

GEO ENeRGY

Promoting *R&D capability in the service of European Industry*

Oil & Gas Research - Investing for the future

Hydrocarbons account for approximately 67% of the European Union's (EU) energy supply. Although forecasts differ in detail, most agree that this will be the case for at least the next 50 years. Natural gas, together with renewable energy sources, will contribute an increasing proportion of the EU's energy requirement replacing coal, as well as accommodating the total increase in energy consumption.

While it is inevitable that the EU will be dependent on hydrocarbons for some time to come, it is important that the future cost of our oil and gas supplies is addressed. The development of innovative technology has an important role to play in the economics of oil and gas recovery, particularly from marginal fields.

In the tough economical climate of the past decade, European and



European-based companies have succeeded in making the North Sea one of the world's most prolific oil provinces through the application of an increasingly sophisticated knowledge base, and through the development and use of advanced technology. In the early years most of the technology was American. However, the North Sea is now at the leading edge for advanced exploration and production technology with know-how being exported by European companies. This, in turn, is securing thousands of jobs for the 300,000+ people employed directly by the European service industry.

Despite the importance of developing new technologies, many oil companies are now returning to basics with R&D divisions and training departments being restructured and reduced. The oil companies are thus focusing on their core business and contracting R&D, drilling, production facilities etc, to service companies. This provides a wealth of opportunities to European providers of research and technology, many of which are small and medium sized enterprises (SME). However, it also puts a great deal of responsibility on the shoulders

of these small, innovative organisations to provide the industry with the technology it requires to continue its development into the next century and beyond.

The European Commission (EC) recognises this and supports hydrocarbons RD&D through its JOULE-THERMIE programme, with particular emphasis on the role of SMEs. While ENeRG supports these activities (two THERMIE projects are discussed in this issue of Geo-Energy), ENeRG considers that the hydrocarbons share of the RD&D budget must be substantially increased from its current level of 6% given the important role of oil and gas in our economy. This will be a recurring theme in future issues of *Geo-Energy*.

Europe's Gas Market - the technological challenge

The demand for natural gas is growing steadily in the world. This growth is linked to the environmental advantages which gas has over other fuels, i.e. it is a clean fuel, which releases about two times less carbon oxide per unit of produced energy as coal. In addition, gas-fired power stations achieve efficiencies of greater than 55%, much better than any other fuel. Proven reserves of natural gas are similar to those of oil and would allow 62 years of consumption at the present rate. This means that the supply of natural gas is secure in the long-term.

In Europe, natural gas consumption is growing at an annual rate of 3%

with consumption currently at 320 Gm³ compared with 220 Gm³ 12 years ago. The share of natural gas in the energy balance, which was about 16% 10 years ago, is now close to 20% but is still below the world ratio of 23%. However, according to a recent EC study* this could increase to between 26% and 28% by 2010. Fig 1 shows that European gas production covers 63% of domestic demand (71% if Norway is included).

Improving the security of supply for the remaining share requires that supplies are diversified, i.e. natural gas has to be obtained from more distant sources of supply than is presently the case.

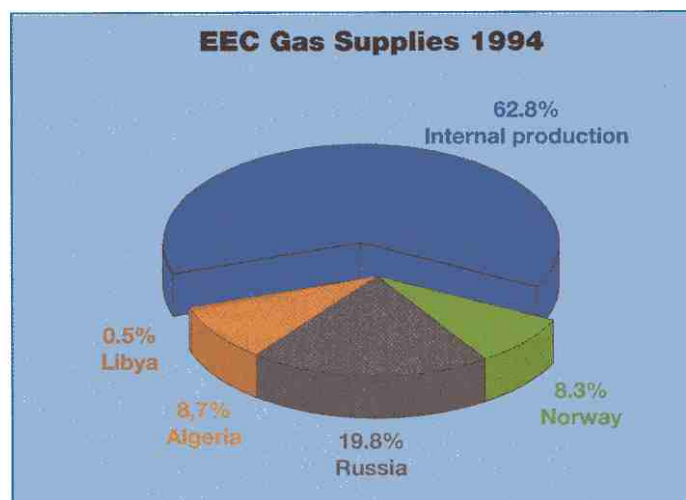


Fig 1 EC gas supplies (1994)

Securing the supply of natural gas for Europe in the future from more diversified sources requires a

significant cost reduction for gas transport.

(Continued on page 3)

THERMIE - Supporting Innovation

The European Commission's THERMIE Programme plays an important role in encouraging the development of innovative technology. Two projects supported by THERMIE, one at the demonstration stage and the other now commercially available, are discussed...

Emerging technology: Advanced wells

A group of oil companies have joined forces in a project on advanced wells which will be sponsored, initially for a two year period, under the European Commission's THERMIE programme.

The aim of the project is to test and demonstrate front-end technology which may lead to cost reductions in exploration and field development. In general this means the development and operation of marginal oil and gas fields from nearby existing rigs. There is, therefore, a requirement for advanced well parts which are capable of getting at the isolated pockets. More accurate steering and measurement techniques are needed for positioning the wellbore, and this calls for improved methods.

A field test of new completion equipment will be performed by the operator but the major part of the programme comprises full-size testing of new technology in on-shore test wells. The economic risk is small compared to real field-tests, and reference to successful prototype equipment tests will help the developers market their technology to the industry.

Two on-shore test wells have been identified for demonstration and testing. These are:

- the U1 well at the RF-Rogaland Research Ullrigg Drilling and Well Centre;
- the Agip Cortemaggiore 57 test well in Piacenza, Italy.

The Norwegian well has been drilled specifically for research and development, whereas the Italian demonstration site is an old depleted oil well.

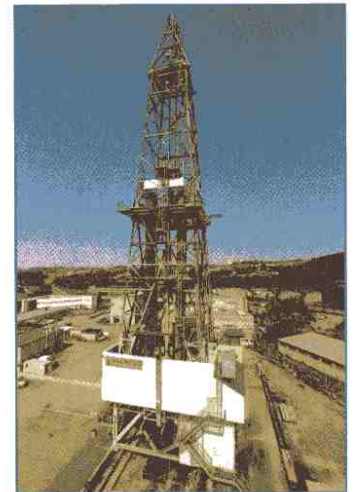
Statoil has been appointed Project Co-ordinator of the Advanced Wells Drilling and Completion project and RF-Rogaland Research will act as its operator and take care of the administration of the Ullrigg testing and demonstration activities. The U1 well will, according to the present plans, be extended from its current depth of 1070 metres to a total length of 2000 metres by hard rock drilling in the basement augeneiss of

Rogaland. The extension comprises a 2/30 m build-up to a horizontal section possibly including a lateral drain hole. The length of the horizontal section will be in the range of 400-800 metres, depending on the available technology to be demonstrated.

The U1 tests will include drillstring dynamics, cutting transport, hard rock drilling and near bit sensor technology.

Some technologies will be tested jointly at the Ullrigg Centre and the Cortemaggiore 57 well including window milling with abrasive jet technology and rotation while steering. The steerable, rotateable drilling system is perhaps the most prestigious single project in the programme as such systems may become an important tool for future extended wells with complicated trajectories.

The hard rock drilling demonstration will include percussion drilling systems and drilling bit nozzles. The near bit sensor tests result from a need for longer and more complex wells where accurate position and drill bit behaviour must be monitored by real-time measurement close to the bit. The drillstring dynamics project aims to test equipment for monitoring drillstring dynamics in order to avoid drillstring failure



The U1 well at RF-Rogaland Research

and to optimise downhole conditions for bit running.

The cuttings transport tests will be carried out at RF-Rogaland Research's flow loops, which utilise gamma densitometers at several stations along the loops. The window milling technology will be surface tested at RF-Rogaland Research and the downhole technology will be demonstrated at the Cortemaggiore 57 site. Eventually, this technique will also be demonstrated downhole at RF-Rogaland Research for drilling a lateral drain hole at the horizontal section of the U1 well.

Diverless subsea pipeline connection system

"CUSP", Connection of Underwater Systems and Pipe/flowlines, is a system for pressure connections of rigid or flexible underwater flowlines, bundles and electro-hydraulic umbilicals. The CUSP connector allows for diverless installation and retrieval of valves and other

equipment for repair and maintenance. Originally designed by Alpha Thames with financial support from the EC's THERMIE programme, CUSP is now licensed to and manufactured solely by Babcock Energy Ltd.

The system consists of a pressure

retaining component with associated assemblies designed for remote installation. The main body/clamping mechanism forms the innovative pressure retaining assembly of the CUSP system which enables diverless, pressure retaining (up to 10,000 PSI), sealed mechanical connections to be made in underwater pipelines. The connector is also fully retrievable which will allow periodic maintenance or inspection operations to take place, if required.

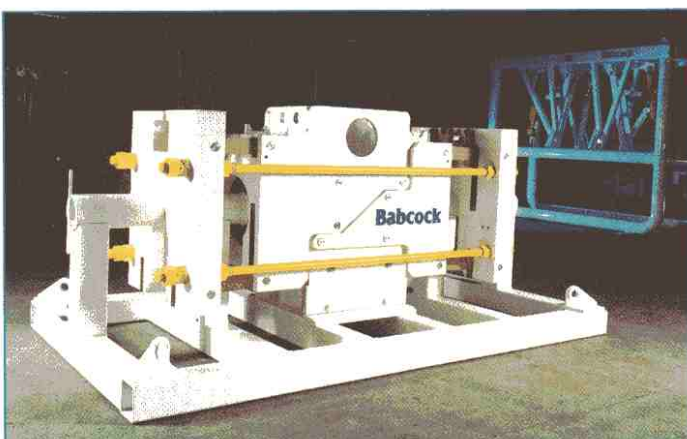
The CUSP connector has been designed for a number of subsea diverless operations including flowline connection, electro/hydraulic umbilical connection, valve installations, pipeline repairs and pig receiver installation.

CUSP offers a number of advantages including:

- significantly reduced installation cost;

- significantly reduced retrieval costs;
- competitive connector unit cost;
- significantly reduced maintenance down time;
- improved safety features due to diverless installation and retrieval;
- the option of double metallic seals giving increased reliability;
- integrated pull-in tool for flowlines;
- integrated flowline pressure and seal test facility.

The system has been subjected to a full subsea demonstration. The series of totally diverless tests included pressure testing of the connector and repeatability tests of the installation and retrieval system. Following the completion of the approval tests, a further week of demonstrations were carried out, during which the equipment was demonstrated subsea to a large audience from the offshore industry.



The CUSP connector

JOULE Emphasises Oil and Gas Production

The EC's JOULE programme, which provides important research funding for innovative technologies, has recently announced its support for nine new petroleum-related research projects. The selected projects, which have a strong emphasis on downhole and reservoir technology, each have between two and ten partners, including universities, research institute and contract research organisations, exploration and production companies, a major service company and a small and medium sized company (SME).

Topics addressed by the projects include:

Reservoir management

Reduction of uncertainty in production forecasting for hydrocarbon reservoirs (Co-ordinator: TNO Institute of Applied Geoscience, The Netherlands).

Modelling of multiphase flow in near-critical hydrocarbon fields responding to pressure drawdown (Co-ordinator: IFP, France)

Hydrocarbon migration

Vertical migration in fine-grained sedimentary rocks at reservoir and basin scales (Co-ordinator: University of Newcastle-upon-Tyne, UK).

Reservoir characterisation

Integrated description and 3D modelling of fractured "dual poroperm" reservoirs (Co-ordinator: Geological Survey of Denmark and Greenland).

3D model visualisation for enhanced delineation of reservoirs in marginal fields (Co-ordinator: Norsk Hydro Research Centre, Norway).

Drilling and downhole technology

Environmentally acceptable polymer-based wellbore fluids for optimising reservoir productivity (Co-ordinator: Schlumberger Cambridge Research Ltd).

Development of low-cost, dynamically stable slimhole drill and core bits (Co-ordinator: Institute of Drilling and Production, Austria).

Improved Oil recovery

Development of predictive models for the optimisation of massive gas injection for improved oil recovery (Co-ordinator: Institute for Energy Technology, Norway).

Production chemistry

Prediction of carbonate scale during production from high pressure/high temperature and chemically "hostile" reservoirs (Co-ordinator: Imperial College, UK).

Industry participation in the above projects includes Schlumberger, Norsk-Hydro, Elf Enterprise Caledonia Ltd, Amoco (UK) Exploration Operating Co, British Petroleum Exploration Operating Co Ltd, British Gas, Enterprise Oil plc and Statoil. The only SME partner is Rig Design Services based in the UK which will

participate in the Austrian led slimhole drill bit project. ENeRG members are involved 16 times as partners in the nine new projects. Further information on each

project is available via the EC's electronic information system CORDIS (<http://www2.cordis.lu/>) or from the co-ordinating organisation.

New Publications

A new EC maxibrochure entitled "Market Prospects for Multiphase Technology", assesses the current status of multiphase developments and identifies world-wide opportunities for developing and exporting multiphase products. The maxibrochure will be of interest to anyone involved in multiphase technology and covers a wide range of subjects including:

- produced fluids
- pipeline simulation
- boosting
- metering
- primary separation

Copies are available free of charge by faxing your request to Jonathan Shackleton at PSTI
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