, manufacturers and other non-member organisations;
- recently modernised, GERG has developed into a highly effective lobbying force with a strong network in Brussels, where it works to secure EU funding for its collaborative R&D projects.

Climate change is a long-term battle for us all and the Kyoto commitments represent only the first step. The European Union achieved its goal in 2000 - but greenhouse gas emissions continue to

rise. In an attempt to combat this, the EUROPEAN UNION's Green Paper: *'Towards a European strategy for the security of energy supply'* sketches out the bare bones of a long-term energy strategy, according to which:

- the development of new and renewable energies is the key to change, even if this has to be buttressed by subsidies;
- and where taxation may be used to enforce a real change in consumer behaviour by penalising the harmful environmental impact of energies.

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.

It's worth noting that the EUROPEAN UNION believes that natural gas is – and I quote - both “precious” and a “seductive alternative to other fuels”, but it views the rapid increase in gas usage as potentially causing a fresh structural weakness in the EUROPEAN UNION. However, It sees technology as providing part of the answer.

The EUROPEAN UNION's Sixth R&D Framework Programme, which has just begun, is concentrated on seven priority fields and, in response to its own Green Paper, there will be a particular commitment to the priority 'Sustainable development, global change and ecosystems' which combines the target of sustainable development with the new strategic goal of energy independence.

This specific area, which is the one of most interest to the Gas Industry, is defined by its targets, which anyone seeking European Union funding must acknowledge and address. The targets, which many will recognise, and which I don't propose to explain here, are specific to the European Union and build on commitments made in Kyoto.

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. This would result in avoided carbon dioxide emissions of almost 200 Mt/year or around 40% of the EUROPEAN UNION's Kyoto commitment.

It's clear that renewable energies don't contribute enough and that if nothing is done to provide a new impetus - they will account for just 9% of total consumption by 2030, which looks bad against

a target of 12% by 2010. So, research in the new 6th R&D Framework Programme has been concentrated on improving the available technologies; reducing their cost; improving their efficiency; and establishing their reliability.

The European Union has steadily increased its financial support for R&D in recent years - and the current Sixth Framework Programme has a budget of 17.5 billion euros for the next 4 years - with more than 800 Meuro allocated for R&D on sustainable energy systems. However, because of the emphasis on renewable energies, natural gas R&D is less well supported than it was in FP5 and, as a consequence, it will be more difficult to secure funding. Nevertheless, there are several topics which offer distinct opportunities for natural gas technologies and in which Gas Industry expertise will be vital. I'm sure that I don't need to explain the list to this audience – these are all familiar subjects.

So, considerable levels of financial support are available, given the right approach but, make no mistake, the EUROPEAN UNION has made its targets absolutely clear, and if R&D proposals do not promise a significant contribution to sustainable development, they will not be funded by the EUROPEAN UNION.

I want to talk now about two specific topics which are very important to the Gas Industry and its future and where, it seems to me, the available support (at least in Europe) is odd, inconsistent or even non-existent.

CHP is clearly a key technology for the Gas Industry - and the European Commission estimates its potential in the EUROPEAN UNION-15 to be close to 1,000 TWh/year which is equivalent to about 30% of expected electricity demand in 2010. However, despite a 9% share for CHP in electricity generation in 1994, latest estimates - almost 10 years later - suggest that this has grown to only 9.5%.

CHP is quite rightly regarded as 'a good thing' so, discouraged by the rate of progress, the European Commission introduced a target of doubling the share of cogeneration to 18% by the year 2010, which could result in a CO₂ emission reduction of 150 x 10⁶ tonnes/year, or approximately 5% of the Community's total emissions in 1990.

However, initiatives to date are not promoting the spread of CHP enough, bearing in mind the European Union's objectives. In particular, the sharp drop in electricity prices, as a result of liberalisation, makes investments in new CHP plants unattractive and the net effect is that, overall, development of CHP systems is very low. In fact, several countries have reduced their cogeneration capacities because costs exceed market prices. For example, COGEN Europe reports:

- a 15% closure in the Netherlands;
- and downturns in both the U.K. and France.

In addition, the European Environment Agency in its recent report "Energy and Environment in the European Union" concludes that, although there was growth in CHP from 1994 to 1998, the share of CHP in the EUROPEAN UNION has diminished ever since.

I find it difficult not to share the skepticism of the newly famous (infamous) Professor Lomborg on several points - and this certainly includes the extent of natural gas resources. Without even acknowledging the existence of methane hydrates, he has no major concerns about an energy crisis in the near future - and the most recent estimates support this. But, crucially, the slide also illustrates - quite clearly - the possible magnitude of the, as yet, untapped global methane resource, and it hardly needs words to describe it.

According to many estimates the planet has extensive deposits of methane hydrates, which, if exploitable, could offer a very long-term option for natural gas supply – probably from the second half of the century. However, extraction is highly problematic and there is considerable debate concerning the extent of the estimated reserves. Estimates of the worldwide natural gas potential of methane hydrates exceed 400 million trillion cubic feet (10×10^{18} (EXA) cubic metres), a profound figure compared to the 5,000 trillion cubic feet (140×10^{12} (TERA) cubic metres) that make up the world's currently known gas reserves.

There is a contrary view, of course, that the published estimates are unreliable and that the prospects for commercial production in the foreseeable future are negligible. However, this is a view shared neither by our hosts here in Japan, nor in the United States where, if only 1% of the methane hydrate resource could be made technically and economically recoverable, the domestic natural gas resource base could be more than doubled.

There is no doubt that methane hydrates represent an important, but tantalising, potential future energy resource. So, if the EUROPEAN UNION is seriously concerned about security of supply, then this is clearly an area where it should be directing at least some funding to explore the future viability of a resource that has the potential for radically changing the world's energy portfolio. This is especially so if, in solving the technological challenge of extracting methane hydrates, solutions can be developed which will enable more cost-efficient sequestration strategies.

O.K., I'm going to move on now and spend the next few minutes on a very quick tour of some current, or recently completed, GERG projects – all of which are being co-funded by the European Union within the Fifth R&D Framework Programme (FP5). These are examples of opportunities that have already been taken:

- **DEO: DOMESTIC ENERGY OPTIMISATION**

... has been presented elsewhere in this conference - by my colleague Simon Burton -, so I don't propose to go into any detail. The project 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 presented earlier at this conference, 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 development, with their superior quality and resolution, we can see progressively more and more detail, as is clear from the photographs of a recent eruption by Sicily's 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.

I want to move on from current projects and look ahead to a major plank in the European Union's 'bridge to security of energy supply' - which is hydrogen exploitation. The EUROPEAN UNION has in mind a 'Hydrogen Economy', a view shared even by President Bush in his recently announced \$1.2 billion Freedom Fuel initiative. There is no doubt that hydrogen can play a major role 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 role to play. But, for me, this diagram clearly illustrates that, between supply and demand, there will be a key role 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. There is, however, a misconception that the technologies needed to convert the natural gas infrastructure for the use of hydrogen are available today, but this is clearly not the case – and this brings me to the NATURALHY project.

The European Gas Industry which, unquestionably, is better qualified for the task than most in Europe, is preparing to examine the barriers that exist to, and the advantages that might come 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. Consequently, 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, 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 - from storage & transmission to a wide range of end-uses.

It includes 62 partners spread across Europe and is valued at about €34 million and, if the European Union decide that it is worthy of funding, it should begin some time around the end of 2003 and last for 5 years.

CONCLUSIONS

It should be clear by now that in Europe it is essential to be, and to be seen to be, embracing sustainable development, especially if seeking to work with - or be funded by - the European Union. The examples I have given, which are ambitious and expensive R&D projects - GERG projects - have illustrated that opportunities do exist for the Gas Industry on the road to sustainability and that there are gas companies actively involved in pursuing solutions that are important both for their business and for the environment.

There is no doubt that we must each play a part in 'Catalysing an eco-responsible future'. However, partnerships are essential, as no-one can make sufficient impact on their own, and to maximize impact, these collaborations must be supported by, and include funding from, 'governmental' organisations such as the EUROPEAN UNION.

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.

In Europe we have been fortunate. GERG has been active in catalysing such activity over the past 40 years. Recently revitalized, 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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