COMMISSION OF THE EUROPEAN COMMUNITIES
DIRECTORATE-GENERAL FOR ENERGY

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The rational use of energy and Alternative sources

PRESENTATION

This information note is devoted to

DEMONSTRATION PROJETS ON LIQUEFACTION AND GASIFICATION OF SOLID FUELS

It follows the two first editions devoted to demonstration projects in the fields of energy saving and geothermal energy (July and October 1981).

Current Community activities relating to demonstration projects concern also the area of the exploitation of solar energy which will appear in the next newsletter/april 1982.

1. Demonstration projects on alternative energy sources – Liquefaction and Gasification of Solid Fuels.

In June 1978 the Council of the European Communities adopted Regulation (EEC) No. 1302/78 on the granting of financial support for projects to exploit alternative energy sources, followed in April 1979 by Council Regulation (EEC) No. 728/79 on the implementation of the 1978 Regulation in the field of liquefaction and gasification of solid fuels. These stipulate, inter alia, that:

— the Community may grant financial support for demonstration projects to exploit alternative energy sources in the Community which by their nature may serve as examples and which prior studies and research have shown to offer prospects of industrial and commercial viability. For the purposes of the Regulation, alternative energy sources means any potential source of energy, with the exception of nuclear energy and fossil fuels, exploited by conventional means.

— all projects must relate to the exploitation of alternative energy sources by means of new techniques or technologies which might encourage the establishment of other installations of the same type. With regard to the liquefaction and gasification of solid fuels in particular, the Regulations state that:

The support may be granted for projects for the liquefaction and gasification of solid fuels which cover one or more of the following aspects:

— the design, construction, putting into operation, operation of or improvement to pilot or demonstration plant,

— in the event of underground gasification, the preparation and execution of the borings and the creation of the linking between boreholes, as well as the recovery of the gases produced.

— such support shall constitute only a minority share of the total financing of the project. Support may not in general exceed 40 % of the total cost of the project.
Half of the support shall be repayable in cases where, after the first year of operation, the plant or process is subsequently used for industrial or commercial purposes.
The repayable part of the support shall be repaid over a maximum period of eight years, starting from the second year after the date on which exploitation of the installation or process brings in revenue. Arrangements for repayment shall depend on the nature of the project and shall be laid down in the contracts to be concluded with the recipients.

— every project submitted for consideration by individuals or undertakings in the Community further to a call for submission of projects published in the Official Journal of the European Communities shall be examined by the Commission on the basis of the following information to be supplied by the applicants:

- a detailed description of the project and the timetable for its execution;
- a description of the preliminary work and research;
- the importance of the project for reducing energy dependence and increasing diversification of supply;
- the financial situation and technical capabilities of those responsible for the project;
- the nature and extent of the technical and economic risks involved in the project;
- the cost of the project, its potential economic viability and the proposed arrangements for financing it;
- whether at an earlier stage of research and development the project has been given financial support by the Community or by Member States;
- details of any other financial support for the project to be provided by, or expected from, Member States or the Community;

- any other information which justifies the Community support requested;
- how it is proposed to publicize the results.

— the Commission shall decide whether to grant or refuse support for projects after consulting the Advisory Committee on the management of the projects concerned, composed of representatives of the Member States.

2. Projects selected

Following the first two calls for submission of projects in June 1978 and July 1980 respectively, the Commission granted support totalling approximately 51 MioECU to the initial phases of the 12 projects that it had selected. In all roughly 476.63 MioECU will be invested in those projects over the next few years. As soon as additional funds are available, support will also be granted to the following phases of these projects or to new projects. The list below gives a brief description of the projects for which the Commission has signed, or intends to sign, contracts, the title of the project and the contract number with the name and address of the contracter, all broken down by type of application.

GASIFICATION

Fluidised bed coal gasification demonstration plant for the generation of electric power in a gas-steam combined cycle.
Design, construction and operation of a gas-steam combined cycle power plant (140 MW, 55 t/d coal) using different, low-rank coals.
Gasification: 2 fluidised bed gasifiers (900-1100°C, 20 bar) from Westinghouse Electric Corp.
Gas turbine: FIAT TTG/TG 50 (100 MW) plus generator.
Steam cycle: Heat recovery boiler, steam turbine, generator.
The project only covers the engineering phase, the construction of 1 gasifier and the plant operation.

FIAT T.T.G. S.p.a.
Via Cuneo, 20
I - 10100 Torino

ANSALDO S.p.a.
Via Pacinotti, 20
I - 16151 Genova
Sampiardarena 80

LG/01/2/80

Torino

Coal gasification demonstration plant.
Design and construction of a Texaco gasification plant (entrained bed) having a capacity of 200-400 t/d coal to produce synthesis gas (for industrial use or further treatment to obtain methanol, motor fuels, etc.), from high-sulphur coals coming from Sulcis (Sardinia).

AGIP Carbone S.p.a.
Via Borgonuovo, 18
I - 20121 Milano

LG/01/5/80

Sulcis (Sardinia)

Demonstraction of a commercial scale slagging gasifier.
Trials with an existing Lurgi-gasifier at Westfield Development Center after conversion to slagging operation.
Construction and operation of a second gasifier in order to prove its commercial viability for SNG production (1300-1500°C, 30 bar).
- Coal performance trials.
- Injection of fines in the tuyères in order to widen up the coal size range (eventually run-of-mine coal).
- Demonstration trials for SNG production by the HCM process.

British Gas Corporation
326 High Holborn
London WC1V 7PT

LG/01/6/80

Westfield (Scotland)

Production of hydrogen for the hydrogenation of heavy oil and coal.
Construction and operation of a full-scale unit (within an existing heavy oil gasification plant) for the gasification of solid fuels (coal or petrol coke, fed by novel screw conveyor) or residues from coal hydrogenation (coal/oil mixtures fed by pump). High pressure gasification (partial oxydation) of 15 t/h residues to produce synthesis gas and further treatment to obtain hydrogen (or methanol/ammonia).

VEBA ÖL Entwicklungs-Gesellschaft mbH
Uhlenbrockstr. 10
D - 4660 Gelsenkirchen-Buer

LG/01/10/80

Gelsenkirchen

Coal gasification in a molten iron bath reactor.
Long-term trials in an existing 60 t converter (18 t/h coal) with a view to the construction and operation of a demonstration plant (150 t/h coal) for coal gasification in an OBM molten iron reactor (Oxygen-Bodenblasen-Maxhütte).

Klöckner
Stahlforschung GmbH
Klöcknerstrasse, 29
D - 4100 Duisburg

LG/01/13/80

Sulzbach-Rosenberg
(Nürnberg)

UNDERGROUND GASIFICATION

Belgo-German experiment on in-situ gasification.
Large-scale test of a new process for underground gasification of coal, characterised by alternating pressure (20-60 bar) of the gasifying medium (air and oxygen) and the depth of the seams to be gasified (800 m and below). Initially, it is planned to produce a gas of medium c.v. which will be burnt in a combined cycle power station (including a gas turbine).

Institut pour le Développement de la Gazéification Souterraine
rue du Chéra, 200
B - 4000 Liège

LG/02/1/78

Thulin (Mons)

Deep underground gasification of coal I and II.
I. Preliminary work aimed at applying the process of pressurized underground coal gasification at great depths for the production of SNG:
- linking between boreholes starting from existing mine roadways
- maintenance of the gasification process
- diagraphy, interpretation of geological measurements
- economic studies

II. Continuation on large scale (from the surface):
- choice of test sites
- drilling and linking
- ignition and combustion
- gasification.

Groupe d'Etude de la Gazéification Souterraine (GEGS)
4, av. du Bois Préau
F - 92500 Rueil-Malmaison

LG/02/2/78 and
LG/02/1/80

Bruay (Nord/Pas-de-Calais)
Faulquemont (Lorraine)

LIQUEFACTION

Coal liquefaction demonstration facility.
Design, construction and operation of a demonstration plant (1 t/h coal) for the production of liquid products from coal using the technique of solvent extraction. Coal extract, obtained using a solvent oil produced from coal, is converted to distillate oils suitable as feedstocks for aromatic petrochemicals, transport fuels, etc., by refining processes including hydrogenation. It is provided to include, at a later stage, also the supercritical gas extraction process.

National Coal Board
Hobart House
Grosvenor Place
London SW1X 7AE

LG/03/1/78 and
LG/03/1/80

Point-of-Ayr (Wales)

Hydroliquefaction of lignite.
Design, construction and operation of a demonstration plant for the hydrogenation of lignite (15 t/h raw lignite, 3 t/h liquid products) to obtain high-rank products (motor fuels, chemical feed-stocks, etc.). Based on the Bergius-Pier process, a number of new components will be developed:
- coal/catalyst digestion: by distillate oils
- solids separation: vacuum distillation
- residue upgrading: gasification to hydrogen

Expected advantages: reduction of pressure from 600 to 300 bar, 50% increase in specific coal throughput.

Rheinische
Braunkohlenwerke AG
Stüttgenweg, 2
D - 5000 Köln 41

LG/03/2/80

Köln

Demonstration project for selective hydrocarbon synthesis.
Construction and operation of a mobile plant (1 t/d products) for the manufacture of gasoline (or other liquid products) from synthesis gas produced by a coal gasification plant. Process: catalytic synthesis at low pressure (methanol synthesis and fractioning).

Haldor Topsøe s.a.
Nymollevej, 55
DK - 2800 Lyngby

LG/03/3/80

Copenhagen

3. Progress reports on some of the selected projects

a) Demonstration of a commercial slagging gasifier (LG/01/6/80).

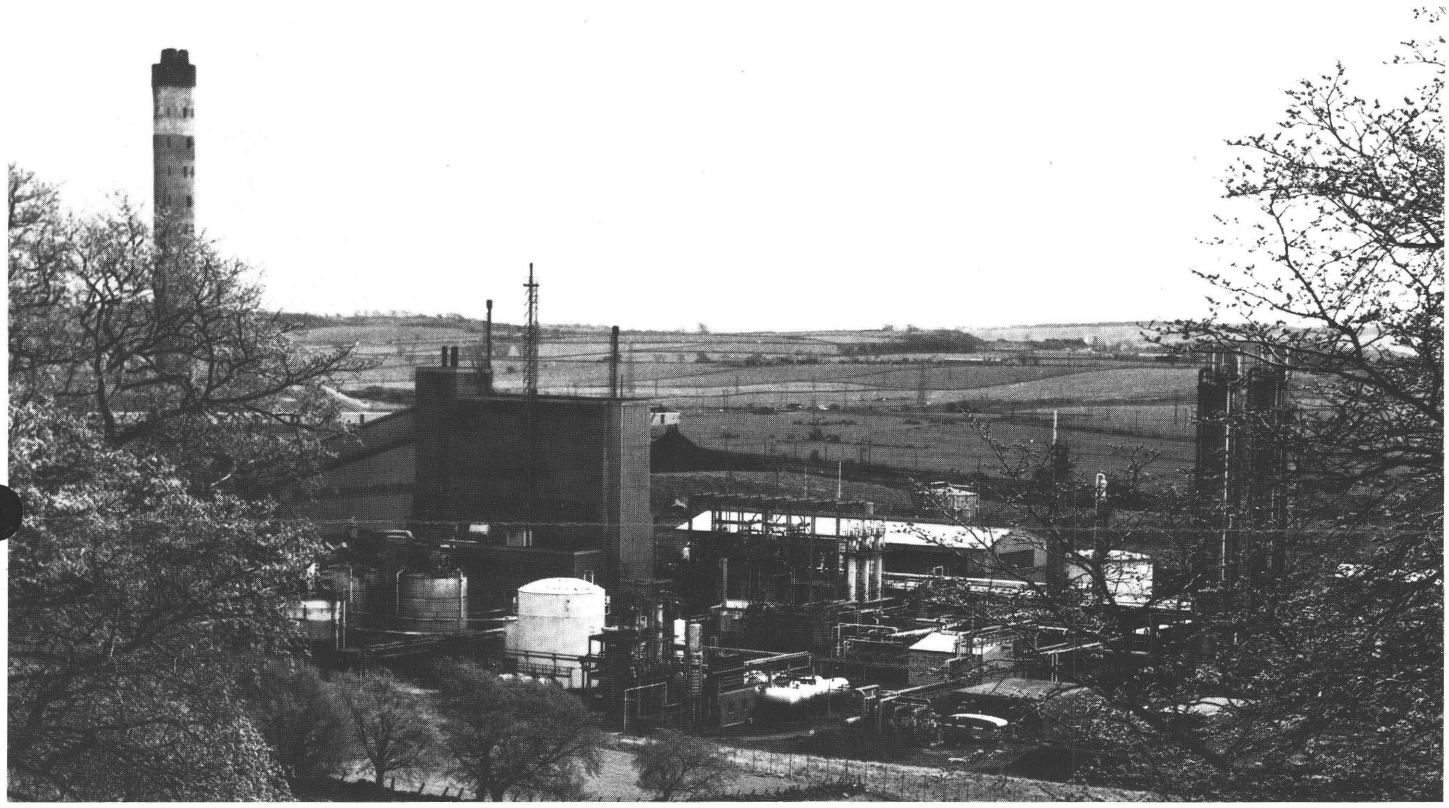
The project is being carried out by the British Gas Corporation (BGC), in collaboration with Lurgi, at the BGC's Westfield Development Centre near Edinburgh, Scotland. One of the four existing Lurgi gasifiers has been lined down from 9 ft. to 6 ft. diameter and converted to slagging operation. The whole project is broken down into 4 phases:

I. Trials on existing gasifier (completed).
II. Injection of fines through tuyères.
III. Construction of an 8 ft. slagging gasifier.
IV. Operation of this gasifier including methanation to produce SNG.

The work has been carried out at Klöckner's "Maximilianhütte" in Sulzbach-Rosenberg (near Nürnberg), a steelworks comprising five blast furnaces and three OBM-(Oxygen blowing Maxhütte) converters for steelmaking. The unique feature of these converters is that, in normal operation, oxygen and fine coal are bottom-blown in the converter, the coal helping to increase the amount of scrap that can be added.

For the gasification trials, one of these 60 tonne converters has been used, without major modification of the converter itself, but with the addition of appropriate instrumentation.

During the trials, very small-sized (48% below 0.05 mm) bituminous coals with up to 14% ash content and pure oxygen have been used to produce a gas with a relatively high heating value (12.000 kJ/Nm^3, 94-95% $CO + H_2$). The coal throughput was of the order of 15 t/h, limited by the feeder capacity.



Westfield Development Centre, British Gas Corporation.

The present contract LG/01/6/80 covers only Phase II of the project.

During Phase I of the project 24 runs with different coals have been successfully carried out showing that under normal conditions (without fines injection) the fines content of the coal might reach 25 or (in one case) even 35%; so far this was a certain handicap for Lurgi fixed bed gasifiers.

Phase II was initiated in August 1980. After construction and commissioning of the fines injection system, five test runs were carried out which proved the system's reliability but did not give significant results (the fines content has been restricted to 15% of total throughput for safety reasons).

The outstanding trials with fines injection will now be continued with the aim of determining the maximal fines content in the coal which can successfully be handled. It is hoped to reach a total fines content (feed plus injection) of well above 40%, which means that eventually even unclassified ROM coal could be gasified.

Parallel to this, the preparation of Phase III is well under way. The construction of the new 8 ft. gasifier is scheduled to start in early 1982 (capacity 600-800 t/d coal).

b) Coal gasification in a molten iron bath (LG/01/13/80)

This project ended on 30 September 1981.

No problems have been caused by the blowing of LG slag to retain the sulphur, nor have slagging or converter wear occurred. On the other hand, changing coal qualities (particularly changes in heating values) have led to some difficulties, but these should be overcome by appropriate means (i.e. temporary blowing of higher grade coal).

A technical problem, caused by the fact that the converter used had been designed for steel-making and not for coal gasification, is the sealing between the converter top and the gas chimney. A solution is expected during subsequent trials in a modified converter.

A great advantage of the process is the low content of pollutants in the product gas. For instance, sulphur content was of the order of 6-104 ppm, averaging 64 ppm. Thus, for some applications (fuel gas), a desulphurisation step does not seem to be necessary. Also the concentration of trace elements (Cd, Hg, Zn, Th ...) is low.

At the end of the project, 2 trials were carried out using larger sized coal (0.1-1 mm). It was found that the gas quality was not affected, but the milling costs were significantly reduced.

Finally, trials carried out by subcontractors, showed that the ash can be used for cement making, for road-building or even as a fertilizer, depending on its phosphorous content. In the latter case, the high sulphur content of the ash may cause problems but this is to be determined by trials that are under way.

c) **Belgo-German experiment on in situ gasification (LG/02/1/78).**

This project aims to develop a new process of underground coal gasification at great depths, since there are large coal reserves available which cannot be mined by conventional methods.

The new process is characterised by three steps:

— sinking of boreholes
— establishment of a "linking" between the boreholes
— gasification of the seam by air or air/oxygen under varying pressure (20-50 bar) to produce a medium c.v. gas to be burned in a combined cycle power station.

The work on the project started in 1979 in the framework of an arrangement between the Belgian and German governments. A test site has been chosen at Thulin (near Mons) in the south of Belgium. After the completion of a first borehole to discover the geological conditions, three boreholes have been sunk, around the original one, at a distance of 35 m. All the four boreholes reached the seam to be gasified (Léopold-Charles) at a depth of about 670 m.

Subsequently, several trials were carried out to improve the natural permeability by injecting water, nitrogen or helium under pressure. The following tests showed that a considerable increase in permeability was obtained, particularly in the direction of natural coal fissuration, which should allow the establishment of a channel between two boreholes (linking by reverse combustion).

At present, the equipment needed for this stage and the subsequent gasification is installed.

d) **Deep underground coal gasification I and II (LG/02/2/78 and LG/02/1/80).**

The first part of this project was completed in March 1981.

First of all, a test site was chosen in the Nord/Pas-de-Cala[illegible] basin, i.e. the Bruay mine, which allowed the trials from existing roadways to be carried out at 1 000 m depth. Subsequently, the site was equipped with two injection boreholes, at a distance of 65 m and a depth of 170 m and five observation boreholes.

First trials on hydraulic fracking and water injection were accompanied by laboratory work to study the permeability of coal and to establish a model of the gasification process.

In March 1980, an unexpected pressure raise during the hydrofracking overloaded the system and blocked the boreholes. After having repaired the equipment, a second linking was successfully carried out in May 1980. Subsequently, on 25 June 1980, ignition of coal at great depth and reverse combustion took place for the first time. These promising results have been confirmed by a second trial at the same site.

Underground coal gasification.

The site at Thulin (Mons) under equipment for the linking and gasification stages.

For more information write to Commission of the European Communities
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