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ENERGY IN EUROPE

Energy policies and trends in the European Community

Number 11 September 1988

Commission of the European Communities □ Directorate-General for Energy

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Contents

Abbreviations and symbols

:	no data available
-	nil
0	figure less than half the unit used
kg oe	kilogram of oil equivalent (41 860 kjoules NCV/kg)
M	million (10^6)
t	tonne (metric ton)
t = t	tonne for tonne
toe	tonne of oil equivalent (41 860 kjoules NCV/kg)
fob	free on board
cif	cost-insurance-freight
MW	megawatt = 10^3 kWh
kWh	kilowatt hour
GWh	gigawatt hour = 10^6 kWh
J	joule
kJ	kilojoule
TJ	terajoule = 10^9 kJ
NCV	net calorific value
GCV	gross calorific value
ECU	European currency unit. The ECU is a composite monetary unit consisting of a basket of the following amounts of each Community currency:

BFR	3.71	HFL	0.256
DKR	0.219	IRL	0.00871
DM	0.719	LIT	140
DR	1.15	LFR	0.14
FF	1.31	UKL	0.0878

USD	US dollar
EUR 10	Total of member countries of the EC before accession of Spain and Portugal in 1986
EUR 12	Total of member countries of the EC
I or —	discontinuity in series
of which	the words 'of which' indicate the presence of all the subdivisions of the total
among which	the words 'among which' indicate the presence of certain subdivisions only

Introduction

This issue of *Energy in Europe* is a very special one for us.

First of all, in July of this year, we celebrate our **20th anniversary** as a Directorate-General and we are proud that the event is marked in this issue by a message from the President of the Commission, Jacques Delors and from Nic Mosar, the Commissioner for Energy. This is followed by a short article giving a brief history of DG XVII and some of the Commission's achievements in the energy field in which the DG has played a major role.

Secondly, this issue contains reports on two important tasks in which DG XVII is currently involved. The first of these was the **review of the Member States' energy programmes** and of progress towards the Community's agreed energy objectives for 1995. The findings of the Commission's study — including criticisms of Member States in areas where they are failing to pursue certain of the objectives — were discussed in detail at the recent meeting of the Energy Council. The other task was the identification of existing or potential obstacles to a unified **internal energy market**. A report has now been completed which does this and describes the main areas which should be given priority attention in the run up to 1992.

We are also pleased to report on the extremely successful **Hydrocarbons Symposium** on new technologies for the exploration and exploitation of oil and gas resources. This was held in Luxembourg in March. In particular, we are happy to bask in the reflected glory of the world record dive in open sea from **Hydra VIII** in February of this year — a project supported by the European Community Hydrocarbon Support Scheme.

This issue sees the first in a new series of reports on **energy supplies to the Community**. In this article we examine the **supply of oil**. Topics covered include internal production, sources of imported crude, supply diversification, problems of varying qualities, and questions relating to the importation of refined product. The series of articles giving profiles of the energy situation in Member States continues with **Denmark**, a country which, in its approach to solving its problems of energy supply, could hardly be more different from the country we reviewed in the first article in the series (Belgium). We also continue the mini-series on **energy programming**. In the last issue we reviewed the period 1980-86. In this issue we describe the 1987 programme and future prospects for cooperation with developing countries.

Two of the other articles in this issue relate to Recommendations. The first, on the **use of solid fuels,** is a review of how the Member States implemented Recommendations adopted by the Council in 1983. The second, which examines the concept of **third-party financing**, is based on the text of a Commission Recommendation and accompanying report concerning its use in accelerating energy efficiency investments.

Since it was created by the Treaty of Rome in 1957, the **European Investment Bank** has financed a large part of the long-term investment that is required for greater Community integration. In 1987 its loans totalled 7 840 MECU. Among its many activities, the EIB is the most important Community source for financing energy projects. In an article prepared specially for *Energy in Europe*, the EIB describes its contribution towards the achievement of the Community's energy objectives.

In the last issue of *Energy in Europe*, we reported on the setting-up of a European Parliament Inquiry into what has become known as the Transnuklear-Mol affair. Some of the speculation in the Press surrounding this subject has been caused by a lack of understanding on what is meant by

'swapping' nuclear material and what 'swaps' are allowed under the terms of agreements between Euratom and our supplier countries. A short article includes the text of Commissioner Mosar's statement to the Inquiry on this subject.

The article on the **short-term outlook for energy** in the Community completes the first part of issue No 11. It contains an analysis based on the complete data for 1987 and is presented in a slightly different format to previous forecasts.

The past few months have been a period of intense activity within DG XVII and this is reflected in the wealth of **Community news** in this issue. Items range from a report on the recent Energy Council in Luxembourg (9 June), through high-level discussions on energy with the Japanese to a number of symposia, seminars and workshops arranged or sponsored by the Commission. This section also contains details of some recent changes to the establishment plan of DG XVII.

Finally, in the **Forthcoming events** section of this issue, we would like to draw your particular attention to the Euroforum new energies congress and exhibition which will take place in Saarbrücken in October 1988 under the joint sponsorship of the Commission and the Government of Saarland.

On 7 July 1988, a series of explosions on the Piper Alpha production platform in the North Sea resulted in the deaths of 166 men. This tragic accident underlined the unavoidable risks involved in winning precious oil and gas from this dangerous environment. It is impossible to estimate the enormous benefits the Community has reaped from the development of the North Sea in the past two decades, nor can we calculate the debt that we owe to those brave men and their families.

Message from the President of the Commission

The 20th anniversary of the Directorate-General for Energy must be the occasion to recall the importance of the energy sector to Europe. This is especially true during this period when there has been some relaxing of the tensions that we have experienced during the last decade. It would, in fact, be irresponsible of us to believe in a trouble-free future and to concern ourselves solely with day-to-day energy management.

Because of this, and in the light of our 1992 objectives, members of the Directorate-General for Energy have a major role to play. I am confident that through their ability, work and determination under the authority of their Commissioner, and in spite of difficulties which may arise, the energy sector will form an essential part of the single market which we are building and that it will be present at the 'Grand rendez-vous européen' to which we have invited the Community.

Jacques Delors

Message from the Commissioner for Energy, Nic Mosar

The Directorate-General for Energy has just celebrated its 20th anniversary; it has therefore come of age. I believe that this augurs well for the future development of our energy policy. In this field, the Community too has entered a new phase with the publication of the Commission document on the internal energy market.

In December 1968, the Commission, in a Communication entitled 'First guidelines for a Community energy policy', showed foresight when it pointed out the necessity of fully integrating the energy sector into the Common Market. Thanks to the continuous efforts over 20 years of the Directorate-General for Energy, substantial progress has been made. However, this progress has not yet been sufficient to meet the early ambitions of the Commission. The impetus given by the completion of the European internal market in 1992 could give us new reasons for hope. From now on, the Directorate-General for Energy must give substance to the hopes of the Commission and the Community Member States in this field.

While we must keep our sights focused on the internal energy market, we must not forget the other main lines of Community energy policy which have been so patiently developed over the last 20 years. In a world where fossil fuels are not inexhaustible and at a time when, following Chernobyl, the future of nuclear power depends on its safe development, our efforts of the last 15 years to use less energy and to use it better must remain a fundamental element of our policy. In the same way, we must reinforce our efforts to achieve the commercial development of renewable energy resources.

I sincerely wish the Directorate-General for Energy — and all its staff — good fortune in bringing about a twenty-first century energy Europe. The DG has all the necessary qualities to succeed and, I am sure, it will show the ability to put them to good effect.

Nic Mosar

20th anniversary of the Directorate-General for Energy

On **8 April 1965** *the Council of Ministers, meeting in intergovernmental conference, signed a Treaty establishing a Single Council and a Single Commission of the European Communities. This Treaty had to be ratified by the six Parliaments of the Member States. Three years later the Directorate-General for Energy was formed. The following is a short history of 20 — sometimes turbulent — years in the energy sector.*

1968

When the three Executives, the High Authority of the European Coal and Steel Community (ECSC), the Commission of the European Economic Community (EEC) and the Commission of the European Atomic Energy Community (EAEC/Euratom) merged in 1968, the Directorate-General for Energy was created with Fernand Spaak as its first Director-General. The Member of the new Commission of the European Communities with special responsibility for energy was Wilhelm Haferkamp.

Until 1968, the three Executives were responsible for their own particular sectors, with the Commission of the European Economic Community taking charge, in the person of Robert Marjolin, of all energy matters excluding coal and nuclear energy.

There were consultations between the institutions within the Inter-Executive Working Party on Energy comprising representatives of the three abovementioned institutions under the presidency of Mr P. O. Lapie, a Member of the High Authority of the ECSC.

The Directorate-General for Energy has since submitted a variety of proposals to the Council, which have served as a basis for the Commission's ongoing action and initiatives in this key sector of the economy.

This article retraces the Commission's early proposals and the changes that have occurred in the Directorate-General for Energy since its establishment. All texts, resolutions or regulations after 1975 are contained in a volume of collected energy acts which will be published separately.

On 18 December 1968 the new Single Commission presented its first Communication to the Council entitled 'First guidelines for a Community energy policy' establishing the framework for its activities in this field.

The proposal reflects the priority the Commission has always attached to monitoring as an energy policy instrument. This was the reason for continuing to issue the annual reports on the energy situation in the Community which had first been published in 1961, the usefulness of which the Council endorsed at its meeting of 13 November 1969.

Wilhelm Haferkamp,
Commissioner for Energy
1968-73.

On 20 December 1968 the Council published the Directive imposing an obligation on Member States of the EEC to maintain minimum stocks of crude oil and/or petroleum products.[1] The oil crisis some years later showed how right the Commission had been to require Member States to maintain on a permanent basis 'stocks of petroleum products at a level corresponding, for each of the categories of petroleum products listed ... to at least 65 days' average daily internal consumption in the preceding calendar year'.

1972

On 13 October 1972, just before the first oil crisis, the Commission presented a further Communication entitled 'Necessary progress in Community energy policy' in which it focused on issues such as protecting the environment, rational use of energy, scientific and technical research, relations between importing countries and between exporting and importing countries, while stressing that the underlying problem was to guarantee long-term security of supplies under satisfactory economic conditions.

1972

In the new Commission, Mr Haferkamp moved to External Relations and Henri Simonet assumed responsibility for energy.

1973

On 27 April 1973, following the accession of three new Member States, the Commission presented its third Communication 'Guidelines and priority actions under the Community energy policy'. It considered this new initiative to be necessary because the measures required to guarantee long-term security of supplies 'must be based on a long-term global assessment of trends. They must also constitute an entity which is coherent enough to render instruments of varying scope truly effective'.

Fernand Spaak,
Director-General for
Energy 1968-75.

Five years after its establishment, the merged Community had to face an oil crisis, which resulted in the adoption by the Council on 24 July 1973 of the 'crisis' Directive on measures to mitigate the effect of difficulties in the supply of crude oil and petroleum products, and the Regulation of 16 March 1973 applying the Regulation of 18 May 1972 on notifying the Commission of imports of crude oil and natural gas.

In the same year, the Council approved the Regulation on support for Community projects in the oil and gas sector.

1974

On 30 January 1974 the Council decided to create an Energy Committee to underpin the Community's approach on information.

On 5 June 1974 the Commission presented its fourth Communication 'Towards a new energy policy strategy for the European Community' and a fifth on the rational use of energy. On the basis of these communications, the Council adopted three resolutions of key importance to the Community's subsequent activities:

(i) the Council Resolution of 17 September 1974 on the new energy policy strategy for the Community;

(ii) the Council Resolution of 17 December 1974 on the objectives of Community energy policy for 1985;

For the first time the Council, acting on a Commission proposal, approved the fixing of medium-term Community energy objectives, and stated that the Member States should contribute to the implementation of these objectives in terms of their specific possibilities and constraints and that the Commission should report at six-monthly intervals to enable the Council to reflect periodically on progress in achieving the Community objectives, in particular with regard to the measures taken at Community and national level;

(iii) the Council Resolution of 17 December 1974 on the Community Action Programme on the rational use of energy.

1975

Fernand Spaak left the Directorate-General for Energy at the end of 1975 to head the Commission's Delegation in Washington. He was replaced by Leonard Williams, who led the Commission's Delegation on Energy to the CIEC (Conference on International Economic Cooperation) organized in Paris between 1975 and 1977 by President Giscard d'Estaing. This Conference enabled a joint analysis to be made for the first time of the international energy situation by developing and industrialized countries and resulted in joint conclusions on several important issues.

Leonard (now Sir Leonard) Williams, Director-General for Energy 1975-8.

1977

Guido Brunner became the Commission Member with special responsibility for energy.

The Directorate-General for Energy organized two hearings on nuclear energy at the end of 1977 and the beginning of 1978.

1978

The Council adopted the Regulations on financial support to demonstration projects relating to alternative energy sources, solid fuels and energy conservation.

1979

The Council adopted the implementing Regulations for the demonstration projects.

Reacting to the second oil crisis, the Council adopted the Regulation of 28 August 1979 introducing registration for crude oil and/or petroleum product imports in the Community, and the Regulation of 20 November 1979 laying down the rules by which registration was to be carried out.

It was also at this time that the Commission introduced its weekly oil bulletin as proof that the Rotterdam quotation was more reasonable than the producer countries thought.

1980

The Council adopted the new Community energy objectives for 1990.

Etienne Davignon, Vice-President of the new Commission, took over a number of portfolios, including energy.

Viscount Etienne Davignon, Commissioner for Energy 1980-84.

1981

Mr Williams left the Commission and was replaced by Christopher Audland. A new Directorate was set up for 'Nuclear Energy' in the Directorate-General for Energy, the former Directorate 'Nuclear Energy, Electricity and Other Energy Sources' becoming Directorate E for 'Energy Saving and Alternative Energy Sources, Electricity and Heat'.
Michel Carpentier became Deputy Director-General.

1 January 1984

Nic Mosar, a Member of the Commission under Mr Delors' presidency, was given the energy portfolio.

1985

On 22 November 1984 the Commission adopted the 'Illustrative Nuclear Programme' on the nuclear industries in the Community pursuant to Article 40 of the Euratom Treaty. It was approved by the Economic and Social Committee on 30 May 1985.

This was the third such programme published by the Commission (the previous one dating from 1972).

In the document the Commission sets out and analyses the situation of the nuclear industry and outlines the prospects for medium- and longer-term development.

On 20 December 1985 the Council adopted the new three-year Regulation to grant financial support to energy demonstration projects and industrial pilot projects.

Christopher (now Sir Christopher) Audland, Director-General for Energy 1981-86.

1986

In April 1986 Chernobyl triggered investigations by Directorate D and other Directorates-General regarding plant safety, monitoring of safety standards, and effects on food and on public health.

In June 1986 an ECSC Decision was adopted establishing Community rules for State aid to the coal industry, followed by an implementing Decision on 30 July 1986.

On 16 September 1986 the Council adopted a Resolution on the new Community energy policy objectives for 1995 and the convergence of Member States' policies.

Christopher Audland left Energy on 1 October to take a Chair at Edinburgh University and was replaced as Director-General by Mr Maniatopoulos who took office in November 1986. Clive Jones was appointed Deputy Director-General at the end of the year in place of Mr Carpentier, who in 1985 had returned to the Task Force (and henceforth DG XIII) 'Telecommunications, Information Industries and Innovation'.

1987

On 30 March 1987 the Council adopted a new Directive on the approximation of the laws of the Member States relating to the sulphur content of certain liquid fuels, followed on 21 July by a new Directive concerning the lead content of petrol.

[1] OJ L 308, 23.12.1968.

A first step towards the internal energy market

At the end of April the Commission sent the Council a Communication[1] *containing an exhaustive inventory of the obstacles to completing the large internal market in the energy sector and describing the means to be employed by the Commission to achieve closer integration of the energy markets. This report will be published in a special edition of* **Energy in Europe** *in September 1988.*

The exercise, ordered by Nic Mosar, Commissioner with responsibility for energy, took the 1985 White Paper on completing the internal market as the starting-point for an in-depth study of this strategic sector, listing ways of overcoming the obstacles to completing the internal energy market with particular emphasis on determined enforcement of the relevant Community legislation.

Lower energy costs, the natural result of a single market and a *sine qua non* for boosting the competitiveness of the Community's economy, are the biggest prize, but the single market will also bring benefits for consumers, for the structure of the energy industry in the Community, for security of supply and for trade between Member States.

But first account will have to be taken of the unique characteristics and constraints on the energy market, with its enormous range of products and applications. For example, depending on the conversion process chosen, the same product can be turned into a heating fuel, a motor fuel, a feedstock or a power source. Others (such as road transport or petrochemicals) have virtually captive markets.

Leaving aside the general problem of economic and social cohesion within the Community, the constraints on completion of the internal energy market stem chiefly from the objective of safeguarding security of supply and from the strategic importance of the energy industry. A single figure will suffice to give an idea of how much remains to be done: the estimated 'cost of non-Europe' in the energy sector stands at between 0.5 and 1% of the Community's GDP, equivalent to 5 to 10% of the cost of 'non-Europe' to the Community economy as a whole.

Four types of action are planned to complete the internal energy market:

1. Implementation of the White Paper;
2. Determined enforcement of Community legislation;
3. Action to protect the environment;
4. Specific energy policy measures (on costs, prices, tariffs and infrastructure).

1. Implementation of the White Paper

Implementation of the White Paper to remove technical and tax barriers on the Community energy market will call for action in three main areas:

(i) Harmonization of rules and technical standards

The new approach adopted by the Council in 1985 should allow harmonization of the technical rules by adoption of the Community Directives proposed in the White Paper.

(ii) Public procurement

By the middle of this year the Commission will put to the Council proposals for legislation on sectors excluded from the Community Directives on public procurement at present, including energy.

(iii) Harmonization of taxation

The differences in energy taxation in the Member States are perhaps the biggest obstacle standing in the way of an internal energy market. Energy is concerned both by the VAT aspect and by the moves to harmonize excise duty on oil products.

The general approach should be based on discussion of the Commission proposals already before the Council.

2. Determined enforcement of Community legislation

Enforcement of Community law, particularly the provisions on free movement of goods and services, monopolies, undertakings and State aid, in the energy sector is one of the keys to completing a more integrated energy market in reasonable time. The Commission will tackle this task determinedly without overlooking the need to strike a balance between its determination and objective measures to take account of the unique features of the energy sector.

3. Action to protect the environment

The central question is how the Community measures on energy and the environment can reconcile the need for a high level of protection with the possibility, for certain Member States, of adopting more stringent or less stringent measures than the Community average.

4. Specific energy policy measures

(i) **Costs, prices and tariffs**

In the second half of 1988 the Commission will be submitting to the Council a detailed comparative analysis of energy prices plus conclusions and proposals regarding price transparency. It also plans to examine price structures and costs in the Member States and to study the conditions applied to energy transfers.

(ii) **Infrastructure**

Fortunately, the Community is already well-endowed in this area. However, there is always room for improvement.

The Commission is keen to encourage integration of three of the main types of infrastructure: the reception facilities, storage installations and carriage/distribution grids. After making the appropriate contacts and completing the studies needed, it will report to the Council by the end of 1989 on all these aspects of energy infrastructure in the light of the plans to complete the internal market.

An annex to the communication describes in length all the outstanding obstacles facing each of the five main energy subsectors.

At the end of next year the Commission will be sending the Council an interim report on the progress made in each of the areas of activity which it has pinpointed.

[1] COM(88) 238 final.

Review of Member States' energy policies

The Community's energy objectives for 1995 — can they be achieved?

In its Resolution of 16 September 1986 (OJ C 241 of 25 September 1986) the Council adopted the Community's new energy policy objectives and asked the Commission to submit, approximately every two years and on its own responsibility, a detailed survey of the progress made and problems encountered in each Member State and in the Community as a whole in implementing the objectives and guidelines. The Commission submitted one such survey on 29 March. We only have space here to consider the most important conclusions, and readers requiring more detailed information should consult the 150-page report classified as Document COM(88) 174.

Community objectives to be achieved by 1995

When devising their own energy policies, Member States should be guided by the Community's general and specific objectives for 1995 and do all they can to ensure that these objectives are achieved.

For ease of comprehension of the analysis which follows, we summarize these specific objectives below:

Energy efficiency: The efficiency of final energy demand should be improved by at least 20%.

Oil: Oil consumption should be kept down to around 40% of energy consumption and net oil imports should be maintained at less than one-third of total energy consumption in the Community.

Gas: The share of natural gas in the Community's energy balance should be maintained.

Solid fuels: The share of solid fuels in energy consumption should be increased and the competitiveness of production capacities should be improved.

Electricity: The proportion of electricity generated from oil and gas should be reduced to less than 15%.

Renewable energy sources: The output from new and renewable energy sources should be substantially increased, thereby enabling them to make a significant contribution to the Community's total energy balance.

Trends from now until 1995

Energy trends from now until 1995 were analysed on the basis of the Commission's own internal projections and the Member States' forecasts. Consideration was given as far as possible to the effects of the fall in oil prices, the Chernobyl accident and a market characterized by world-wide surpluses. A summary of the results of the study for each sector is given below.

Energy efficiency: There is little likelihood that the efficiency of final energy demand will improve by as much as the 20% minimum objective.

Oil: The share of oil in total energy consumption should drop still further towards the 40% objective and it should be possible to maintain net oil imports at approximately one-third of Community energy consumption.

Gas: The share of gas in the Community energy balance should be maintained.

Solid fuels: There is a risk that the present trend of declining consumption will continue and that the objective for 1995 will not be attained.

Electricity: The proportion of electricity generated from oil and gas should be reduced to less than 15% whereas the proportion generated from solid fuels and nuclear energy could increase to 44% and 38% respectively.

Renewable energy sources: Renewable energy sources should account for 2% of the Community's total energy balance.

What energy policy measures need to be taken?

Developments in the energy sector between 1973 and 1986 and prospects for 1995 clearly show that in the past the Community has made considerable progress with restructuring and that some of its objectives, e.g. for gas and electricity, can be met, unless prevented by unforeseen circumstances. However, certain problem areas should be mentioned, and there is serious concern about the attainment of the Community objectives concerning energy efficiency and solid fuels. In these two sectors in particular, the Commission feels there is need for more action.

Energy efficiency

The objective of improving energy efficiency (the ratio between final energy consumption and GDP) by at least 20% by 1995 cannot be achieved unless new energy policy measures are taken at Community or national level.

The simple ways of saving energy have already been tried and the fact that energy prices are low at present has deprived the energy-saving process of some of its momentum. Between 1973 and 1986 energy efficiency improved by a remarkable 20%, although in the period from 1982 to 1986 the improvement was only a modest 2%.

Percentage improvement in energy efficiency

	D	F	I	NL	B	L	UK	IRL	DK	GR	P	E	EUR 12
1973/82	21.0	26	12.6	17.3	29.5	38.8	18.8	27.6	27.9	-1.9	NA	NA	20
1981/86	-0.3	0.1	6.1	-4.3	-2.1	9.4	5.3	-13	5.6	0.8	3.6	6.7	2.4

If this trend continues, the Community's energy consumption by 1995 would be some 70-110 Mtoe higher than stated in the energy objectives. At current oil prices this additional 70-110 Mtoe would cost only between 8 000 and 13 000 MECU but would make the Community much more vulnerable to supply bottlenecks and/or price rises.

Since rational use of energy is presumably one of the major areas where measures which are taken now will clearly affect the energy situation in 1995, the Commission is asking the Member States to take immediate steps to offset the current negative trends and hasten the energy-saving process.

Solid fuels

Consumption of solid fuels in the Community is now lower than between 1973 and 1982.

Proportion of gross energy consumption accounted for by solid fuels

	B	DK	D	GR	E	F	IRL	I	L	NL	P	UK	EUR 12
1973	23	12	31	18	17	16	20	7	54	4	15	35	23
1983	25	33	32	24	26	16	22	10	46	8	3	33	24
1986	19	37	29	33	25	10	31	10	42	9	10	32	22

It is quite possible that by 1995 these proportions will either have diminished or will have stayed the same. Apart from power stations, prospects for increasing the use of solid fuels are relatively limited. Even for power generation it is still extremely uncertain whether the use of solid fuels can be increased in such a way that the overall objective for 1995 can be achieved. For the base load, nuclear energy remains a strong competitor, and the need to use environmentally-acceptable technologies will increase the power production costs of thermal power stations. Attempts made in the past by the Community and the Member States to increase consumption have not always been very successful (except in periods where solid fuels enjoyed a considerable price advantage over other energy sources). In the current climate of low oil prices, these price advantages have largely disappeared.

Since the anticipated increase in the market share of solid fuels by 1995 is extremely uncertain, the Commission is asking the Member States to take immediate steps to increase the use of coal in all sectors. They should make a real effort to apply existing instruments, like the two recommendations on the encouragement of investment in the use of solid fuel in industry, in public buildings and in district heating systems (83/250/EEC and 83/251/EEC).

As far as the competitive position of Community coal on the world market is concerned, studies have shown that external factors like the world price of coal or currency exchange rates have a more marked effect on the economics of coal production than restructuring within the Community.

The other **energy sectors** have their own problems too but they are not nearly as serious.

Oil

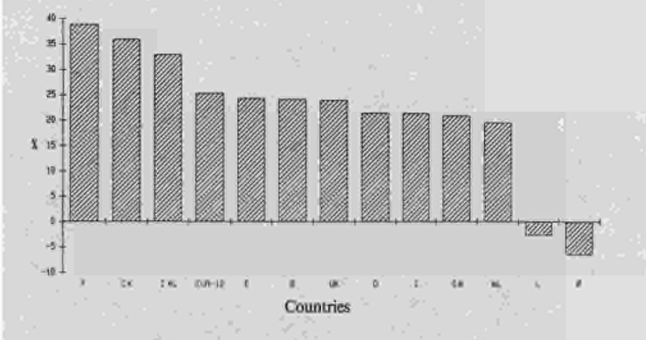
Because of the unstable market and the ever-present risk of supply difficulties, the current monitoring system should be continued. It is particularly important to follow developments in the transport sector, which accounts for 40% of inland consumption and is expected in the future to account for an increasing proportion of demand.

Electricity

No supply difficulties are expected before 1995, although, even before that date, some important investment decisions will have to be taken if we are to avoid long-term supply shortages. If the aim is not to increase the proportion of oil and gas used to generate power, then nuclear energy and solid fuels are the only energy sources which can meet the extra demand. Member States will therefore have to take clear decisions about the future role of nuclear energy.

Renewable energy sources
Competitiveness *vis-à-vis* conventional fuels has diminished with falling energy prices. The increase in the use of renewable energy sources will probably be less than was assumed in the past, unless specific measures are taken to promote the use of those renewable energy sources which are already economically viable.

There are vast differences between the views of the individual Member States as regards achievement of the Community's energy policy objectives. The specific possibilities and practical constraints of each Member State differ considerably. However, the Member States have been invited to apply the principle of Community solidarity and to make efforts of comparable intensity to achieve the 1995 energy objectives. The following tables and diagrams show the positions of the Member States. When studying the tables it should be remembered that the energy policy objectives for 1995 apply only to the Community and not to each individual Member State.



Oil as a percentage of total energy consumption
% improvement 1986/1973

Net oil imports as a percentage of total energy consumption [1]

	B	DK	D	GR	E	F	IRL	I	L	NL	P	UK	EUR 12
1973	63	91	54	89	75	72	79	80	37	55	76	50	62
1982	50	55	41	64	61	50	55	67	35	43	87	*	38
1986	48	39	43	65	51	41	55	60	38	41	82	*	33

* Net oil exporter.
[1] Imports from other Member States included.

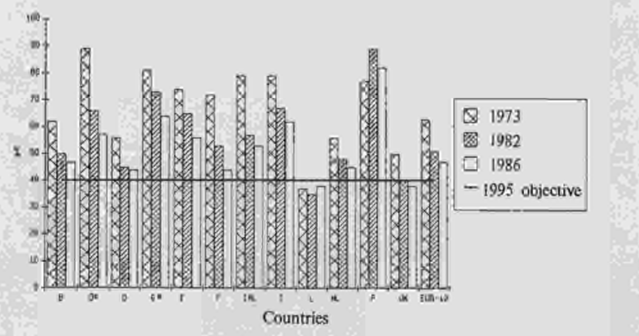
Trends

Oil as a percentage of total energy consumption

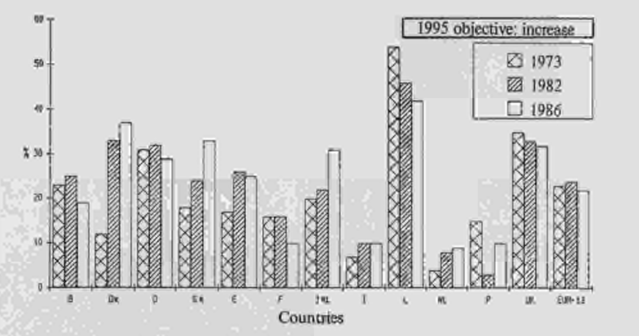
	B	DK	D	GR	E	F	IRL	I	L	NL	P	UK	EUR 12
1973	62	89	56	81	74	72	79	79	37	56	77	50	63
1982	50	66	56	73	65	53	57	67	35	48	89	40	51
1986	47	57	44	64	56	44	53	62	38	45	82	38	47

Natural gas as a percentage of total energy consumption

	B	DK	D	GR	E	F	IRL	I	L	NL	P	UK	EUR 12
1973	15	0	10	0	2	8	0	12	5	39	0	11	11
1982	16	0	15	0	3	12	20	18	9	42	0	21	16
1986	14	6	15	0	3	12	15	21	10	44	0	23	17

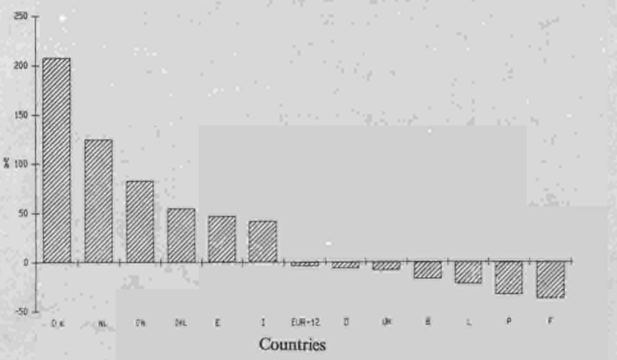


Oil as a percentage of total energy consumption

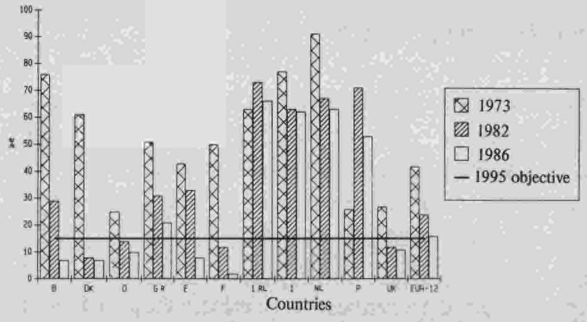


Solid fuels as a percentage of total energy consumption

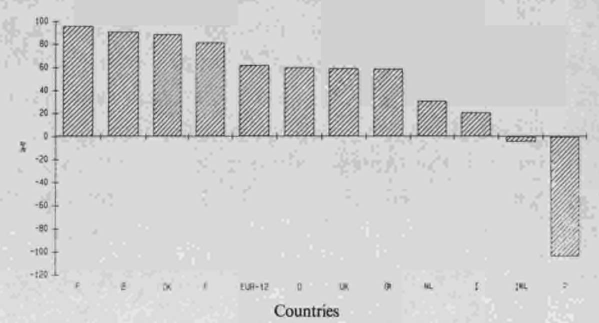
Solid fuels as a percentage of total energy consumption
% improvement 1986/1973



Percentage of electricity generated by oil and gas



Percentage of electricity generated by oil and gas
% improvement 1986/1973



Percentage of electricity generated by oil and gas

	B	DK	D	GR	E	F	IRL	I	L	NL	P	UK	EUR 12
1973	76	61	25	51	43	50	63	77	*	91	26	27	42
1982	29	8	14	31	33	12	73	63	*	67	71	12	24
1986	7	7	10	21	8	2	66	62	*	63	53	11	16

* L is an electricity importer.

Hydrocarbons Symposium

The third Hydrocarbons Symposium on new technologies for the exploration and exploitation of oil and gas resources, held in Luxembourg in March, conveyed the important message that to secure European primary energy sources new technologies are required and that to develop such technologies the Community's programme of support to 'hydrocarbon projects' is an important factor.

Opening session

Johny Lahure, Secretary of State, Ministry of the Economy, gave the welcoming address as the representative of the Government of the Grand Duchy of Luxembourg. He commented on the importance of the energy needs of the European Communities, emphasizing the hydrocarbons reserves and the required new technologies for exploration and exploitation.

The European Communities represent about 6.5% of the world's population and utilize about 15% of the world's energy consumption; the Community's energy dependence on non-member countries was at a level of 45% in 1987; the 'energy' factor is vital in promoting the development of the economic activities. These important features were underlined by Commissioner **Nic Mosar,** who went on to indicate and justify the Community's energy policy outlining the objectives which relate to the security of supply, interior energy market, and technological innovations. On the subject of security of supply, he stated that at the time of the petroleum crisis of 1979, the crude oil production of the Communities was around 87 million tons, which covered just 16% of the oil needs. In 1987, the European Communities' production reached 144 million tonnes, which represented 30% of the consumption.

Oil and gas together are now, and will still be at the end of the century, 60% of the total energy requirements of the European Communities. However, it should be noted that oil reserves in the Community are 1.6% of world total, and gas reserves 3.1%. The Middle East, having 55% of the world's proven recoverable reserves, controls, and will continue to be able to control, the petroleum market.

Previous Hydrocarbons Symposia (1979 and 1984), have clearly shown that although originally the technology for the exploration and exploitation of oil and gas resources was developed in the United States of America, the European industry has made significant progress in the last 15 years, with valuable contributions in new technologies, especially in offshore applications. European oil and oil-related industries have become competitive and have achieved, in many instances, major technological breakthroughs.

The Community played an important role in supporting the development of new technologies. This was outlined by **Constantinos Maniatopoulos,** the Director-General for Energy, who discussed the Community's involvement in energy R&D, the funding of the R&D activities, and the programmes of support for technological development in the hydrocarbons sector and for the demonstration and industrial pilot projects (energy conservation, new and renewable energy sources, etc.). Comparing these programmes to the Community's framework programme, which includes R&D for energy-related activities, he emphasized the fact that these two programmes are the only significant ones in the non-nuclear energy field in terms of funding, and unless they are renewed next year, the remaining funding devoted to non-nuclear energy R&D will be only a 2.3% of the total framework programme.

The achievements of the hydrocarbons programme were noted and the future challenges were reviewed. The message conveyed indicated that the programme of support for technological development in the hydrocarbons sector is the only programme directly related to applications and specifically to cost reductions and to safety and efficiency improvements which contribute to the ongoing work in exploration and exploitation of oil and gas resources.

Jean Meo, President of the *Institut français du pétrole,* also emphasized the important need for technological development in the hydrocarbons sector insisting that as oil consumption is more and more concentrating on non-substitutable uses, the only substitute for oil is oil. He also pointed to the importance of the Community's funding of technological development programmes and the small allocation of funds for non-nuclear R&D.

Today European petroleum production represents 8% of the world total and nearly 90% of that is from the North Sea, shared 72% by the United Kingdom, 24% by Norway and 4% by Denmark and the Netherlands. It is foreseen that in the year 2000 the offshore fields will represent 40 to 45% of the western world's production. Here is where European technology will continue to play a big role, and in the years to come we will be seeing technological know-how being transferred from Europe to other continents.

Mr Meo's main point was that the reduction of production costs is a principal factor in keeping the price of the barrel at a level compatible with the economic development of our industrialized nations while at the same time giving the oil producing nations a reasonable rate of return without them being in a position to create unbearable constraints on the world-wide economy. The objective, he stated, must be to reduce the production cost of this high risk new technology oil by USD 10 per barrel.

Both **Bonifacio Garcia-Sineriz,** Managing Director of Repsol Exploration, and **John D'Ancona,** Director-General of Offshore Supplies Office, agreed with Mr Meo that there is sufficient oil and gas in the world to fill the needs in the years to come. However, the three speakers underlined that the cost of production is at a level that will require us to develop methods and technologies to improve production and values, i.e. new more efficient ways for exploration and exploitation, and reduction of production costs, in order to meet the demands. The European technological development programmes are custom-built to achieve this objective by developing the appropriate required new technologies. Having gone through two major crises, the industry has been able to maintain the R&D activities in this field and will have to continue. The call must be for innovation to take it beyond what can currently be achieved. With the drop in oil prices the financial resources in Europe are limited, and in some cases non-existent, to finance fully fledged R&D programmes, and the need for national and Community support is evident.

Round Table discussion

The Conference devoted half-a-day to a Round Table panel discussion on the subject 'Community-supported R&D for long-term oil and gas supply: necessity or nonsense?'.

The Panel, chaired by **G. Adam,** Vice-President of the Committee for Energy, Research and Technology of the European Parliament, gave the opportunity for an open discussion and debate on such an important subject. Mr Adam was assisted by panelists involved in the industry with experience in the economic importance of hydrocarbons, namely **H. G. Delauze,** President of Comex, **G. Sfligiotti,** Executive Vice-President, AGIP, **H. E. Norton,** Managing Director and Chief Executive Officer, BP Exploration, **G. Siepmann,** Director, Ministry of the Economy, FR of Germany, **P. Vermehren,** Managing Director of I. Kruger and **R. De Bauw,** Director of Oil and Gas, Directorate-General for Energy.

The moment had arrived when one could look into the future and see that European oil and oil-related industry must depend on new techniques, new technologies that only science can develop. Therefore, the Community must resort to the systematic associations sought between the industrial and scientific media to overcome technological obstacles, develop new products and processes, and meet head-on the challenges of the new technological revolution in the hydrocarbons field. The order of magnitude of the cost of scientific research was often less important than that of R&D operation, but on the other hand, in most cases, the materialization delays were often significant. It was concluded that to be efficient and effective this systematic recourse to science and technology for studying and developing new oil and gas technologies should be carried out on a European scale rather than a national scale. Emphasis was made during the discussion for the Community to encourage joint ventures between European partners.

The need for collaboration, cooperation and team-work was strongly emphasized in this Conference. The only way to face the challenge of technological development to achieve the objective of industrial growth and security, is team-work. But team-work must be learned. Europe has all the scientific, technical and economic resources to do whatever has to be done. Europe has oil and oil-related companies with vast experience that have been involved in various phases of development and have the technological know-how required. The task is to put them together, and to work as a team, then the strength will be tremendous. It was made very clear in this Symposium that the Commission should assist in encouraging team-work by organizing workshops and conferences as an effective way of exchanging know-how and experience.

An important question was raised: why solicit Community support for technological development in the field of hydrocarbons? It only represents a drop in the ocean compared to investments made by oil companies. The answer was that the costs implied by scientific research or advanced R&D projects — thus excluding commercial development — are such that the budgetary intervention of the EEC is significant and often decisive. Decisive because during unfavourable periods, such as we experience now, industrial operators are often faced with the necessity of giving up in priority the results of a medium-long term policy; assistance from the Community would thus have a decisive compensating effect, and the future is thus preserved.

The fact that the primary responsibility for financing R&D activities lies with the oil companies and oil-related industries is well accepted, but the appropriated budgets for such developments are limited and the considerable risks become a very significant factor, which slows down technological development. The Community's programme of support shares in the risk of each financially supported project and encourages and motivates these industries to carry on with development. The identified need was for the Community's programme to be strengthened and be continuously adapted and trimmed to the actual and more long-term development in the field. The Community should strengthen the support to and further the implementation of the programme's intentions as to project cooperation among the Member States, and increase the weight on major integrating cooperation projects within the fields of activity given priority, especially where this means increased cooperation between researchers and the business community.

The discussions also indicated a need for more selective project support. Projects aimed at increasing the probability of finding new oil and gas reserves, projects aimed at reducing exploration and exploitation costs, projects destined to increase effectiveness and value in offshore operations — deep-sea operations — and automation that minimizes accident risk, are among those that would produce the highest return on investment for technological development.

The comments and discussions gave the clear answer to the subject question: **necessity**. In addition, it became evident that in terms of priorities the need for supporting cooperation and team-work is at the top of the list. The Community's programme of support should continue with certain modifications to be more adaptable to the requirements of the years ahead and to assist the European technological revolution in the field of hydrocarbons.

Technical sessions

The technical sessions of the Symposium, which covered one and a half days of extensive work, gave participants the opportunity to discuss in nine parallel meetings the 80 technical papers pertaining to projects supported by the Community.

Recent years have shown that *exploration* is searching for hydrocarbon accumulations in geologically more complex areas as well as in deeper waters and frontier areas. The exploration process must be optimized in order to achieve better cost effectiveness of the acquisition techniques required for development and production of present and future reserves.

Among the technical priorities for research and development, delegates pointed to data acquisition in seismics, especially in the marine environment, tools and techniques for better understanding of reservoir characteristics and integrated methods and interactive interpretations using all available results obtained for example by geochemistry and non-seismic methods.

Considering the important share of *drilling* in exploration costs, and the possible reduction of costs that could be achieved, this area must see a continuing research effort. Improving the rate of productive drilling and reducing time lost through reduction of tripping and better equipment handling should be the main technical trends for developments in this field.

Production systems, structures and sub-sea systems was an important session where delegates pointed out that reduced oil prices have badly affected the economic viability of the various projects thus enlightening the need for further research and development work with a view to reducing costs. The main technical trends in this field should aim at transferring recent development work into state-of-the-art technology and undertake truly innovative research and development.

Sub-sea production issues, with particular emphasis on multiphase fluid transportation and diverless equipment for application in deep waters and harsh environment, were discussed. Another important aspect was the extension of capacity and life of platforms through the possible use of new materials. Floating production systems was also an important topic which deserved attention because of the need to develop an increasing number of small and marginal fields.

The session about *production operations and equipment* showed that important progress was to be achieved for more efficient exploitation. Multiphase fluid transportation had been recognized as a major topic. Sub-sea production for deep waters and marginal fields exploitation was also a strategic research line with particular emphasis on sub-sea intervention through intelligent remote-operated vehicles, better design for flexible risers, treatment equipment and telemonitoring equipment adapted to great distances. Qualification and selection of components with a view to increased reliability and system optimization was also to be considered. Progress towards automation and optimization of topside facilities was required with the ultimate goal to develop unmanned platforms reducing investment and operating costs and increasing safety of the production operations.

Enhanced oil-recovery techniques contributing to a better reservoir rate of recovery still remained a field where technological development would be very valuable in the long term. Pilot testing of EOR processes which were expensive would continue to be subject to a very cautious approach but laboratory work should be encouraged to solve pending technical problems and improve the cost-effectiveness of the different methods. Improvement of reservoir coverage for the different methods, better characterization of the reservoirs, development of low cost and more efficient chemicals, will require coordinated efforts from several segments of the industry, including chemical producers.

Sub-sea operations techniques had emerged in the past years as a major feature which would be largely used in three main future markets: marginal fields exploitation in conventional water depths, inspection and maintenance of sub-sea equipment and structures and new development in deep waters. Advanced robotics and further development in human intervention, combined when necessary for better efficiency, will be the priority areas.

Pipeline networks are a major element of hydrocarbon production. Improved reliability and achieving low construction and operating costs are very important for the oil and gas transport. Design methodologies must be improved with special attention to flowlines in marginal fields where high temperatures are to be expected. Technological development should focus on intelligent pigs to investigate internal conditions of the pipes, more versatile repair systems, use of new materials, development of external tools for accurate survey of pipe characteristics. In addition, system management to keep information up-dated and advise for decisions about inspection maintenance and repair (IMR) activity should also be favoured.

Natural gas will continue to be an important source of energy for Europe in the future. Its use is narrowly dependent on transport (pipelines or LNG tankers) and storage and the main trend must be to optimize gas production, to increase flexibility and to enhance gas uses. Considering the various and different situations of the Member States regarding this question, the delegates participating in this session stressed the necessity for an investigation at European level about geological and geographical storage possibilities.

One session was devoted to a presentation of the Directorate-General for Research sub-programme 'Optimization of the production and utilization of hydrocarbons' of the Non-nuclear energy R&D programme. This programme, dealing with basic research, is part of the so-called 'Framework programme for R&D', and closely coordinated with the 'Hydrocarbons project' programme.

At this session the present and future programmes were outlined, the content and status of the research contracts actually in force was synthetically described in the fields of advanced geophysical methods, well behaviour and dynamics, conversion of natural gas and utilization of heavy oil fractions. The intermediate results reported, indicated that promising achievements will be obtained at the conclusion of the various projects.

Good participation was evident in all technical sessions with the greatest number of participants in the technical sessions on production systems and production equipment, which again indicates the interest and need for new technologies related to cost reduction and efficiency in production operations.

Conclusions

The technical sessions' conclusions, which were presented in the final plenary session, indicated satisfaction with the achievements of the projects under the Community's support programme, and established certain priorities for the years to come.

The Commission will keep in mind these priorities, as well as using them in the next call for offers, so that they will be complied with in the eventual continuation of the programme following its expiry at the end of 1989.

The Director for Hydrocarbons, Mr De Bauw, recalled in his adjournment address the principal points made during the first day of the Symposium. A double challenge was to be set. From the energy plan viewpoint there is a need to develop, with the help of new technologies, low-cost oil that will be indispensable for the security of supply. From the industrial viewpoint, there is a need to assure the survival of the European oil-related industries in a more competitive environment in which their technical capacities will only be able to blossom in the course of a reinforced intercompany cooperation.

Mr De Bauw also recalled the principal subjects discussed at the Round Table. The debates of this discussion provided the elements of extremely important thoughts for the preparation of the proposals related to the future of the programme, which the Commission must present to the Council before the end of 1988.

Following his announcement that the next Symposium will most likely take place in 1992, Mr De Bauw thanked the participants for their numerous suggestions on the subject and the content of the programme's scheme, and assured them that these will be examined with great attention.

This third Hydrocarbons Symposium had a larger number of participants than the previous ones. The general opinion of the participants was that it was a very successful conference which not only offered the opportunity to learn of the technical achievements from development efforts supported by the Community, but also allowed open and frank discussions on subjects of vital importance to the Europen industrial and economic future: how to get access to secure oil and gas resources in the most economic way, which priorities should be established in the Communities' programme, and how to achieve cooperation and team-work within the European Communities in such important efforts.

Robert De Bauw (Director: Hydrocarbons) addressing the Round Table

A demonstration of the Sesame data base for the Editor of *Energy in Europe*

Some of the many exhibits in the poster session

The opening plenary session, addressed by Mr Mosar, Commissioner with special responsibility for Energy, and Mr Maniatopoulos, Director-General of DG XVII

Hydra VIII

World first and world record

World records are not only established in sports but also in technological development. On the last day of February 1988, divers worked in open sea at a water depth of 520 m (a world record), breathing a gas mixture of hydrogen-helium-oxygen called Hydreliox (a world first).

Why establish a world record and a world first?

Offshore oil and gas production started off in shallow water (+/- 30 m) and reached depths of about 300 m in recent years. This called for underwater work to be carried out by divers. Pressure increases under water by about one atmosphere every 10 m. The pressure of the gas the diver breathes should be the same as the surrounding pressure at the depth the diver is located. Bringing the diver to the desired pressure (compression) and especially back to atmospheric pressure (decompression) must be done slowly and carefully. If not, the diver can be seriously injured or even killed.

With Contracts TH 15.85/86 and TH 15.108/87 of the European Community Hydrocarbon Support Scheme, the Community supported the cost of the selection of divers for the test, development of equipment and execution of the operational sea trials. (Regulation EEC No 3639/85: Financial support for technological development projects in the hydrocarbon sector (OJ L 350 of 27 December 1985)).

At the present time, industrial diving includes two main categories of sub-sea operations:

(i) **bounce diving** which, as the name implies, consists of a single dive to a certain depth following which the diver returns to the surface at atmospheric pressure, after a decompression schedule which is a function of the depth and dive time. Beyond a certain depth (about 70 m), returning to surface has to be done very slowly, and is thus time-consuming because of the decompression schedule;

(ii) **saturation diving** which consists of 'storing' the diver in pressurized chambers on board a surface vessel or platform for the duration of his task. Pressure and breathing gas in the chambers are the same as at the underwater working site. For transfer to the working site, a diving bell at the same pressure and with the same gas is used. The bell is clamped to the pressure chamber, divers are seated in the bell, which is then closed and declamped, put into the sea and lowered to the working depth. The bell remains connected to the surface support by means of an umbilical for gas and power supply. On their arrival, the divers open the exit door situated at the bottom of the bell. Thus external and internal pressure will equalize and no water will enter the bell. The divers swim out and start working. In most cases their gas is supplied by an umbilical connected to the bell. For safety reasons, two divers usually go outside the bell to work while a third remains inside for assistance in case of necessity. The bell has emergency supply of gas and power for 72 hours autonomy in case the connection with the surface support is interrupted.

Saturation diving has the big advantage that only one long decompression period is needed at the end of the task.

The divers' breathing gas is selected according to the type of dive:

(a) air, for bounce dives to a depth of 50 m;

(b) Nitrox, a binary mixture of nitrogen and oxygen for some saturation dives in shallow water;

(c) Heliox, a binary mixture of helium and oxygen for bounce and saturation dives beyond 50 m;

(d) Nitrogen Trimix, a trimix of helium, nitrogen and oxygen for certain experimental deep dives.

Air or Nitrox cannot be used beyond a certain depth because they contain a high percentage of nitrogen which is a powerful hallucinogene at high pressure. When breathing these mixtures, narcosis occurs at a depth of about 50 m, increases rapidly, becoming quite dangerous beyond 70 to 80 m, following a phase of euphoria for divers not accustomed to this type of diving.

Helium has thus replaced nitrogen as a vehicle for oxygen at depths below 50 m because no narcotic effects of helium have shown up at pressures of several tens of atmospheres.

The efficiency of the deep-sea diver is at present limited beyond a certain depth (around 300 m), by two important factors:

(i) the high-pressure nervous syndrome, or HPNS, which is related to the effect of hydrostatic pressure on the central nervous system. Increasing with depth, HPNS causes motoric disorders, which can seriously affect the diver's efficiency;

(ii) the density of the breathing mixture which increases proportionally to the pressure and makes breathing increasingly difficult for the diver, thus considerably diminishing his working capacity.

Nitrogen Trimixes have sometimes been used during experimental dives of 300 m or more, in order to reduce the effects of HPNS, as the narcotic power of nitrogen tends to counteract the development of HPNS. But in order for the counter-effect to work, the nitrogen content must be fairly high, increasing substantially the density of the breathing gas and thus producing a correspondingly negative effect on the breathing mechanism of the diver.

The new diving technique developed by Comex is based on the use of a vehicle gas which combines the following two advantages:

(a) HPNS counter-effect;
(b) low density.

This gas is hydrogen.

The narcotic power of hydrogen was demonstrated for the first time during the Hydra IV experimental dive carried out in November 1983 at the Comex Hyperbaric Research Centre in Marseilles. The narcotic power of hydrogen is roughly one-quarter that of nitrogen which should make it possible to use four times as much hydrogen for an equivalent narcotic effect. This would be most advantageous, because it would greatly reduce the density of the breathing mixture while at the same time diminishing HPNS to an acceptable level.

The counteraction of hydrogen on HPNS was clearly demonstrated during experimental dives of Hydra V and Hydra VI. No clinical signs of HPNS appeared. There was no evidence of tremor, dysmetria or febrility.

Hydrogen must be handled very carefully. If more than 4% is mixed with a gas containing oxygen, this mixture might become highly explosive. Experiments proved that if the oxygen content is less than 4.4%, the mixture is not inflammable, regardless of the hydrogen:helium ratio at pressures up to 75 atmospheres. Since, for biological reasons the oxygen content must be kept low in a breathing gas at high pressure, an oxygen content of 0.8% is adequate for a depth of 500 m. Thus, the mixture is not inflammable.

Hydra VII and Hydra VIII were the decisive tests for the new Hydreliox mixture.

On 22 February 1988, four divers from Comex and two from the French Navy entered into the pressure chambers on board the diving support vessel of Houlder Offshore 'Orelia'.

The vessel had been equipped for the use of Hydreliox which required stringent safety procedures and a sophisticated hydrogen leak detection system. After a four-day compression period, the divers were at a pressure of 50 atmospheres ready to start diving.

Between 28 February and 5 March, a total of 27 hours of classical offshore sub-sea work (maintenance, mechanical work, connection of pipelines and cables) was carried out at 520 m water depth during six dives by different divers. Thereafter, they were slowly decompressed over a period of 20 days to atmospheric pressure.

The growing offshore oil and gas prospection in water-depth ranges between 300 and 700 m (North Sea, Mexico, Brazil, etc.) will certainly need diving operations. Of course, robots have been developed and automated sub-sea systems will be used, but the availability of divers is often very helpful because they can assess the situation on site and react in accordance with their own experience and judgment.

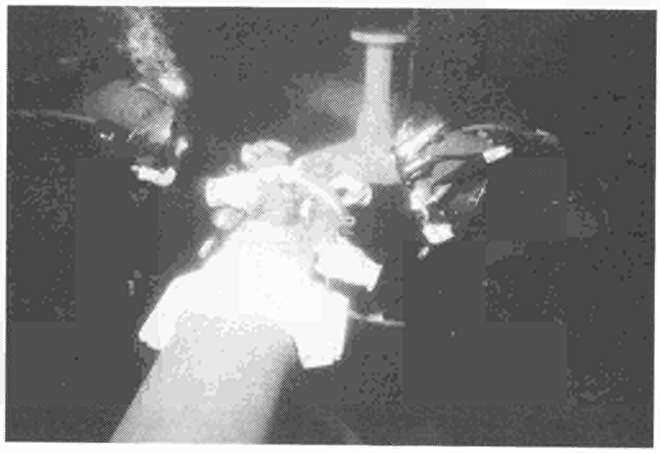
This was clearly demonstrated during the first dive of Hydra VIII. The sub-sea working site was surveyed by a remote-controlled robot, 'Sea Worker', equipped with three cameras and two manipulator arms. During sub-sea work on the night of 27 February, the Sea Worker got a line entangled in its propellor. Thus the first real work ever done by a diver at 520 m water depth was unwrapping the robot's propellor.

This is why we need world records and world firsts.

Further information on the Hydra project can be obtained from:

Comex SA
36, boulevard des Océans
F-13275 Marseille Cedex
Tel. 91 41 01 07
Telex 41 09 85 (For attention of: C. Gortan)

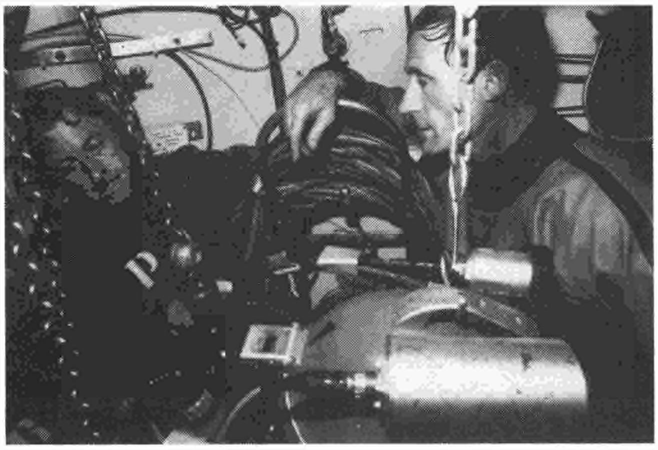
Diving control room aboard DSV 'Orelia'



Diving support vessel 'Orelia'

Decompression control room aboard DSV 'Orelia'

Divers working at 520 m water depth



Inside diving bell at 520 m water depth

Diver leaving the bell at 520 m water depth

Diver leaving the bell at 520 m water depth

The Community's oil supplies

Recent years have seen major changes in the Community's supplies of crude oil and petroleum products. This article reviews the main components, including the sources of supply and products concerned, and looks ahead to the prospects for the future.

1. Crude oil supplies

Pattern of supply

Before 1974 the Community imported almost all its crude oil, primarily from OPEC members. Today the pattern of supply is far more diversified, with the Community producing around one-third of its oil itself and importing the other two-thirds from a wide variety of sources (see Table 2).

In the process, crude oil production in the Community, with just 1.4% of the world's estimated oil reserves of 96 000 Mt, has grown steadily since 1974 when it stood at just 13 Mt or 2% of the Community's supplies. Boosted by the jump in oil prices from around USD 3 per barrel in 1973 to USD 34 in 1981, production in the Community peaked at around 149 Mt or 34% of the Community's needs in 1986. In 1987 crude oil production in the Community fell for the first time, to 145 Mt. The United Kingdom still extracts almost 85% (122 Mt) of the Community's output though all the other Member States, except Belgium, Ireland, Luxembourg and Portugal, also produce some oil, from as little as 1 Mt in Greece up to 5 Mt in Denmark. Most of the oil produced in the Community is refined in the Community too. Only a small proportion (no more than 20%) is exported, most of it to the US. The projections forecast a further fall in output until 1995, particularly in the United Kingdom, with output then levelling out at just above 100 Mt with today's oil prices.

Oil imports from non-Community countries fell steadily between 1974 and 1987, accompanied by a marked diversification of sources of supply. Total crude oil imports fell from 560 Mt in 1974 to 328 Mt in 1986 and 1987. Industrialized countries' (Norway's) share of supplies rose from 0 to 7% and the Soviet Union's from 1 to 6%, while the developing countries' share plummeted from 97 to 57%. OPEC provided no more than 45% of the Community's supplies in 1987 compared with around 94% in 1974. The Gulf Cooperation Council members bore the brunt as their share fell from 45% in 1974 to just 14% by 1987. Consequently, the Community's crude oil supplies are now far more diversified than they were 10 years or so ago, which is fully in line with the Community's security of supply objectives. The projections for oil consumption and production in the Community suggest a steady increase in imports, with the sources depending, as in the past, primarily on availability and price. The security of supply objective implies that the emphasis must be placed on prospecting for and extracting new resources in the Member States as well as on maintaining a satisfactory variety of sources of supply for imports from outside the Community.

Quality problems

As environmental regulations have been tightened up and the pattern of demand has changed, greater emphasis is being placed on the availability of light, low-sulphur crudes than in the past. The average API gravity of processed crudes — apart from the extra heavy fuel oil required because of the 1984 miners' strike in the United Kingdom — held relatively steady until 1985 when a shift towards lighter products started only, however, to lose momentum again in 1986 when Spain and Portugal joined the Community. At the same time the sulphur content of imported crudes fell steadily to, on average, 1.1% by 1985. Since 1986, however, it has risen slightly and now averages 1.36% (see Figures 1 and 2).

Most of the industry does not share the fears voiced by certain circles that lower oil prices in particular could restrict the supply of low-sulphur light crudes. In practice, the changes in the environmental regulations imposed on the refining industry, combined with the greater demand for light products in preference to heavy ones, should widen the price differential between the two and make it economic for the industry to invest in extra conversion capacity, giving a better return on refinery output. What is more, light crudes from Norway should keep the supply from the North Sea steady. Light crudes from Africa and the recent discoveries in North Yemen, Venezuela and the Soviet Union should also contribute to the Community's supplies. Consequently, provided the environmental protection measures are not excessive, this combination of more rigorous conversion processes and of refining light, low-sulphur crudes should provide the flexibility which the industry needs.

2. Supply of oil products

For years the Community has been pursuing a liberal policy on oil imports from non-Community countries.

To maintain this open approach in June 1985 the Community introduced a system for monitoring and exchanging information on imports to gain an idea of exporters' intentions. Since then the Community has kept in close contact with the countries concerned so that the two sides can compare oil supply-and-demand forecasts. In July 1985 the OECD/IEA adopted a similar but wider approach and monitoring system.

In this way the Community regularly assesses the impact of its current policy of giving new exporters an opportunity of establishing stable outlets on the Community market provided they in no way endanger the survival of a reasonable level of refining capacity to satisfy the legitimate concern for security of supply.

The situation today

Gross imports of petroleum products (including feedstocks) from non-Community countries totalled 108 Mt in 1987, some 6.5% or 6.6 Mt higher than in 1986 (see Table 1). Deducting the 32 Mt exported to non-Community countries (the same as in 1986), the Community imported a net 76 Mt, including feedstocks, almost 7 Mt more than in 1986.

Looking at the sources of supply, between 1986 and 1987 the State-trading countries' share grew fastest (by 13% or 4.6 Mt), followed by the industrialized countries' (by 7.5% or 1.5 Mt), and, finally, the developing countries' (up 1% or 0.5 Mt). The developing countries remained the leading source of supply in 1987 on 42%. However, the State-trading countries' share has grown to 38%, the highest in recent years. The industrialized countries' share of supply is holding steady at around 20%.

Analysing the changes in oil imports by **customs treatment**, imports at zero duty were slightly down on 1986 at 61%. Within this category imports for specific processing or chemical conversion continued to take a large share on 48 Mt, almost half the total, though slightly down on 1986. Imports covered by the Generalized System of Preferences (GSP) took their share of all imports up to 21%. Consequently, only around 18% of oil imports into the Community in 1987 were liable to the normal Common Customs Tariff (CCT) duties. This proportion has held relatively steady over the last few years.

The **breakdown** of imports by product category for 1987 shows, as was traditionally the case before the introduction of the 'netback deals' in 1986, a revival in heavy oils (gas oil and fuel oil) which again take over two-thirds (68%) of the total or 73 Mt. Much of this increase in imports of heavy oils and, in particular, fuel oil (up 4.3 Mt) can be attributed to greater consumption at power stations, especially in Italy. Light oils' share fell a little to 20%, while that of other products (LPG and petroleum coke) held relatively steady.

Intra-Community trade in oil products in 1987 was around 9% down on 1986, with a total volume of 86 Mt. The 1987 figures for trade in oil products between the Member States confirm the Netherlands (31 Mt), the United Kingdom (5 Mt) and Spain (5 Mt) as the leading net exporters and Germany as by far the top importer (on 29 Mt). However, after adding trade with non-Community countries only the Netherlands (on 20 Mt) and Spain (3.3 Mt) remain net exporters of oil products (see Tables 3 and 4).

The provisional figures show that the Community **as a whole imported a net 27 Mt of finished oil products, excluding feedstocks,** (total imports minus total exports) or around 6% of its total consumption. This is comparable to the volume recorded for the Ten in 1985 but far higher than the 1986 figure (see Table 5).

Import projections

There is nothing to suggest any significant increase in oil imports from non-Community countries over the next few years. There are several reasons for reaching this conclusion.

First, the moves to **liberalize international trade** in oil products are continuing and being stepped up, particularly in Japan, which sharply increased its imports of all product categories in 1986 and then again in 1987. According to the OECD data, net imports now cover 24% of consumption in Japan, 8% in the Community and 3% in the US. While certain circles in the US are still calling for the introduction of an import fee, care will have to be taken during the bilateral and multilateral moves within the IEA/OECD and GATT to avoid decisions dictated essentially by budget considerations but detrimental to international trade in oil.

Second, there are signs of a stabilization in imports from the crude-oil producing regions which brought into service new refining capacity geared to the export market, particularly the countries in the Gulf Cooperation Council. No further major increase is expected. Indeed, remembering the capacity scheduled to come on stream in the near future and the expected increase in consumption in the countries concerned themselves and their neighbours, the **surplus of exportable oil products** should **start to fall** steadily in the early 1990s, particularly amongst the OAPEC (Organization of Arab Petroleum Exporting Countries) members.

Finally, if the trend observed over the last few years for the producing countries to invest in the downstream branches of the oil industry in the Community were to continue, the countries concerned would probably concentrate on **exporting crude oil,** rather than refined products, to the Community market.

In conclusion, today the Community's oil supplies are widely diversified in keeping with the Community's energy objectives (see Table 6). Nevertheless every effort must be made to continue to develop the Community's indigenous oil resources and to take precautions against the damage which excessive deterioration of its balance of foreign trade in oil could wreak on the refining industry. The next issue of *Energy in Europe* will discuss this aspect in greater depth.

Table 1
Petroleum products — EUR 12:
Imports from third countries to the EC

'000 tonnes

	1986	1987*	Variations 1987/86 '000 t	Variations 1987/86 %
All products/all uses, of which:	101 554	108 154	+ 6 600	+ 6.5
— light oils	21 055	21 312	+ 257	+ 1.2
— medium oils	961	1 117	+ 156	+ 16.2
— gas oil	29 212	30 449	+ 1 237	+ 4.2
— fuel oils	38 414	42 784	+ 4 370	+ 11.4
— other products	11 912	12 492	+ 580	+ 4.9
All products/all uses, of which:	101 554	108 154	+ 6 600	+ 6.5
— specific treatment or chemical conversion	48 107	48 376	+ 269	+ 0.6
— other uses (for consumption)	53 447	59 778	+ 6 331	+ 11.8
All products/all uses from:	101 554	108 154	+ 6 600	+ 6.5
— Industrialized third countries, of which:	20 547	22 098	+ 1 551	+ 7.5
EFTA	8 089	10 693	+ 2 604	+ 32.2
USA	9 810	8 493	— 1 317	— 13.4
— Developing countries, of which:	44 770	45 256	+ 486	+ 1.1
Kuwait	9 686	9 500	— 186	— 1.9
Libya	7 439	7 738	+ 299	+ 4.0
Algeria	7 392	7 431	+ 39	+ 0.5
Saudi Arabia	5 737	6 727	+ 990	+ 17.3
Venezuela	2 566	1 608	— 958	— 37.3
OPEC	37 413	38 244	+ 831	+ 2.2
OAPEC (Egypt included)	37 994	40 440	+ 2 446	+ 6.4
GCC	16 520	16 964	+ 444	+ 2.7
— State-trading countries, of which:	36 237	40 800	+ 4 563	+ 12.6
USSR	27 704	30 976	+ 3 272	+ 11.8
Romania	5 358	6 701	+ 1 343	+ 25.1

Source: External trade statistics of the Community (customs declarations: Nimexe system).
Feedstocks included.
* Estimated data for Greece for the last quarter of 1987.

Table 2
Community's oil supplies:
Changes in the pattern of crude oil supplies [1]
(Between 1974 and 1987)

	EUR 9				EUR 10				EUR 12			
	1974		1978		1982		1985		1986		1987[2]	
	Mt	%	Mt	%	Mt	%	Mt	%	Mt	%	Mt	%
1. Community production (crude + LNG)	13	2	64	12	117	30	146	39	149	34	145	33
2. Imports into the Community[3] from non-Community countries, of which:	560	98	470	90	302	77	253	68	328	74	328	74
A. Industrialized countries, of which:	1	0	8	2	10	3	21	6	25	6	30	7
Norway	1	0	8	2	10	3	21	6	25	6	30	7
B. Developing countries, of which:	555	97	447	86	271	69	196	53	264	59	252	57
Algeria	23	4	19	4	16	4	14	4	16	4	16	4
Saudi Arabia	169	29	121	23	98	25	23	6	66	15	37	8
Egypt	1	0	9	2	9	2	11	3	10	2	12	3
United Arab Emirates	31	5	30	6	14	4	4	1	4	1	9	2
Iraq	39	7	56	11	11	3	16	4	24	5	28	6
Iran	100	17	77	15	28	7	20	5	21	5	29	7
Kuwait	47	8	35	7	3	1	7	2	10	2	13	3
Libya	56	10	36	7	32	8	31	8	35	8	33	7
Mexico	0	0	0	0	9	2	9	2	13	3	21	5
Nigeria	49	9	34	7	23	6	34	9	32	7	22	5
Venezuela	9	2	4	1	7	2	9	2	9	2	8	2
C. State-trading countries of which:	4	1	15	3	20	5	20	5	23	5	26	6
Soviet Union	4	1	15	3	20	5	20	5	23	5	26	6
OPEC	541	94	424	81	238	61	164	44	224	50	201	45
OAPEC (incl. Egypt)	384	67	322	62	191	49	113	30	173	39	157	36
GCC	265	46	197	38	122	31	36	10	83	19	62	14
3. Exports to third countries from the EEC	0	0	12	2	29	7	26	7	33	7	31	7
4. Crude oil supplies to the Community market (1+2—3=4)	573	100	522	100	390	100	373	100	444	100	442	100

[1] Excluding feedstocks and stock variations.
[2] Estimated figures for Greece for the last quarter of 1987.
[3] Totals A, B and C plus imports of unspecified origin.
Sources: Imports/exports: Nimexe.
Production: Eurostat.

Figure 1
Average API values
of crude oil supplies in the EEC 1981-87

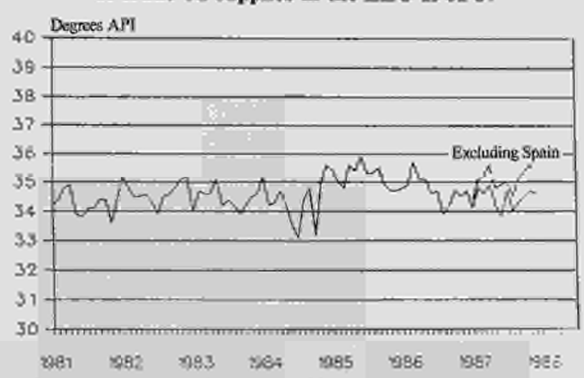


Table 3
Net balance of intra-Community trade and trade with third countries in all oil products — EUR 10/EUR 12
Trend from 1981 to 1987

'000 tonnes
(figures between parentheses = exports)

	1981 EUR 10		1982 EUR 10		1983 EUR 10		1984 EUR 10		1985 EUR 10		1986 EUR 12		1987 EUR12	
	Balance intra-EC	Balance extra-EC	Balance intra-EC	Balance extra-EC	Balance intra-EC	Balance extra-EC	Balance intra-EC	Balance extra-EC	Balance intra-EC	Balance extra-EC	Balance intra-EC	Balance extra-EC	Balance intra-EC	Balance extra-EC
France	(3.6)	6.3	(0.0)	10.5	1.7	9.9	1.6	7.2	0.3	9.7	3.7	11.0	6.6	14.1
Belgium/ Luxembourg	(3.3)	0.7	(1.2)	2.0	(0.4)	2.7	(0.1)	3.4	0.8	3.9	0.8	2.6	0.6	0.2
Netherlands	(16.7)	7.1	(21.7)	9.9	(24.0)	9.0	(28.6)	8.7	(29.0)	12.8	(32.0)	11.6	(31.0)	11.0
FR of Germany	17.4	8.1	17.1	10.1	20.7	12.3	21.3	12.0	24.9	13.3	31.1	13.5	29.2	12.6
Italy	(0.3)	8.6	(2.0)	10.0	(0.5)	16.1	(1.3)	20.5	(1.6)	22.6	(4.5)	18.3	(2.4)	24.4
United Kingdom	(2.3)	2.6	(2.6)	4.6	(3.5)	5.7	0.7	11.5	(2.4)	9.7	(3.4)	8.1	(4.9)	8.9
Ireland	4.1	0.2	3.8	0.2	2.8	0.2	2.8	0.3	2.6	0.2	3.6	0.4	2.9	0.2
Denmark	3.1	2.4	2.7	3.6	1.2	3.1	(0.0)	3.6	0.3	3.6	0.2	3.2	(0.2)	3.3
Greece	(0.2)	(0.6)	(0.4)	(1.0)	(0.2)	(0.6)	(0.5)	(0.4)	(0.7)	(0.1)	(0.2)	(0.4)	(0.7)°	(0.4)°
Spain											(6.8)	0.4	(4.7)	1.4
Portugal											1.2	0.3	1.4	0.2
EUR 10/EUR 12														
- feedstocks incl. (1)	(1.9)*	35.5	(4.3)*	49.9	(2.2)*	58.4	(4.0)*	66.9	(4.6)*	75.5	(6.3)*	68.9	(3.2)*	75.9
- feedstocks excl. (2)	n.a.**	7.0	n.a.**	21.3	n.a.**	15.5	n.a.**	29.2	n.a.**	29.6	n.a.**	18.9	n.a.**	27.0

Sources: (1) External trade statistics of the Community and trade between Member States (customs declarations: Nimexe system) — Feedstocks included.
(2) National data (data bank: Cronos of Eurostat) — Feedstocks excluded.
* Statistical error: Difference between the import and export returns at intra-Community level.
** n.a.: not available
Note: EUR 10/EUR 12 data may not correspond to the sum of the Member States' figures due to roundings (data given in tonnes in Nimexe).
° Estimated data for Greece for the last quarter of 1987.

Table 4
Exports of petroleum products by product category and by main country of destination — EUR 12
(1986-87*)

'000 tonnes

Main third country of destination in 1987 (by decreasing order of magnitude) Total > 600000 t	Light oils		Medium oils		Gas oil		Fuel oils		Other products		Total All petroleum products		
	1986	1987*	1986	1987*	1986	1987*	1986	1987*	1986	1987*	1986	1987*	Variation 87/86 %
USA	4 326	4 548	743	747	551	615	3 185	5 046	943	532	9 748	11 488	+ 17.8
Switzerland	2 221	2 162	619	665	2 771	1 858	242	153	335	313	6 188	5 151	— 16.8
Sweden	1 409	884	187	223	980	778	1 191	703	423	405	4 190	2 993	— 28.6
Austria	408	402	14	23	120	133	428	334	362	360	1 333	1 252	— 6.1
Norway	350	220	112	107	177	218	77	32	363	280	1 079	857	— 20.6
Libya	447	479	4	57	125	0	198	139	70	133	844	808	— 4.3
Tunisia	2	180	49	53	196	181	594	245	87	87	927	746	— 19.5
Algeria	3	3	0	0	0	0	430	472	189	178	621	653	+ 5.2
Iran	47	55	436	204	276	273	—	0	56	90	814	622	— 23.6
Other destinations	1 141	1 206	1 226	1 316	1 044	1 131	1 789	2 215	1 700	1 905	6 902	7 773	+ 12.6
Total extra-EC	10 354	10 139	3 390	3 395	6 240	5 187	8 134	9 339	4 528	4 283	32 646	32 343	— 0.9
of which:													
Industrialized third countries	9 345	8 846	2 174	2 211	4 964	3 970	5 759	7 008	2 752	2 292	24 995	24 327	— 2.7
Developing countries	984	1 291	1 167	1 173	1 270	1 213	2 071	2 115	1 590	1 807	7 083	7 599	+ 7.3
State-trading countries	24	2	49	11	6	4	304	216	186	184	568	417	— 26.6
OPEC countries	691	707	678	421	496	432	758	640	527	643	3 151	2 483	— 9.8
OAPEC countries	467	665	173	111	426	183	1 353	858	555	666	2 974	2 843	— 16.5
GCC countries	5	16	63	0	65	2	144	0	81	120	358	138	— 61.5
Total intra-EC	21 858	21 057	5 123	5 516	30 962	26 261	27 401	24 215	8 456	8 595	93 799	85 644	— 8.7

* Estimated data for Greece for the last quarter of 1987.
Source: External trade statistics of the Community (customs declarations: Nimexe system).

Table 5
Overall pattern of external trade in finished petroleum products — EUR 10/EUR 12

Mt

	EUR 10					EUR 12		
	1981	1982	1983	1984	1985	1986	1987 First estimates	Variations 1987/1986 in %
Total imports of finished products *	122.5	138.7	136.0	145.8	145.3	163.3	164	+ 0.4
Total exports of finished products *	115.5	117.4	120.5	116.6	115.7	144.4	137	— 5
Net imports (exports) of finished products	7.0	21.3	15.5	29.2	29.6	18.9	27	+ 43

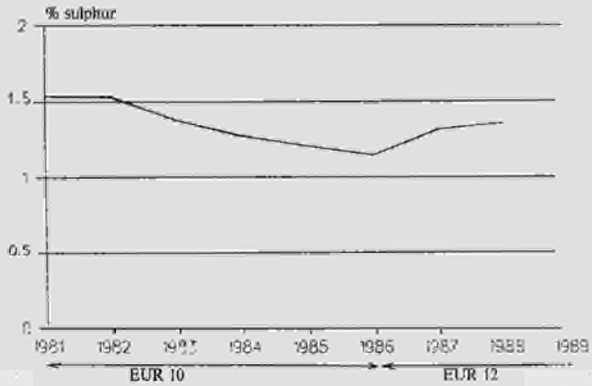
Source: Cronos (national statistics) — Feedstocks excluded.
* Intra-Community trade included.

Table 6
Imports of crude oil and petroleum products from third countries to the EC (EUR 12) (Changes between 1986 and 1987 by economic bloc)

Third countries	1986				1987[1] (estimates)			
	Crude oil (excluding feedstocks)		Petroleum products (including feedstocks)		Crude oil (excluding feedstocks)		Petroleum products (including feedstocks)	
	Mt	%	Mt	%	Mt	%	Mt	%
A. Industrialized countries	25	8	21	21	30	9	22	20
Norway	25	8	2	2	30	9	3	3
USA	—	—	10	10	—	—	8	7
B. Developing countries	264	80	45	44	252	77	45	42
OPEC	224	68	37	36	201	61	38	35
OAPEC	173	53	38	37	157	48	40	37
GCC	83	25	17	17	62	19	17	16
C. State-trading countries	23	7	36	35	26	8	41	38
Soviet Union	23	7	28	27	26	8	31	29
Total for all non-Community countries	328	100	102	100	328	100	108	100

[1] Totals A, B and C plus imports of unspecified origin.
Source: External trade statistics of the Community (Nimexe system).

Figure 2
Average sulphur content of crude oil supplies in the EEC 1981-87



Source: Crude-oil Register of the Commission.

Denmark

Economic profile

Denmark has a surface area of 43 100 km^2 and its population in 1987 was 5.1 million. Its population density of 119 inhabitants/km^2 is lower than the Community average (143/km^2).

The working civilian population in 1986 amounted to 2.9 million, while unemployment in the same year stood at 7.5%.

Gross domestic product (GDP) at current prices will probably amount to almost 700 000 million DKR in 1987, or 88 000 MECU. Denmark is the richest Community country, but according to national accounting data based on purchasing power parities, its GDP per capita is considerably lower than Luxembourg's and just behind that of Germany.

The transition to a services-based economy is also well advanced in Denmark, the share of services at 67.5% of GDP in 1985 being the highest in the Community and among the highest of all the Western industrialized countries.

While GDP increased by 2.0% per annum between 1972 and 1982, the growth rate until 1986 was much higher at 3.1% per annum on average. However, 1987 witnessed a stagnation of growth.

For many years, the Danish economy has been characterized by a current account deficit. The situation worsened considerably after 1973 owing to the impact of two successive oil price crises. This put a serious strain on the trade balance in energy products, which passed from a deficit of 560 MECU in 1973 to a peak of 3 500 MECU in 1982, falling back to 2 900 MECU in 1985. The position improved substantially in 1986 (1 400 MECU) and again in 1987 (1 100 MECU) as a result of the exploitation of Danish oil and gas resources in the North Sea and price trends in the international oil market.

Another feature of the Danish economy is high short-term and long-term interest rates. This explains in part why Denmark, unlike Germany and the Benelux countries for example, borrows considerable amounts of Community funds from the EIB (own resources and NCI), mainly to finance energy projects.

Loans to Denmark's energy sector in 1987 amounted to 283 MECU, which is almost 4% of the total provided by the EIB and NCI for that year. Since Denmark's energy plan was introduced in 1976, the EIB has provided loans of 1 700 MECU or 14 000 million DKR for investments in energy projects in that country.

Successful energy policy

Following the 1973/74 oil crisis, the Danish authorities reacted swiftly and decisively to reduce the country's almost total dependence on external energy supplies in general and its reliance on imports for almost 90% of its oil supplies.

Denmark's energy self-sufficiency and diversification of supplies have improved dramatically as a result of converting power stations to coal and installing district heating and cogeneration systems, all of which was accomplished within a very short time-scale and without recourse to public funds, and with the added bonus of Denmark's new oil and gas resources. By 1986, the share of gross domestic consumption covered by imported energy and oil had fallen to 74.5% and 39% respectively.

A second significant factor in Denmark has been the spectacular progress made in energy efficiency in all sectors.

Denmark has outstripped all the Member States except Luxembourg in this field during the whole of the period 1973-86, and it is steadfastly continuing to pursue this policy.

Following the approval of the first official energy plan in 1976, the Government and Parliament adopted an updated version towards the end of 1981. Since then, the reports, Parliamentary debates and Government decisions, often with the active support of the opposition parties, have put the finishing touches to an energy policy the principles of which are clear and consistent with Community objectives.

The broad lines of this policy are:

(i) an energy conservation programme setting out standards for the private and commercial sectors, backed by financial incentives and heavy taxation of oil products and of electricity for consumption in the home;

(ii) the development of a national heating plan, which came into force on 1 September 1979 and was adapted in March 1985 to take account of the changed conditions in the internal energy market; this plan entails in particular an increasing shift to collective heating systems and the development of combined heat and power generation;

(iii) the development of Denmark's oil and gas resources;

(iv) increased emphasis on the use of new and renewable energy sources.

On 29 March 1985, Parliament made a clear decision to exclude nuclear energy as an option in Denmark's energy planning.

The trend in gross energy consumption since 1973 is shown in the following table, which illustrates the decline in overall demand and the changes in the supply structure in Denmark:

	1973		1982		1986	
	Mtoe	%	Mtoe	%	Mtoe	%
Solid fuels (including wood and straw)	2.3	11.4	5.8	33.8	7.2	37.5
Oil	17.9	88.6	11.4	65.6	10.9	56.7
Natural gas	—	—	—	—	1.1	5.7
Primary electricity (imported, wind energy, other)			0.2	1.1	. .	0.1
Total	20.2	100.0	17.4	100.1	19.2	100.0

A profound structural change in Denmark's energy economy towards greater diversification is evident: reduced dependence on oil, a greater role for coal and the introduction of natural gas. Domestic oil and gas production has greatly reduced the need for imports.

Domestic energy resources

As we have seen, dependence on imported energy began to diminish immediately after the first oil crisis owing to domestic oil production. In 1984, natural gas also began to come on stream from Denmark's North Sea drilling operations. Denmark is now in a very fortunate position regarding oil and gas production. With a total of 4.6 million tonnes of oil and 2 500 million m^3 of gas produced in 1987, Denmark will have been able to cover almost 70% of internal oil and gas consumption and about 40% of total energy consumption in that year.

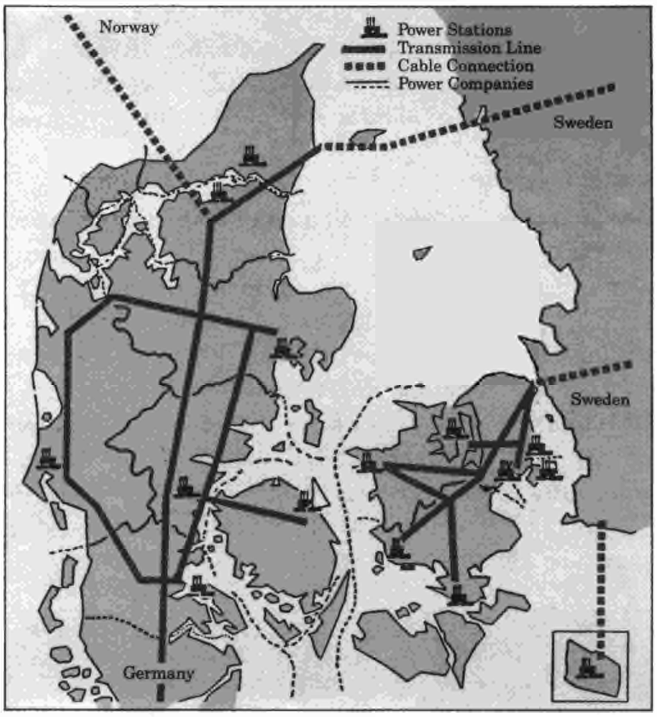
According to the Danish Energy Agency, reserves of oil and natural gas currently stand at 120 million m^3 and 125 000 million m^3 respectively, which will permit production at a steady pace for a number of years, i.e. 6 million tonnes of oil per annum until the year 2000 and 3 000 million m^3 of natural gas annually for another 40 years.[1]

The second key to the exploitation of domestic energy resources is the development of renewable energy sources. This will be based on the decisions to incorporate into the electricity network an additional 100 MW in wind generating capacity between 1986 and 1990 and 450 MW from small, decentralized CHP units burning indigenous fuels by 1995. As a result of this policy, the contribution of new and renewable energy sources (wind energy, wood, straw, municipal waste, industrial waste heat) to covering overall demand, which was almost 4% in 1986, should be significantly boosted.

Masnedo Five 750 kW wind generators

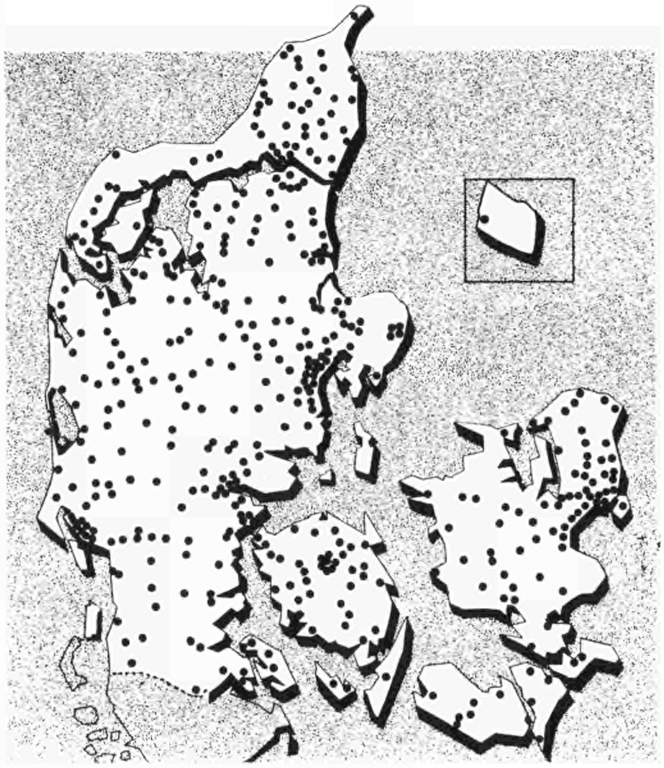
Electricity and heat

The electricity industry in Denmark is highly decentralized with 12 companies engaged in generation and about 120 in distribution. These companies are organized in two associations: Elsam for the west of the country and Elkraft for the east. These two associations are also members of DEF,[2] which represents all operators in the sector in Denmark except the private generators. The Government has nevertheless managed to keep control of this situation and the plan guidelines regarding the type of fuel used in thermal power stations have been followed, while at the same time a rapid expansion of demand has been accommodated. The conversion to coal was quickly accomplished: from 39% in 1973, the share of coal increased to 65% in 1979, and by 1986 it covered 95% of the primary energy requirements of electricity generation plants (approximately 7 Mtoe).



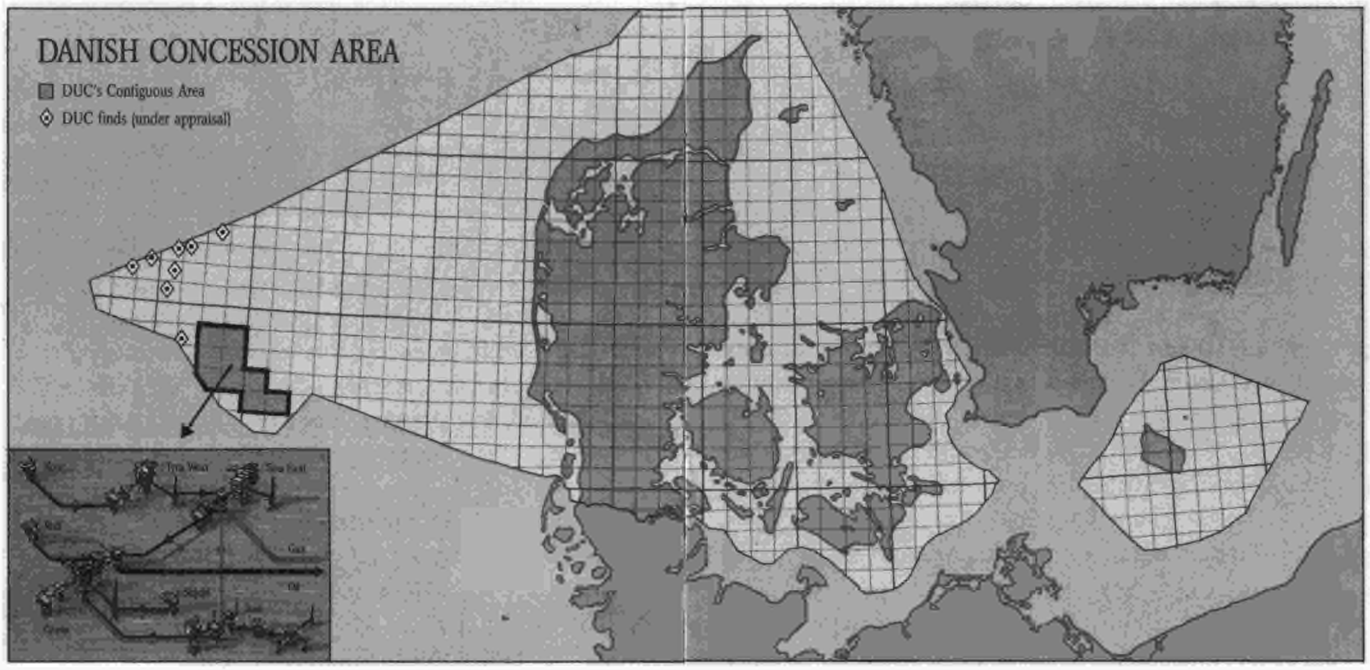
Danish electricity supply system

The electricity companies are also involved in feeding the district heating networks, which are very widespread in Denmark. District heating now covers about 40% of heating and hot water requirements, half of which is supplied from the heat produced in combined heat and power facilities. It is planned to increase the share of heat produced in CHP installations to 45% of demand in the year 2000, compared with an 11% share for the district heating plants.



The Danish district heating systems

Net heat consumption to the year 2000 is expected to remain stable at around 160 PJ (petajoules) or 3.8 Mtoe.



The role of district heating in Denmark, which has a long tradition dating back to the beginning of the century, making it the first country in the Western world to use this energy vector, merits a few supplementary remarks.

About 330 companies are engaged in district heating and combined heat and power generation and in downstream distribution. These companies, about 50 of which are public and belong to the municipalities, and about 275 of which are private, or, to be more precise, are owned by consumers' associations, operate 350 transport networks throughout the whole of the country, constituting a finely branched energy supply network that is unique in the world.

The oil industry

The picture of Denmark's energy operators would not be complete without a brief description of the oil companies, which will have an important role to play for several decades in securing the country's energy supplies as well, perhaps, as those of other parts of the Community.

The private company DUC (Dansk Undergrunds Consortium), set up in 1962, 46% of whose shares are currently held by Shell, 39% by A. P. Moeller, a Danish interest, and 15% by Texaco, was the first *concessionnaire* for prospecting work in the North Sea. This company, which has ceased its prospecting activities, is currently the only oil and gas producer on the Danish continental shelf, with five fields: *Dan* (oil and gas), *Gorm* (oil and gas), *Skjold* (oil), *Rolf* (oil) and *Tyra* (gas and condensate). A sixth field, *Roar* (oil and gas), will come on stream in the next few years.

Under a contract signed in 1979, DUC has to deliver the natural gas from its four fields to the public company DONG (Dansk Olie og Naturgas A/S), founded in 1972. To be more precise, the deliveries go to Dangas (Dansk Naturgas A/S), one of the four subsidiaries making up the parent company, DONG. This company owns and operates the primary natural gas transmission system and sells the natural gas direct to distribution companies in Denmark, Sweden and the Federal Republic of Germany. Dangas shares responsibility for sales to large natural gas consumers with the five regional companies owned by the municipalities, but it can make direct sales to certain major customers such as the city of Copenhagen and the power stations. Dopas (Dansk Olie og Gasproduction A/S) represents the interests of the State in oil and gas exploration and production. It participates, generally with foreign companies, in all the consortia which obtained concessions in the first (1984) and second (1986) licensing rounds. Dopas also has a 50% holding in Danop (Dansk Operatìrselskab I/S), the other half of which is held by Denerco (Dansk Energie Consortium K/S), all the shares of which in turn are in the hands of over a dozen private Danish companies. Doras (Dansk Olieror A/S) is a DONG subsidiary which is responsible for the transfer onshore of crude oil from the North Sea. The fourth subsidiary is Dofas (Dansk Olieforsying A/S), which administers the State's share of the oil produced by DUC in the Danish sector of the North Sea. This share comprises the royalty crude and any quantities resulting from the exercise of the State's purchase option from DUC. Dofas is also responsible for marketing the oil products refined from this crude in Denmark.

Energy and the environment

The impact of energy on the environment and the possible remedial measures constitutes an increasingly important element of Danish energy policy. The action already taken can be illustrated by a few examples.

In May 1984 a law was adopted with the objective of reducing SO^2 emissions from power stations to 125 000 tonnes by 1995, a cut of 40% compared with 1980. A firm schedule for installing desulphurization equipment in the various power stations for the period until 1992 has been adopted. In 1985, the electricity generating companies began a major research effort on NO_X emissions with the support of the Energy Ministry.

The Government has introduced a system of tax incentives to promote the use of unleaded petrol.

In a different sector, the ban on straw-burning in the open will facilitate its use in energy generating plant, in particular as a fuel for district heating systems.

Long- and medium-term outlook for energy demand

Gross domestic consumption of energy in Denmark is likely to increase by an average of 1.7% per annum between 1986 and 1990, when it will have reached 20.5 Mtoe. It will then remain steady until 1995.

There will, however, be slight differences between the two periods in how this demand is covered, with the share of natural gas and solid fuels increasing, while the share of oil will continue to diminish.

The structure of demand by product in 1990 and 1995 will be as follows:

	1990		1995	
	Mtoe	%	Mtoe	%
Solid fuels (including wood, straw)	9.0	44.7	9.3	46.3
Oil	9.6	45.8	8.9	42.3
Natural gas	1.8	9.0	2.1	10.4
Primary electricity	0.1	0.5	0.2	1.0
Total	20.5	100.0	20.5	100.0

Studies still in progress at the Commission indicate that GDP in Denmark will increase at a substantially faster rate than the Community average until the year 2010.

This favourable prediction results from the combination of a recovery in investment and a relatively moderate increase in wages and salaries and in consumption in the home.

The improvement in the public sector borrowing requirement will proceed more rapidly from 1990 than in the last three years, owing to the progressive reduction in the current account deficit and the incomes policy introduced.

With regard to GDP, manufacturing industry will perform best, developing a diversified range of products with a high technological content and high energy intensity.

The link between growth and energy consumption has now been broken in Denmark's socio-economic system. Nevertheless, industrial change will have an impact on global energy demand, which is likely to expand at a slightly faster pace than forecast for the period until 1995.

1 These estimates differ from those contained in the table on energy balances.
2 Danske Elvaerkers Forening (Danish Electricity Producers' Association).

Community energy planning programme for developing countries: Balance sheet for 1987 and outlook

Introduction

Eight years ago the Directorate-General for Energy launched an energy planning programme. A great deal has been accomplished since then, and it is time to examine the results.

To do this, we must first retrace the original objectives and consider whether they have been achieved. The outcome of our review can then be used as a basis to develop guidelines for future work in this field, taking account of the fact that the energy situation and the economic and social background are constantly changing. It is clear that energy planning objectives are inextricably linked with the general objectives of several Community policies:

(i) energy policy *per se*, the general and specific objectives of which are adopted by the Member States as a whole;

(ii) policies relating to the Community's external relations (including trade policy and development cooperation);

(iii) policies relating to the internal market, i.e. economic policy and competition, financial and budget policy;

(iv) sectoral policies such as industry and transport;

(v) policies relevant to all sectors, i.e. environment policy, regional development, social policy, R&D.

As energy is one factor — a vital one — in economic and social development, it will have a crucial role in promoting European integration and genuine cooperation between industrialized and developing countries.

This aspect assumes increased significance in the light of the integration process in the Community (recent accession of three 'southern' Member States) and the completion of a single market.

Programme objectives

The upheavals in the energy markets in the 1970s with the resulting, frequently serious, repercussions on economic development in most countries led to some restructuring of energy consumption.

The lack of reliable data, of appropriate methods and instruments and — last but not least — the absence of technical contacts and a climate of trust between all parties concerned proved a major obstacle to these efforts.

This demonstrated the importance of energy planning, which has been undertaken since then in many countries of Europe and the Third World. In order to be effective, any measures taken have to be implemented at all administrative levels, thus national measures should be supplemented by corresponding activities at regional and international level.

The Commission has adapted its aid in the energy planning field to the needs manifested in the developing countries and in the Community. Its energy planning programme has five specific objectives:

1. to obtain fuller information on the energy markets and more detailed analyses of the situation with regard to demand, energy supplies, reserves, development scenarios and the complex interrelationships;

2. to improve decision-making structures in energy policy and energy planning;

3. to facilitate the technical and political debate between consumers and producers and the exchange of experience between Europe and the Third World;

4. to facilitate speedier implementation of the results of the Community's R&D programmes and of its political and regulatory activities;

5. to support research in fields vital to energy and economic development, such as:

   (a) energy demand (including RUE and long-term structural changes resulting from technological innovation);

(b) regional supply sources (new and renewable);
(c) energy and regional development;
(d) energy and the environment;
(e) energy and employment.

While the Commission can only play a modest role supplementing the activities of the private sector and the public authorities at all levels, its contribution, as in many other sectors, helps to promote harmonious development within the Community and cooperation with the Third World.

Characteristics of the Community programme

Since it was set up in 1980, the Community energy planning programme has contributed during two four-year programmes to the development of a number of analytical instruments, the establishment or strengthening of energy planning institutions, executive training schemes, the organization of seminars and the exchange of information.

The first programme (1980-83) primarily concerned the development of analytical instruments and methods and the creation of research structures, training and information. It was mainly targeted at the developing countries and received 10 MECU in financial support from the Commission.

The second programme (1984-87) has just been completed. It concentrated more on assisting the establishment of energy planning structures and the training of key personnel in the developing countries; in addition, analyses of energy problems, in particular on the demand side, were undertaken in many parts of the Community. The Commission contributed 28 MECU to this programme.

The next programme (1988-91) will have two main objectives:

(i) within the Community, efforts will be devoted to integrating fully the 'younger' Member States and also to furthering the creation and functioning of the internal market (1992);

(ii) outside the Community, the objective will be to consolidate and step up actions taken to date (data bases, assistance to local institutions, training) and to expand cooperation in certain priority areas, such as technology transfer, the effects of energy on the environment, etc.

Programme contents

What has been the Commission's role?

The Commission has contributed to the financing of 300 projects costing a total of around 70 MECU; its share (amounting to 38 MECU) has therefore averaged out at 55%.

These 300 projects have been carried out under 65 specific programmes falling within six categories:

1. studies, surveys, appraisals, research;
2. support for/setting-up of energy planning bodies, establishment of energy plans;
3. training of key personnel and experts in energy planning;
4. organization of seminars/conferences, exchange of information;
5. organization of exchanges of officials and experts;
6. coordination, publications, administrative support, verification.

Around 230 projects have been carried out in the developing countries (with financial support totalling 28 MECU), while 70 projects have been cofinanced in the Community since 1982 (for a total of 10 MECU, in 35 regions and across-the-board projects).

The lion's share of the work in developing countries has undoubtedly been concerned with studies: 100 projects have been financed under five programmes to the tune of 7.5 MECU. On average, the Commission has contributed 57% towards the cost of these projects, the remainder being financed by the authorities in the developing countries, through bilateral aid or through international organizations (UNDP, ESCAP, IDB, etc.).

The most important programme in the 'studies' category has been the one concerning the 'EC network' of energy research institutes for the developing countries, in which 10 institutes, mainly from developing countries, have been engaged since 1980 in a collaborative research programme on energy planning in the developing countries. More recently, the network's activities have been extended to other fields such as training and technical assistance for the establishment of energy plans and regional energy analyses. This activity is of prime importance and will be the subject of a special article in a subsequent issue.

Two other large-scale activities have been carried out in collaboration with the developing countries concerning the establishment of energy planning structures and energy plans, and the training of key personnel: 40 projects have received 9 MECU in financial support and 20 projects 5.5 MECU. The Commission's financial contribution in these cases has varied between 66% (for the energy plans) and 44% (for training).

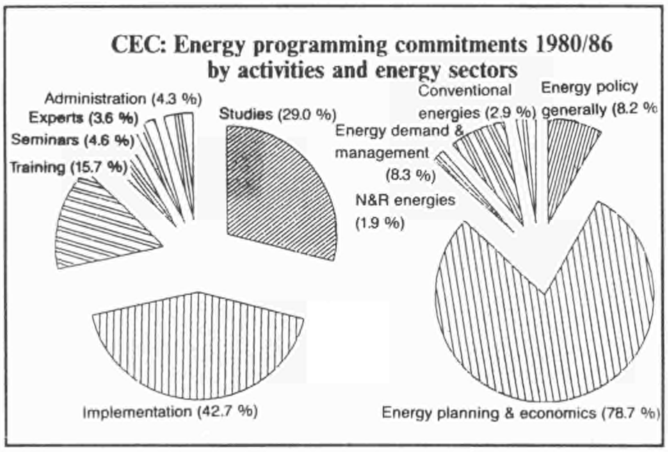
The biggest programmes have been carried out

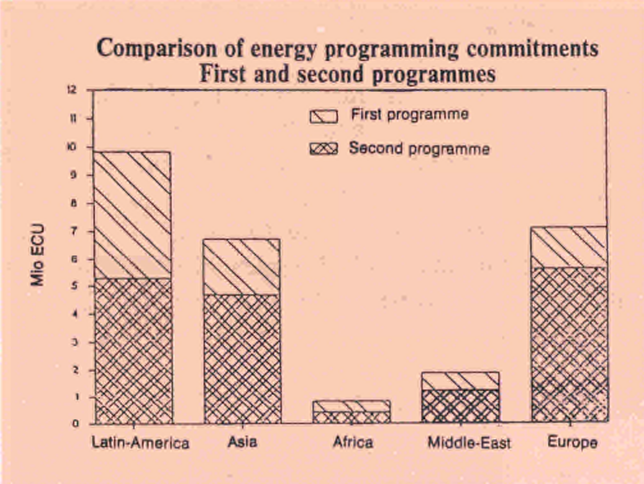
(a) in China, concerning in particular the training of 2 000 key personnel in energy policy and analysis and energy management. This was done with the assistance of eight training centres in China. The cost to the Commission to date has been 5 MECU;

(b) in South-East Asia, concerning the training of about 100 experts at the AIT in Bangkok, the provision of teaching staff (energy policy) and the development of a data base and energy demand forecasts in the Thai Government's national energy administration. Commission aid so far: 4 MECU;

(c) in Latin America, involving three major technical assistance schemes in ministries or national energy administrations or institutes for energy in Ecuador, Colombia and Mexico (mainly concerned with the development of data bases, energy demand analyses, energy savings, new and renewable (N&R) energies and the development of fossil resources). Three other support schemes of a different type have been financed to promote regional development and the training of key personnel in Argentina and Brazil and at regional level for the Olade. Commission support to date: 11 MECU;

(d) in Africa, where a major programme of training and assistance to African administrations has been in progress through the ENDA-Dakar for a number of years. Commission aid so far: 1.0 MECU.





Results

The results of the energy planning programmes are regularly evaluated. The latest report drawn up on 30 July 1987 for the period 1980-86 presents a series of direct results (not to be confused with utilization of the results, see p. 42), the most important of which are summarized below.

1. Studies

More than 60 studies, analyses of energy planning research in developing countries (demand, prices, investments, resources), 45 energy balance sheets, material for about 20 training programmes and 15 study missions to energy planning institutes in developing countries have been accomplished. The Commission has contributed 50% on average to the cost of the projects.

2. Evaluation reports

Eleven evaluation reports have been compiled for the Commission. They concern the activities of the other providers of funds to energy cooperation and assessments of the schemes financed by the Commission itself.

These activities are financed in full by the Commission.

3. Establishment of energy plans and strengthening of energy planning structures in the developing countries

This concerns 12 projects leading to the establishment of four energy plans, the creation of six energy data bases, the setting-up and/or consolidation of energy planning institutes in Latin America, Asia and especially China.

4. Training

There have been 10 programmes for training key staff/experts in energy policy and planning, energy management and conventional energy sources (coal, electricity, nuclear safety). These programmes, several of which have been in progress for five years, have led to the training of more than 2 000 key personnel/experts, particularly in China, with the collaboration of almost 50 experts per year.

5. Seminars/conferences

Approximately 30 seminars with over 1 400 participants have been held, including 12 major seminars contributing to an exchange of experience between Europe and the developing countries (in Brussels, Berlin, Luxembourg, Marseilles, Grenoble, Brighton, Bariloche, Rio de Janeiro, Bangkok, Dakar, Beijing, New Delhi).

6. Exchange of experts/officials, publications/information

Almost 200 experts/officials have visited Europe or have gone to the developing countries, many of the latter themselves coming from developing countries (regional exchange).

Utilization of results

Considerable information has been gathered on the utilization of results for the projects which began under the first programme from 1980 to 1983.

With regard to the developing countries, for example, the programmes and projects have produced the following results:

(a) Ecuador: investment in the use of N&R energy sources and rational use of energy (RUE), mining legislation, geothermal energy, mini hydropower stations, energy pricing policy;

(b) Colombia: development of coal production;

(c) Brazil: development of coal production and the use of N&R energy sources (especially biomass and alcohol);

(d) Africa: more rational use of fuel wood;

(e) Middle East: development of new and renewable energy sources (solar, wind);

(f) South-East Asia: more rational use and development of N&R energy sources, improvement of agricultural production;

(g) China: savings of coal and oil exceeding 500 000 toe per annum in industry.

Another important result, though difficult to quantify, is the transfer of know-how. Thus the initiatives to establish energy balance sheets and set up energy planning structures have been facilitated by the advice and assistance of experts having benefited from experience in other countries or regions.

This has given rise to true 'South-South' cooperation among developing countries, or to be more exact 'West-East' (between Latin America and Africa or Asia) and 'North-South' cooperation (Argentina-Olade, Ecuador-Mexico).

Another aspect that cannot be quantified is the contact established between researchers from the 'North' and 'South' and between political decision-makers from Europe and the developing countries, in short the climate of true cooperation which is not merely cosmetic but is put into practice every day.

Outlook

What will be the thrust of the next Community programme for the period 1988-91?

The principal goal will be to consolidate Community action and build on what has been achieved.

The programme could be devoted to:

(a) stepping up dissemination of the results of programmes, including those not financed by the Commission;

(b) continuation of studies seeking solutions to certain problems or bottlenecks generally associated with regional/local analyses;

(c) strengthening of analytical structures and/or decision-making, mainly through training and advice;

(d) the establishment of a framework for analysis and joint reflection on energy planning in the Community: a reference document which will be of value to any expert in the private or public sector analysing energy problems at regional or local level.

It is clear that, as in the past, activities exceeding the Community's resources will not be tackled, e.g.

(i) a programme covering all the Community regions and most regions in the developing countries; this would be much too extensive and of little value. Support must be limited to typical cases and regions relevant to the objectives of Community policies;

(ii) extension to the supply side (except for the indigenous energy sources of a region);

(iii) elaboration of a uniform, rigid approach which would not do justice to the differing circumstances of regions and communities.

With regard to content, the schemes will have to accommodate changes/developments in the *status quo* and depart from the strict energy context to take more account of the economic, social and technological problems closely bound up with energy supply and demand.

During the last 15 years the energy markets have been characterized above all by extreme sensitivity and uncontrolled price fluctuations which have harmed economic and social development. In this context, the general objective of the Community and the developing countries continues to be the maintenance of secure, inexpensive energy supplies. This can only be achieved if efforts to improve energy planning along the lines of the past eight years are sustained.

However, apart from the need to provide secure, diversified and inexpensive energy supplies, high energy costs and the need to supply quick political answers have obscured the emergence of other problems that are equally important to the future of our societies and prevented certain 'energy models' from being challenged.

Growing energy demand (even if the link with economic development can temporarily be severed) creates problems in connection primarily with the burning of fossil fuels, air pollution and warming-up of water courses and the atmosphere. Given the dimension of these problems and the increased awareness of the general public, it is imperative to develop more environmentally compatible energy consumption models. The interrelationships between energy and the environment can be effectively demonstrated in small-scale local or regional analyses. This applies both to Europe and to the developing countries.

The restructuring of our national economies and energy supplies generates employment problems in many cases. The decline of indigenous coal, the reduction in refinery capacities, the development of new and renewable energy sources and energy savings — in short, the restructuring of energy supply and demand — have had direct and indirect effects on the level of employment. This will be a priority area of the programme for the coming four years.

Regional development in Europe and the developing countries also depends to a large extent on the availability of cheap energy supplies (where possible indigenous to the region). The problems arising from regional policy should also be taken into account in general energy analyses. The development of energy as a factor of production gives rise to considerable problems, particularly in peripheral areas undergoing economic restructuring and in the poorer areas of Europe and the Third World.

One final important factor concerns the effect of technological innovation on energy demand. Here, too, increasingly obvious signals and problems are emerging which need to be thoroughly analysed and taken into account in energy policy.

To conclude, as established at last year's seminar in Marseilles, the main directions of the programme will concern:

(a) more secure, diversified energy supplies under acceptable economic conditions;

(b) energy investments with a positive impact on employment;

(c) a more balanced economic and social situation in the poorer or less-favoured regions;

(d) the long-term effects of technological innovation on energy supply and demand;

(e) cooperation to develop complementarity between the economies of Europe and the developing countries.

The instruments, data and analytical methods needed can be provided by appropriate, consistent energy planning. Significant progress has already been made by the energy industry, research institutes, enterprises/agencies and local, regional or national authorities. However, there is a need for a better organized, more comprehensive exchange of experience at European level and between Europe and the Third World. Implementation of the Community programme will help solve these problems.

The measures to be financed by the Commission are along the lines of those implemented under its energy planning programmes since 1980:

(a) studies and analyses (in particular in cooperation with research institutes that are part of the European and developing country network and with regional institutions);

(b) advice and technical assistance (particularly in the developing countries and less-favoured areas);

(c) training of experts and key personnel (particularly in developing countries);

(d) seminars, dissemination of information.

In this connection it is important, as in the past, that the Community financing instrument should be used as a complementary tool, as action can only be taken with the active (including financial) support of the institutions, regions or countries concerned. This also ensures that the scheme will be effective and responsive to needs, as well as a sensible application of the results.

As far as possible, it should be ensured that the measures are complementary to those undertaken by other providers of funds, in the first instance Community countries and the EIB, but also the international organizations who have cofinanced projects in the past. Cooperation with the United Nations, universities and regional organizations (Escap, Olade, Andean Pact, Oapec) must be maintained and indeed reinforced. It is in the interests of all that the available resources be used as effectively as possible.

Use of solid fuels on the heat market

On 24 May 1983 the Council adopted two Recommendations to the Member States on the encouragement of investment in the use of solid fuels in industry (83/250/EEC) and in public buildings and district heating systems (83/251/EEC). On 8 April 1988 the Commission reported to the Council on the steps taken to implement these Recommendations by the Member States. This article sums up that report, which is now available in every Community language (reference: COM(88) 185).

After the first energy crisis (in 1973), everyone agreed that coal had an important part to play in reducing the Community's dependence on oil. Yet by the second energy crisis (in 1979) there had still been no significant increase in coal consumption, which had remained by and large unchanged from 1973 to 1979. Consequently, on 10 February 1982 the Commission submitted to the Council a Communication entitled 'The role for coal in Community energy strategy' (OJ C 105, 26 April 1982). This Communication concluded that more needed to be done to promote investment in the use of solid fuels. Two draft Council Recommendations to the Member States were annexed to encourage such investment. On 24 May 1983 the Council adopted them both.

Together, these Recommendations call on the Member States to take all environmentally-compatible measures which they consider appropriate to encourage the conversion or reconversion to solid fuel of existing combustion installations fired by fuel oil and to encourage the building of new solid-fuel-fired installations:

(i) in undertakings in all branches of industry, with the exception of the iron and steel industry and the energy sector;

(ii) in public buildings (administrative buildings, barracks, schools, etc.);

(iii) in district heating systems.

To follow up its brief 1984 and 1985 reports on the measures taken to implement these Recommendations, earlier this year the Commission decided that the time had come to produce a more detailed analysis of the progress made in using solid fuels on the heat market. This article sums up this analysis, which not only fulfils the Commission's obligation to report to the Council on this subject but also supplements the solid fuels section of the Commission's review of Member States' energy policies in the light of the 1995 Community energy objectives (Communication COM(88) 174 of 6 April 1988: 'The main findings of the Commission's review of Member States' energy policies — The 1995 Community energy objectives').

Changes in the market for solid fuels

Statistics

The table below shows how the shares of the various forms of primary energy in gross inland energy consumption in the Twelve have changed since the first energy crisis in 1973:

(%)

	1973	1980	1983	1987
Solid fuels	23.5	23.1	23.9	22.2
Oil	61.3	53.9	48.5	45.1
Natural gas	11.8	16.7	17.4	18.5
Nuclear	1.9	4.3	8.2	12.8
Other	1.5	2.0	2.0	1.4

These figures show that considerable progress has been made in reducing the Community's dependence on oil but that solid fuels themselves have lost ground over the last few years.

The breakdown of demand for coal by consumer sector is as follows:

	1983		1987	
	Mt	%	Mt	%
Power stations (public utilities and pithead)	197.0	61.3	194.7	60.6
Coking plants and steel industry	76.7	29.3	75.8	23.6
Other industries (including industry-owned power stations)	24.8	7.7	29.0	9.0
Households and small consumers	14.6	4.5	13.0	4.0
Other	8.3	2.6	9.0	2.8
Total	321.4	100.0	321.5	100.0

'Other industries' — which are covered by Recommendation 83/250/EEC — account for 29 Mt or 9% of hard-coal consumption in the Community, a considerable increase over 1983.

Consumption of coal in the sectors covered by Recommendation 83/251/EEC (public buildings and district heating systems) is roughly 8-9 Mt, 6 Mt of which is used for district heating. This amounts to between 2.5 and 2.8% of the Community's total coal consumption in 1987.

As a rough guide, therefore, the two Council Recommendations of 24 May 1983 cover a coal market which amounted to 38 Mt (29 plus 8 Mt) or 12% of total consumption in 1987. Lignite and peat generally play only a very small part in the sectors covered by the Recommendations, though they are of considerable importance to certain regions.

Competitiveness of solid fuels on the heat market

The scope for economic replacement of petroleum products by solid fuels in the sectors covered by the two Council Recommendations depends on a number of factors, the most important being the difference in price between the two. The difference itself may vary considerably between consumers; it will depend in particular on the cost of transport to the site, on the sources of supply, taxes, and national aid. The table below provides an indication of how the price differential has varied over the last five years:

(ECU/tce)

	1983	1984	1985	1986	1987
(A) Annual average price of heavy fuel oil (a)	131.61	160.70	158.62	67.19	65.11
(B) Average list price of Community steam coal (b)	87.37	92.21	92.37	84.35	...
(C) Annual average price imported steam coal (c)	64.76	64.45	67.65	48.96	38.33
Price differential:					
A - B	44.24	68.45	66.25	−17.16	...
A - C	66.85	96.25	90.97	18.23	26.78

(a) *Source:* Eurostat.
(b) *Source:* Information supplied to the Commission by the coal producers.
(c) *Source:* Information supplied to the Commission under Commission Decision 85/161/ECSC.

Both capital and operating costs of solid-fuel boilers are higher than those of oil-fired and gas-fired boilers. For solid fuels to be competitive with fuel oil despite this technical handicap the price differential in favour of coal must be at least 15 ECU/tce for large boilers in base-load power stations and at least 30 ECU/tce in the case of smaller boilers with lower annual load factors. The extra cost of burning coal also depends very much on the environmental-protection measures required for the various types of boilers.

As can be seen from the table above, up to 1985 the price differential between fuel oil and steam coal, both Community and imported, was easily sufficient to make the use of coal economic. Why then did a price differential as high as 66 to 96 ECU/tce in 1984 fail to trigger off much more extensive conversion to coal-firing? Even if in some cases the differential had to be reduced by, say, 10 ECU/tce to take account of the higher transport costs, coal's advantage was still appreciable. The answer no doubt lies in the uncertainty about future movements of the price differential between fuel oil and coal and in a sort of psychological barrier to the use of coal even where it is economically warranted.

The big drop in oil prices, combined with the fall in the dollar, fundamentally changed the situation from 1986: list prices Community coal completely ceased to be competitive with fuel oil; imported steam coal was just about able to remain competitive, and even then only in power stations. However, the situation tends to vary from one Member State to another depending, in particular, on the taxes imposed on oil products.

Substitution

The demand for coal in 'other industries' over the last five years is summed up in the following table:

	1983	1984	1985	1986	1987
Coal consumption by 'other industries' (Mt)	24.8	26.6	30.8	29.3	29.0
Solid fuels' share of energy consumption by 'other industries' (%)	11.5	11.6	13.9	12.7	12.5

The combined effect of the big price differential between coal and oil and of the national incentives for industry to switch to solid fuel boosted coal consumption in 'other industries' by 6 Mt, or almost 25%, between 1983 and 1985. Since then falling oil prices and the declining dollar have led to consumption slipping back to 1.3 Mt below the 1985 peak. The Member States' latest forecasts suggest that in 1988 consumption is likely to remain close to the 1987 level. Consequently, it is fair to conclude that the swing back to oil in these industries is losing momentum. The net advance made by coal in industry since 1983 is nevertheless almost 5 Mt or 20%.

Very few public buildings have been converted to solid fuel except in Ireland. Most of the increase in coal consumption has been in the district heating sector (up 1.2 Mt or 25% between 1983 and 1986). However, even this trend was confined chiefly to the countries with a tradition of this type of system, i.e. Denmark, France and the FR of Germany.

Council Recommendations of 24 May 1983

Eleven Member States had taken measures to encourage investments in the use of solid fuels in industry before 24 May 1983 or, in the case of Spain and Portugal, before they joined the Community. Consequently, the Council Recommendations merely consolidated a policy already widely pursued by the Member States. Only the coal-producing Member States have taken specific measures to promote the use of coal in industry. In all the others, measures to encourage use of solid fuel formed part of a broader energy efficiency programme for industry.

Only four Member States introduced new measures or extended their existing schemes after 24 May 1983 (1 January 1986 in Spain and Portugal). Consequently, Council Recommendation 83/250/EEC has produced only a limited incentive and knock-on effect.

By 1 January 1988 only six Member States still had government incentives to encourage investment in the use of solid fuels in industry. Virtually all of them were part of energy efficiency programmes covering more than just solid fuels. Measures to promote technological research, development and demonstration work are not covered by the Council Recommendations or included here.

In the coal-producing Member States, non-governmental schemes have been launched, on the initiative of the coal producers in particular. Naturally, they cannot offer financial inducements to users. Instead, they have opted for commercial schemes to reduce the risk to industrialists who decide to convert to coal. Often these take the form of all-in packages offering to carry out feasibility studies, provide assistance during construction, help with the financing and grant technical and economic guarantees during operation.

These schemes have generally produced good results. However, now that the price differential between oil and coal is too narrow to offset the extra cost of coal-fired installations, all-in packages of this sort no longer provide an effective enough incentive for industry to switch to coal.

The Recommendation concerning the encouragement of investment in the use of solid fuel in public buildings and in district heating systems affects some Member States more than others; in much of southern Europe the climate does not warrant heating systems requiring such heavy investment as coal-fired boilers or district heating systems. In northern Europe, only Denmark, France and the FR of Germany have fully developed district heating networks though there are small-scale systems in Belgium, the Netherlands, Northern Italy and the United Kingdom.

Four Member States had launched schemes before 24 May 1983. Only the United Kingdom introduced fresh measures after this date, the only ones still in force on 1 January 1988, after the other Member States had completed their programmes. Community-wide, efforts have been very patchy. In the final analysis, Council Recommendation 83/251/EEC has made little impact.

Conclusions

1. It has not been shown for certain that specific measures to encourage investment in the use of solid fuels have in fact been taken following the two Council Recommendations of 24 May 1983. Actually very few new measures were introduced in the three years following the Council's adoption of the two recommendations. Most of the measures that were taken during that period were non-specific measures covering energy efficiency in all areas.

   Countries that had taken measures prior to 24 May 1983 also continued with them after that date. In contrast, countries that had not introduced measures before 24 May 1983 generally did not do so after that date either.

2. The specific measures to encourage investment in the use of solid fuels were designed essentially to develop the market for fuels of Community origin. These measures were taken only in the Member States that produce coal.

   Non-specific measures designed to promote all methods of making more rational use of energy were taken by most Member States. Generally speaking, these measures also applied to projects burning imported coal.

3. Wherever specific promotion measures have been introduced by the Member States the results have generally been positive. However, the information supplied to the Commission has not always been sufficient to quantify the results of the measures taken by the Member States and to differentiate between results due to market forces and results attributable to the promotional measures.

4. Very encouraging results have also been obtained by non-governmental promotion efforts. In this respect the scheme put into effect by some coal boards is worth mentioning. This all-in package consists of a promoter taking responsibility, against payments, for all the technical, economic and financial constraints of a project involving the use of coal and could serve as a model for a Community approach to the problem of encouraging the use of solid fuels on the heat market.

5. At the beginning of 1988 few measures were still in force or had any real impact on conversion to solid fuels. The combined effect of lower oil prices and the drop in the dollar has meant that the price differential between petroleum products and coal is no longer enough to make conversion projects economically viable.

6. The uncertainties surrounding future regulations limiting emissions from small and medium-sized boilers and the lack of economic technologies compatible with the environment form an additional handicap to the use of coal in the sectors covered by the two Council Recommendations. It is essential for environmental protection measures and technological development efforts to be coordinated.

7. In this difficult period, national and Community programmes of financial aid to projects to demonstrate new ways of using coal provide fundamental support for investments in the sectors covered by the Council Recommendations. In a good number of Member States these programmes are currently the only support for the use of solid fuels.

8. The analysis in the report shows that in the sectors in question solid fuels are not currently playing the role of alternatives to petroleum products which they are assigned by the Community's energy policy objectives. With today's oil prices and in the absence of effective promotional measures there is little chance of them playing such a role. On the contrary, solid fuels are losing ground all the time to gas and oil.

While oil prices remain as low as they are at the moment this situation will not change unless a positive policy to promote coal is adopted. New approaches need to be found. The Commission will present specific proposals in due course.

Third-party financing

The Commission seminar on third-party financing, held in Luxembourg in October 1987, called for the Commission to consider what steps are necessary to promote the concept in the European Community. This article is based on a text of a Commission Communication to the Council of Ministers which examines the third-party financing concept and the mechanisms which could encourage its spread within the European Community. At its meeting of 29 March the Commission adopted a Recommendation to the Member States outlining the steps it feels necessary to accomplish its goal of accelerating discrete energy efficiency investment.

Accelerating discrete energy efficiency investments through third-party financing

Introduction

The Council of Ministers, at their meeting on 16 September 1986, set new energy objectives for the Community in 1995, which included a further improvement in energy efficiency of at least 20%.[1] The recent evaluation of the energy policies of the Member States indicates that the Council's 1995 energy efficiency objective is unlikely to be attained unless stronger policy measures are taken. Energy efficiency efforts, and in particular investment in discrete energy efficiency projects, seem to be decreasing. Among the reasons for this decrease are the current low energy prices, the low priority often attached to energy saving investments in decision making, the financial structure of firms and the disparities in the required rate of return between energy supply and energy saving projects.

The achievement of the Council's 1995 energy efficiency objective translated on a sectoral basis would require a saving in annual consumption of 50 Mtoe in the building sector and 40 Mtoe in the industrial sector. If these savings were to be accomplished by investment alone, an investment of about 65 000 MECU[2] would be required in the building sector and an investment of about 45 000 MECU[3] in the industrial sector. Therefore to achieve the 1995 objective by investment alone about 100 000 MECU in total must be invested in energy saving by 1995.

Investments in new electrical appliances, vehicles, new buildings, burners and boilers or industrial process plant often entrain, as an additional advantage, better energy efficiency. Such investments are usually driven by the need to replace obsolete or worn-out facilities rather than by the energy efficiency advantages alone. But major energy savings can also be accomplished by improving energy efficiency in existing buildings and industrial process plants which are not being replaced or renovated. Something needs to be done to stimulate discrete investments which are primarily intended to save energy costs.

This Communication addresses the question of how specific energy efficiency investments may be encouraged without the public authorities having to subsidize such investments. It looks at the potential of third-party financing as a mechanism for accelerating such investments, examines experience in the use of this mechanism and some of the obstacles to its introduction in the European Community and concludes by recommending an action programme.

What is third-party financing?

Several novel financial mechanisms have been developed in various countries to accelerate energy efficiency investments. Each type of financing uses different mechanisms, involves various technologies, and can involve more than two participants at the contractual level.

Innovative vendor financing essentially consists of energy equipment vendors either financing the purchase of their equipment in exchange for a share of future energy cost savings, or underwriting the cost for the purchaser by contractually guaranteeing a level of savings. It naturally tends to be focused on the one technology or equipment type offered by the vendor. This method of financing energy-saving investments is already established in several Member States. Energy service company financing or third-party financing is however still little used in the Community. This type of approach consists of an independent energy service company identifying energy-saving investments and providing the client with the finance (and advice) necessary to carry out the investment in exchange for a share of the energy costs saved.

The Commission believes that third-party financing is probably the most promising mechanism for the European Community to mobilize the large amounts of private capital required to carry out discrete energy efficiency investments. This is an application case for the financial engineering approach adopted by the Commission.

As has been explained, this provision of private capital is accomplished by means of an energy service company (ESCO) borrowing from private sources the finance for energy-saving investments and using part of the resulting cost savings to pay off the loan. The energy savings are, therefore, viewed as a stream of income for the ESCO which is, therefore, central to the successful operation of the mechanism: an ESCO must provide a combination of engineering, financial and marketing skills.

The necessary steps to establish a third-party financing investment are outlined in Annex 1. The ESCO carries out a preliminary energy audit to estimate the likely economic level of energy savings. A proposal is then made to the facility owner which outlines a programme for establishing and accomplishing these energy savings. A contract is negotiated, and an energy baseline or average consumption pattern is ascertained. The ESCO then carries out a detailed energy audit, decides what is necessary and installs equipment aimed at accomplishing the potential energy savings. The facility owner and the ESCO share the financial benefit from energy savings made during the term of the contract.

Third-party financing therefore has the significant advantage that the facility owner does not have to provide funds for the conservation measure. He can still make other investments while starting to reap the benefits of the energy saving. Neither does the facility owner have to determine which equipment is most appropriate. The ESCO bears all the risk of energy savings not being achieved. It is usual to arrange that the facility owner owns the equipment at the end of the contract, which can vary from 2 to 10 years' duration.

The experience to date with third-party financing

Third-party financing was originally developed in the United States and Canada and much of the operational experience has come from there. The market for third-party financing in the United States has been developing rapidly. By 1984, the last year for which disaggregated data is available, there were about 150 companies offering 'energy services' and energy-saving investments made through these companies resulted in about USD 350 M being invested.

One of the factors which has assisted the growth of the 'energy services' market in the US has been the active role played by government at federal, State and local levels. The active participation of government institutions has led to a situation where by 1985 energy efficiency investments in public-sector buildings accounted for 50% of all third-party financing compared to 20% in 1983. At federal level, the Government has, through its various departments promoted the use of third-party financing in making energy-saving investments in government buildings. The Federal Energy Management Programme has set up a clearing-house on third-party financing, in order to assist government building managers to avail themselves of the technique. Similar arrangements have been made at State level and with many local authorities.

Since the inception of the third-party financing technique in the US, many types of organization have started to provide third-party financing services. They include engineering consultants, engineering firms, subsidiaries of gas and electricity utilities, and in some cases local governments themselves.

In Europe, the concept of third-party financing has been much slower to develop. A study carried out for the Commission in 1985 and published in 1986[4] found that the technique was not widely known in Europe but estimated the industrial sector market in the Community for third-party financing at 44 000 MECU and the corresponding building sector market at 42 000 MECU. These estimates were established by considering only those energy efficiency investments with payback periods of less than three years and investment values over 60 000 ECU. The achievement of these investments would have a major impact on the attaining of the 1995 energy efficiency objective.

The obstacles to third-party financing

Several factors have been influential in restricting recourse to third-party financing in the European Community. Among the major factors are:

(i) **third-party financing contracts** tend to be complex, which may result in some facility owners being discouraged from attempting such schemes;

(ii) **lack of knowledge of the technique.** The limited application of third-party financing in the European Community has been caused in part by the mechanism not been widely understood, or even known;

(iii) an insufficient **number of ESCOs** to develop the market. There are less than 10 energy service companies currently operating in Europe and these companies are concentrated in only a small number of Member States (notably the United Kingdom, Belgium, Spain and Luxembourg). In 1985, the two large and several small ESCOs collectively invested about 16 MECU (potential market 86 000 MECU) in energy-saving projects. In view of the size of the estimated EC market for third-party financing services, more energy service companies are needed to supply third-party financing in Europe. It has to be recognized that the cash flow of an ESCO only develops as the shared value of the energy saving from the contracts made are accomplished. Contracts may take a year or more to negotiate and even then income only accrues after the investment has been made and the equipment installed. This means that finance to set up and to expand the business of an ESCO can be a problem unless, as in the US and Europe, an ESCO can draw its finance from a larger parent company. Thus far the traditional suppliers of capital, the financial institutions, have been unwilling to enter this field;

(iv) legislative or budgetary constraints have in many cases prevented the **public sector** from using third-party financing. For instance one Finance Ministry in the Community ruled that third-party financing contracts entered into by local authorities must be considered as part of the authority's budgetary expenditure. Until it was changed this ruling effectively blocked any third- party financing investment by that Member State's local authorities. Other hindrances to the use of this technique in the public sector are inflexible public procurement rules, which require choices to be made on simple cost grounds alone and the fact that decision-making in the public sector is frequently a lengthy process. Public officials may also lack the motivation and time to investigate thoroughly a third-party financed energy-saving project. Member States are currently tackling this problem and there are now cases where some obstacles have been overcome. The Mayor of one large city has, for example, succeeded in getting the approval of central government to carry out a major and successful energy efficiency investment in municipal buildings using third-party financing;

(v) **energy utilities** in the United States have played a major role in the development of third-party financing. Utilities have the financial means, unrivalled contact with energy users, and knowledge of energy efficiency technologies. However, in Europe utilities are under no strong pressure to promote energy saving, and do not consider that they have a role in either supporting or indeed entering the third-party financing business. Unless governments can bring utilities, particularly publicly-owned utilities, to change their position, there is little likelihood of European utilities supporting this concept in the near future.

Accelerating energy efficiency investments through third-party financing

Starting from the thesis developed in the introduction: that a new financing mechanism is necessary to help in achieving the Community's 1995 energy efficiency objective, the Commission considers that third-party financing deserves positive encouragement. This means that the Community must seek to accelerate the development of a third-party financing sector and to eliminate the obstacles currently restricting the widespread use of this technique in the Community.

The Commission, willing to promote private initiative and mobilization of private capital towards priority objectives of its action, has already presented in 1986 (COM(86) 723 final) a Communication on the meaning of financial engineering activity in this area.

Moreover, the Commission has already taken some actions aimed at overcoming the lack of knowledge about third-party financing in the Community. Two seminars, the first in Brussels in November 1985 and the second in Luxembourg in October 1987, attempted to make the mechanism better known in the Community. This action was supported by the publication of the report cited above. The Commission has also supported the drawing-up of a series of model contracts for third-party financing in both the building and industrial sectors. Each contract is accompanied by a guidebook which explains the contract clauses in layman's terms.

To continue this work and to facilitate the development of third-party financing as a mechanism for accelerating energy efficiency investment, the following seven-point course of action is proposed:

1. The Member States should create an **environment** in the public sector in which third-party financing services can flourish. This can be accomplished by removing administrative obstacles to the application of third-party financing techniques and by encouraging government departments and local authorities to pursue energy efficiency investments financed by this means.

   One proven method of accomplishing this aim would be the initiation of a series of pilot projects which would introduce the third-party financing concept to the public sector.

2. In view of the economic benefits resulting from **greater energy efficiency**, there is a good case for Member States promoting the creation and growth of third-party financing companies by helping them to **overcome the financial obstacles** which tend to face any new and unfamiliar activity. This could be done by making deferred interest loans available to such companies or by providing them with financial guarantees. Alternatively Member States may wish to strengthen the financial position of such companies through direct equity participation.

3. The **energy supply companies** of the Member States, and in particular the electricity and gas utilities, have the requisite customer access and technical, financial and marketing capabilities to play a vital role in expanding the use of third-party financing. The Community's utilities represent a vast repository of energy expertise which has, thus far, remained largely untapped in the case of energy efficiency. Member States should encourage gas and electricity utilities to expand their role to encompass the setting-up of ESCOs and if necessary, direct them to take on such a role as far as the residential sector is concerned. In such cases the parent company should ensure that the ESCO is set up with the necessary engineering, financial and marketing skills, and provide an effective guarantee to enable the ESCO to borrow the necessary finance from financial institutions.

4. The market for the services of third-party financing companies in the energy efficiency field may be constrained in the case of multiple dwellings and smaller commercial or industrial enterprises by reluctance to finance the **costs of energy audits** which are a necessary preliminary. Governments should seek to diminish this obstacle by subsidizing part of the cost of such audits for these smaller consumers.

5. Another obstacle to third-party financing arrangements has in some countries proved to be difficulty in drawing up contracts which equitably reflect the partition of the risks, responsibilities and benefits involved. The solution to this should lie in the establishment of **national model contracts** on the lines of examples already prepared by the Commission.

6. The **small and medium-sized enterprise** sector constitutes an important market segment for third-party financed energy-efficiency investments. Over 10 000 European SMEs have already taken part as clients in the Community's Energy Bus Scheme and therefore a large body of information on consumption and possible energy efficiency improvements in such companies already exists. The Commission will explore mechanisms whereby the SMEs and the ESCOs can come together to effect the necessary energy-saving investments.

7. A concentrated **publicity campaign** should be launched by the Commission and the Member States in order to make third-party financing better known and understood by those contemplating energy efficiency investments. For its part the Commission intends to prepare a symposium designed to convince large companies, with appropriate capabilities, to form divisions or subsidiaries which could operate as ESCOs.

Based on the above paper the Commission, at its meeting on 29 March, recommended the Member States to take the following steps to promote the use of third-party financing for energy efficiency investments:

(a) the removal of legislative or administrative obstacles to the use of third-party financing for energy efficiency investments, in particular those restricting the ability of local authorities to use third-party financing services;

(b) the active promotion of the use of this technique within the public sector;

(c) the establishment of national model third-party financing contracts along the lines of those prepared by the Commission;

(d) the encouragement of public- or private-sector enterprises, particularly those involved in energy supply, to play an expanded role by providing third-party financing services;

(e) measures to encourage and promote the provision of third-party financing services by gas and electricity utilities, particularly for the tertiary and multiple residential sectors, and for small and medium-sized companies;

(f) the provision of grants to multiple dwellings and smaller commercial or industrial enterprises to defray the costs of audits carried out by recognized energy service and third-party financing companies;

(g) measures to accelerate the creation of third-party financing enterprises in the energy efficiency field by means of financial incentives such as access to deferred interest loans, direct State equity participation or financial guarantees;

(h) the establishment of comprehensive information programmes designed to promote the use of third-party financing for energy efficiency investments in all sectors of the economy;

(i) cooperation with the Commission and other Member States in regular reviews of progress and of the possible need for additional measures in this field.

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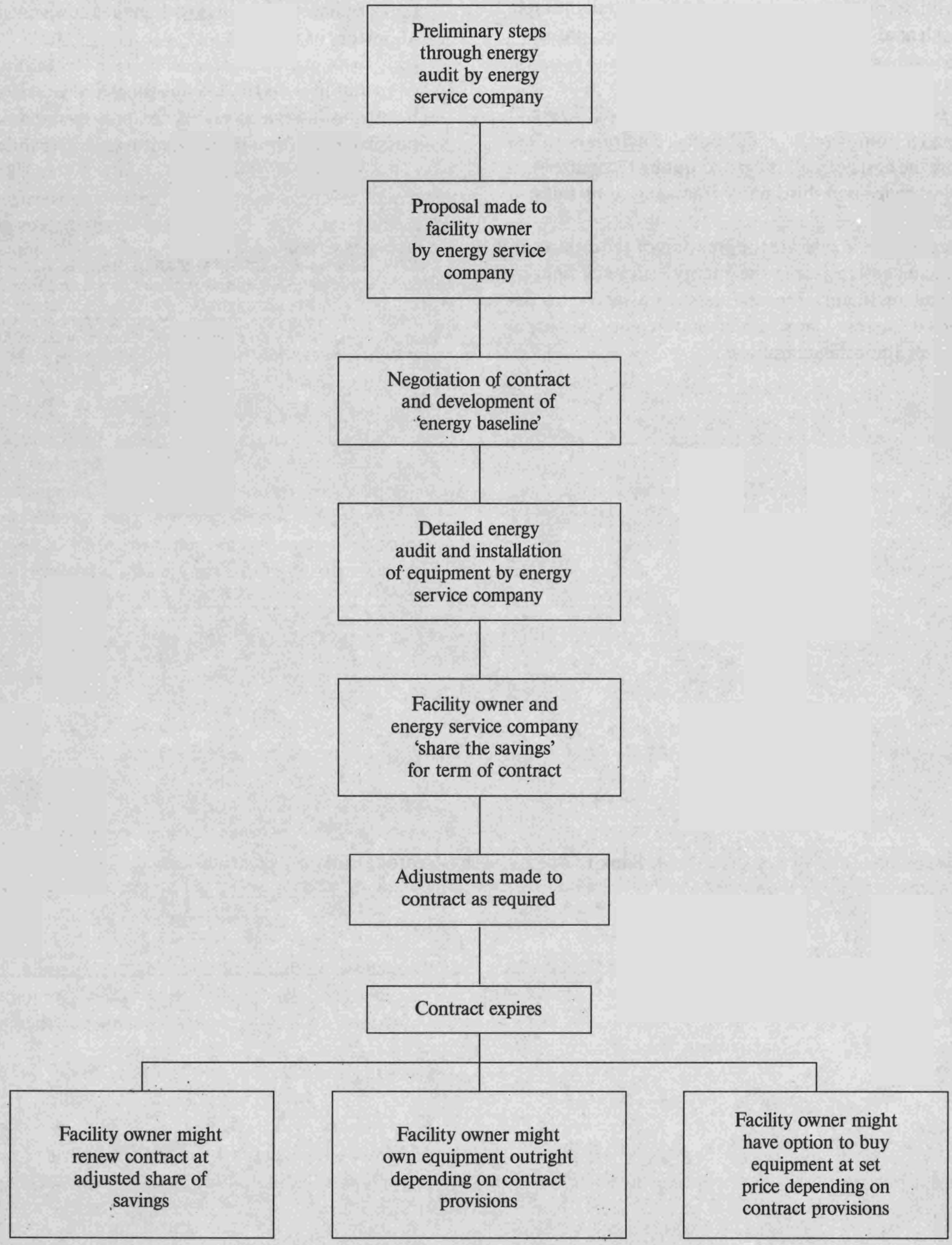
1 OJ C 241, 25.9.1986.

2 1 300 ECU/toe saved — COM(86) 264 final, Brussels, 16.5.1986.

3 1 050 ECU/toe saved — *Agence française pour la maîtrise de l'energie.*

4 *Third-party financing opportunities for energy efficiency in the European Community*, Association for the Conservation of Energy, Kogan Page, London, 1986.



Energy savings contract — Flow diagram

European Investment Bank operations in pursuit of Community energy policy objectives

Created under the Treaty of Rome of March 1957, the European Investment Bank (EIB) is the European Community's bank for financing capital investment fostering European integration. Operating on a non-profit-making basis, it provides long-term credit both within and outside the Community, using funds borrowed on the national and international capital markets. The EIB is the main Community source of investment finance: in 1987, its total lending amounted to 7 840 MECU. Some 450 MECU of this came from the resources of the New Community Instrument (NCI), which the EIB, acting under mandate, may draw upon to grant loans in accordance with the guidelines laid down by the Council of the European Communities and following a Commission decision on the eligibility of projects to receive loans.

Financing operations in the EEC in 1987 added up to 7 450 MECU. Of this amount, over 2 200 MECU was channelled into infrastructure schemes and productive-sector projects contributing towards attainment of Community energy policy objectives; hence, in terms of economic policy goals, energy accounted for some 30% of financing provided by the EIB in 1987 alone. The figure comprised 863 MECU for promoting rational use of energy in industry or infrastructure, 696 MECU for fostering import diversification, e.g. using natural gas or coal instead of oil for electricity and/or heat generation or in industry, and 668 MECU for harnessing the Community's indigenous resources (mainly oil and natural gas fields off the coast of Italy). **The EIB thus constitutes the leading source of Community financing for energy projects** as much in the form of loans as other budgetary aids. Whereas the loans made by the EIB in 1987 represented 1% of the gross fixed capital formation in the EEC, for energy they amounted to 3%. The EIB has made major strides in building up its role as a provider of funds for this sector over the years to reflect the objectives set by the Community on this front. It should be stressed that, in conducting its lending activities, the EIB does not operate according to any preordained distribution by country, region or sector but rather on the basis of financing applications received and, needless to say, compliance of projects examined with Community policies (Article 21 of the Statute of the EIB), its eligibil-

Articles of the EEC Treaty establishing the European Investment Bank

Article 129

A European Investment Bank is hereby established; it shall have legal personality.

The members of the European Investment Bank shall be the Member States.

The Statute of the European Investment Bank is laid down in a Protocol annexed to this Treaty.

Article 130

The task of the European Investment Bank shall be to contribute, by having recourse to the capital market and utilizing its own resources, to the balanced and steady development of the common market in the interest of the Community. For this purpose the Bank shall, operating on a non-profitmaking basis, grant loans and give guarantees which facilitate the financing of the following projects in all sectors of the economy:

(a) projects for developing less-developed regions;

(b) projects for modernizing or converting undertakings or for developing fresh activities called for by the progressive establishment of the common market, where these projects are of such a size or nature that they cannot be entirely financed by the various means available in the individual Member States;

(c) projects of common interest to several Member States which are of such a size or nature that they cannot be entirely financed by the various means available in the individual Member States.

ity criteria and functions as well as their economic and financial viability.

The EIB's tasks

Under the terms of the Treaty, the EIB's function is to support, on a non-profitmaking basis, the implementation of both public- and private-sector projects, in all sectors of the economy (industry and allied steady development of the Community). Projects financed must contribute directly or indirectly towards boosting economic productivity and must accord with one or more of the following economic policy objectives:

(a) regional: this in practice means backing projects located in areas eligible for national or Community regional aid or projects of direct benefit to these areas;

Under the other eligibility criteria, the EIB can finance investment projects complying with the following priorities **irrespective of location**:

(b) projects which contribute towards attaining the Community's energy policy objectives, covering in particular investment of any kind making either for tighter control over energy consumption or reducing dependence on imported oil by boosting the development of indigenous resources while at the same time maintaining a balanced diversification policy and greater flexibility of supplies;

(c) projects developing communications between Member States (e.g. trunk roads and motorways, ports, airports, telecommunications);

(d) projects helping to protect the environment (sewerage networks, water treatment plant, domestic waste incineration facilities, installations to reduce pollution from industrial plant, etc.);

(e) projects contributing towards the development or introduction of advanced technology, assisting European industry in sharpening its competitiveness;

(f) projects which call for cooperation between companies from several Member States;

(g) productive investment by smaller enterprises (drawing on NCI resources and, under a specific parallel Decision by the EIB's Board of Governors, the Bank's own resources up to an amount of 750 MECU in each case).

An expanding role in energy

The priorities laid down for the EIB in the Treaty of Rome are couched in sufficiently flexible terms to enable the Bank to mould its activities to the Community's changing economic situation: this has certainly been the case since the 1970s with energy projects which in the wake of the two oil shocks came to assume increasing importance, continuing ever since to figure large in the Bank's activities.

Granted, the EIB has always, since its inception, been active in the energy sector: some of its very first loans in 1959 went into financing energy projects. However, at this early stage, such operations were generally deemed eligible in terms of their contribution to regional development, the majority being located in less prosperous areas of the Community's six founder members (regions such as the Mezzogiorno and Western and Southern France). Other energy projects, although not located in the less prosperous areas, also attracted financing to the extent that they involved cooperation between several Member countries: an early example of this was Vianden hydroelectric power plant and dam in the Grand Duchy of Luxembourg. Between 1958 and 1972, projects in the energy sector absorbed 17% of total Bank lending. However, with the onset of uncertainties surrounding supply, followed by the deteriorating situation on the crude-oil market, the Community felt the time had come to redouble its efforts aimed at cutting back on its energy imports, at that time predominantly based on oil, and diversifying as regards both source of energy and, insofar as possible, country of origin.

It was against this background that, well before the first oil shock, the EIB deemed that energy projects complied with the objective of 'common interest' wherever they helped in securing the Community's supplies and thus reducing its dependence on one preponderant source of energy. Following the definition of a Community energy policy in 1972-73, the Bank further broadened its eligibility criteria for energy projects, encompassing not only production and imports but also distribution and consumption. Consequently, **energy**, with the more specific goal of cutting back dependence on oil, became **an objective in itself** and not just one sector amongst many in which the EIB financed projects serving to attain its general objectives. At this point, the Bank channelled a far greater volume of funds into developing Member States' oil and natural gas deposits, especially in Italy and subsequently in the United Kingdom, as well as into nuclear and coal, peat or lignite-fired power stations, pumped storage plant and major gasline networks supplying natural gas from the Netherlands, the North Sea, the Soviet Union and Algeria.

The sustained economic growth recorded throughout the 1960s and up until 1973 and consistently rising living standards within the EEC fed through into a strong surge in energy consumption, mostly oil-based since this commodity was very cheap at the time and readily usable. Between 1950 and 1973, the Six's energy consumption tripled, climbing from 210 to 690 Mtoe per annum. In 1973, the Community of Nine was reliant on oil, largely imported, for 62% of its energy needs. Inevitably, the Community was dealt a body-blow by both the supply cuts and price rises. It was high time for a thoroughgoing reassessment of its energy strategy.

Energy supplies naturally came to take on an increasingly key role with the advent of successive oil crises, sparking off a marked expansion in the flows of finance handled by the Bank whilst broadening considerably the spectrum of projects funded. In addition, the Community's various enlargements widened the geographical footprint of EIB financing to include certain countries with a particularly high degree of dependence on the energy front, particularly in terms of oil (Greece, Portugal and Spain).

In accordance with its task of generally fostering investment contributing directly or indirectly to lessening structural disparities in the Community and promoting the economic competitiveness of businesses, the EIB has stepped up substantially the volume of its financing directed towards improving the Community's energy supplies. **With this goal in view, the EIB may finance projects irrespective of their geographical location in both the public and private sector**, wherever they contribute towards attaining Community objectives.

In very many instances, energy projects backed by the EIB also tie in with one or more other priority objectives entrusted to the Bank, particularly regional development and in some cases application of advanced technology and environmental protection. Nonetheless, the suitability of such projects for financing is judged first and foremost on whether they contribute, directly or indirectly, to the Community's objectives in the energy sphere.

Naturally, as with every project submitted for possible financing, the EIB scrutinizes closely the technical feasibility of energy schemes and also examines compliance with national legislation and Community directives, notably with respect to procurement and environmental protection. The Bank also conducts an economic appraisal of each project, encompassing, *inter alia*, an analysis of its place within an overall programme at Community and national level. This assessment looks in particular at the economic grounds for the programme as a whole and how it fits in with investment policy and current thinking on price levels against the background of the general direction of the Community's energy policy.

As already stated, particular emphasis is attached to assessing a project's environmental impact when appraising applications. The Bank may even finance investment specifically designed to bring planned or existing installations into line with current environmental protection standards, irrespective of whether or not the works concerned involve new production capacities. Hence, in recent years, the EIB has helped to fund major schemes centred on modernizing or cutting back pollution at a broad range of thermal power plants in the Federal Republic of Germany, largely by reducing harmful emissions from coal-fired power stations (Hanover, Wuppertal, Cologne, two in Saarbrücken and two in Duisburg) to within the limits laid down by legislation on combating atmospheric pollution.

Types of project and criteria

Projects contributing to the development of domestic energy resources

1. Installations for producing primary energy (oil and natural gas fields, coal and lignite mines, peat-bog workings, nuclear, hydroelectric, geothermal, solar and wind-turbine power stations, etc. and their connection to the electricity supply grid).

2. Infrastructure necessary for developing and marketing Community energy resources (e.g. facilities for the transport and storage of oil, natural gas and coal reserves; power stations fired with solid fuels produced within the Community).

3. Installations allowing the use of the Community's internal coal resources, nuclear energy, etc. such as power stations, industrial boilers and district heating facilities, pumped-storage power stations, modifications to existing industrial processes allowing the

use of solid fuels, installations required for harnessing renewable energy and nuclear fuel processing.

4. In countries where power is generated mainly by sources other than oil and natural gas, projects tending to increase the use of electricity — as a substitute for oil — in an economic and efficient manner, in accordance with Community guidelines.

5. Industries producing specific equipment necessary to avoid delaying or jeopardizing attainment of Community objectives or incorporating technological innovations which may contribute to reducing the cost of projects or to accelerating their implementation.

Criteria

1. As regards harnessing Community energy resources, the chief criterion of eligibility is a comparison between the cost of the energy produced and the cost of competitive forms of energy available, or in the evaluation of the relative economic benefits by comparison with competitive forms of energy. Where domestic resources are involved, the Bank takes into its evaluation the advantages stemming from greater security of supplies.

2. As regards new technologies, the Bank is able to support projects which can provide production or services on an industrial scale. Certain industrial demonstration projects might be accepted in the light of the likely economic benefits accruing from industrial application, provided there are sufficient grounds for supposing that the process will subsequently be used at an industrial level.

3. In the case of infrastructure, the production of specific equipment and installations contributing indirectly to developing Community resources, appraisal of projects is concerned essentially with their economic repercussions, availability of supplies and the cost of the types of energy involved. Examples of such projects include a reduction in the cost of coal resulting from implementation of a specific transport project; more efficient use of gas made possible by the construction of a storage resevoir (eliminating interruptions in supplies) and a pipeline; a reduction in the cost of production of oil and natural gas as a result of more efficient wellhead equipment, etc.

Projects serving the interests of import diversification

1. Infrastructure facilitating imports of reliable additional energy supplies for the Community replacing oil at satisfactory prices, such as transport and storage of imported natural gas and coal-handling installations.

2. Specific installations necessary to make use of imported substitutes for petroleum: power stations, coal-fired industrial boilers and boilers for district heating (new installations or conversion of existing plant); coal-fired district heating systems, natural gas distribution systems.

Criteria

1. The determining factor in the economic evaluation of projects is the comparison between the cost of energy supplied to consumers and that of the best alternative, bearing in mind the cost of imported energy, of the installations included in the investment project and of other necessary work, together with operating costs. Finally, the prospects as regards the reliability of supplies are examined, taking into account the extent to which the Community is dependent on imports from particular countries and the interest which these have in maintaining regular deliveries (the importance of the associated revenue for their own development programmes, the volume of related investment which they have to finance, etc.).

2. Account is also taken of the benefits offered by natural gas networks serving to direct gas consumption to outlets where its economic value is highest (private households, specific industrial uses). Similarly, district heating networks both enable coal to be used in place of oil for heating and, in the case of combined heat and power plants, make for substantial energy savings.

Projects fostering rational use of energy

Projects falling in this category cover a wide range of investment schemes, embracing infrastructure as well as industry, agriculture and services. Given the diverse nature of investment projects likely to contribute, in all sectors, to more rational use of energy, the following list is given purely by way of example and is by no means exclusive:

1. The infrastructure projects include in particular district heating systems, pumped-storage power stations, control centres and equipment and apparatus for interconnecting electricity grids, distribution networks for natural gas used to replace town gas, incineration plant generating electricity or heat from refuse, heat recovery and transmission systems.

2. Industrial projects eligible for financing under this heading include those designed to boost the energy efficiency of existing manufacturing processes (for example, conversion to processes requiring less energy, combined heat and power generation), reduce energy losses and recycle waste products and materials with a high energy content.

3. Eligibility is also extended to other industrial projects designed for large-scale production of equipment and materials which when in use will make for energy savings, provided that there is a growing demand for such equipment or that it incorporates technological innovations. Such projects also offer particularly valuable spin-offs inasmuch as they contribute, by trimming production costs, towards boosting productivity and sharpening the competitive edge of the businesses concerned.

Criteria

The determining factor in assessing the economic justification for an energy-saving product is the relationship between the benefits obtained and the investment cost. This is assessed in the light of the energy balance before and after the project is implemented, the effective benefits of the energy savings evaluated on the basis of the cost of the corresponding primary energy in real terms before tax and the spread of these economic benefits over a period of time (calculation of the present value over the working life of the installations concerned). The EIB calculates an internal rate of return, which serves as a yardstick for judging the economic arguments underlying the project and its opportunity cost in terms of other sources of energy or alternative investment schemes.

In the case of modifications to existing installations, the basis for comparison is the situation existing before the project's implementation. With a new installation, comparison is made with equipment in current use; there would be no justification for comparison based on technology which had become economically obsolete.

A flexible approach tailored to requirements

These general eligibility criteria are simply those most commonly arising; certain types of investment not mentioned may also qualify for financing under certain conditions. As always, the EIB adopts a pragmatic and flexible approach. It can finance any project in the energy sector, or indeed in other sectors, which accords with the Community's policy objectives on this score, for example factories producing rockwool for insulation purposes or lightweight windscreens, helping to cut down on weight and thereby trim fuel consumption in motor vehicles.

The location of projects financed provides another pointer to this flexible approach. Under its Statute, the EIB advances credit for projects within the European territories of the Member States. However, when major energy projects of importance for supplying the Community have been put on the table, the EIB has not hesitated to make use of the scope allowed under Article 18 of its Statute, to fund, having gained the unanimous approval of its Board of Governors (in practice, the Finance Ministers of the Twelve), projects located outside the territory of Member States but offering major benefits in terms of the EEC's energy objectives. Such projects include development of the Ekofisk natural gas deposits in the Norwegian sector of the North Sea, a hydroelectric scheme in Zillertal in Austria, the section of the Algeria-Tunisia-Italy gasline laid in international waters in the Mediterranean and the Trans-Austria gasline conveying Soviet natural gas across Austria to the Community.

From the point of view of financing instruments, a major contribution towards fostering attainment of Community objectives was the inception, in 1978, of global loans (essentially lines of credit) earmarked for small and medium-scale investment schemes. These global loans can be used to finance smaller-scale (minimum of 20 000 ECU per loan, or a total cost of 40 000 ECU per venture) infrastructure schemes and projects in industry, be they more energy-efficient manufacturing processes, electricity distribution projects, construction of mini power stations, insulation work, erection of solar panels, heat recovery schemes, geothermal facilities, etc.

EIB financing can cover a maximum of 50% of a project's fixed asset cost and this ceiling applies be it an individual loan or a global loan. All projects are subjected to a thorough appraisal procedure, conducted by the Bank, which looks at the technical, economic and financial aspects. Loans may be disbursed in one or more currencies, Community or non-Community, the main ones being the ECU, German mark, US dollar, Swiss franc, Dutch guilder, French franc and Italian lira, according to the borrower's wishes and the market situation. For infrastructure projects, terms of up to 20 years can be arranged, sometimes even 30 years, with a five-year grace period, depending on the type of project. Industrial projects may attract loans of up to 15 years. Bullet loans, with a single final repayment, are also a possibility.

The type of project, the borrower's status and the location have no bearing on the rate of interest charged. This is decided in the light of the term and the currencies of disbursement and hinges very much on conditions obtaining on the capital markets. The EIB has earned the highest possible credit rating, enjoying AAA status on the American market. The Bank can thus raise funds on the finest terms available on the market and, as it works on a non-profitmaking basis, can pass on the ensuing benefits to its borrowers, merely adding on a small margin of 0.15% to cover administrative costs. Although the bulk of loans are granted at fixed rates of interest, variable rate loans are also possible, depending upon the borrower's preferences and the EIB's holdings.

The impact of projects financed by the EIB under the heading of Community energy policy objectives over recent years is considerable: of the total of 11 200 MECU lent between 1983 and 1987, over 5 900 MECU went to developing indigenous resources, of which 1 900 MECU was devoted to tapping oil and natural gas deposits in Member States, chiefly Italy, 3 200 MECU to nuclear sector projects, a decline on previous years as major nuclear construction programmes are gradually nearing completion, 620 MECU to various hydroelectric schemes and 200 MECU to using lignite, coal and peat. A further 1 800 MECU was given over to import diversification (over 1 100 MECU for natural gas and almost 700 MECU for coal). On top of this, schemes to make more efficient use of energy attracted 3 600 MECU, with examples of projects here including district heating networks, combined heat and power generation, reduced energy consumption at cement works and oil refineries, and heat recovery.

Once completed, projects financed by the Bank in 1987 should help to cut the Community's dependence on oil by 13.5 Mtoe per annum. Energy projects financed by the Bank since 1983 should combine to reduce reliance on imported oil by 55 Mtoe per annum (including 18 Mtoe by making more efficient use of energy) which represents about 14% of projected annual Community imports in 1995.

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Short-term energy outlook in the European Community[1]

*Our last two forecasts for 1988 (*Energy in Europe, *Nos 9 and 10), made during a period of major economic uncertainty, were based on the working assumption that the stock market crash of October 1987 could result in a slowdown of economic activity in Europe. It is now becoming clear that this will not be the case, at least not for 1988. Under these conditions, and with an oil price which will probably be of the order of USD 16/barrel (compared with almost USD 18/barrel in 1987), overall energy demand could increase faster than previously expected in 1988.*

According to our latest forecast, assuming normal weather conditions after the first quarter, total primary energy demand in the Community could increase by 1.4% in 1988.

Due to lower prices, oil demand (gross inland consumption) may grow by about 2%, with the gas/diesel oil growing faster than other products.

Demand for solid fuels could remain at practically the same level as in 1987, or perhaps increase slightly because of some growth in the power generation sector.

Total demand for natural gas could be lower than in 1987 because of the exceptional weather conditions in the first quarter of this year.

Finally, electricity demand is likely to increase in line with GDP by some 2.5%. On the basis of new generation capacities installed, nuclear production could grow a little faster than in 1987 (3.5%).

*A summary of the main assumptions used in the preparation of this forecast and the results is given in Table 1 (**see p. 68**).*

Data for 1987

First provisional data for 1987 show an increase of total primary energy demand in the Community of 1.2%. This figure, if confirmed, reflects a higher than expected growth of energy consumption during the last quarter of 1987.

This considerable increase in energy consumption during the fourth quarter (more than 5% higher than in the same quarter of 1986) is, in great part, explained by three factors: a higher than anticipated level of economic activity, a fall in real energy prices, and climatic conditions (21 more degree-days than the same period of 1986, but still significantly less than average).

As has already been pointed out in our previous issues, the two main characteristics of 1987 were an impressive growth of natural gas consumption (6.5%) and a slower growth rate in the nuclear sector.

Main working assumptions

The main working assumptions underlying our 1988 forecasts are presented in Table 2 (see also Graphs 1 and 2).

It is now becoming increasingly clear that the stock market events of October 1987 have not affected economic activity in 1988 as much as had been feared. In line with the latest available estimates of the Commission's Directorate-General for Economic Affairs, our assumption is that the average GDP growth rate in EUR 12 for 1988 will be of the order of 2.5%.

Internal demand is expected to grow even faster. A 3.3% growth rate is assumed for private consumption.

Our working assumption on the average import price of crude oil (cif) remains the same as in the previous issue, USD 16/barrel for 1988. Denoted in ECU terms, this as-

[1] Manuscript completed on 17 June 1988.

sumption means a 20% decline in the average imported crude-oil price, compared to 1987.

The oil price

During the last months, world oil prices were under an intense downward pressure. The average import price (cif) for EUR 12 decreased by more than USD 3 between November 1987 (USD 18.1/b) and March 1988 (USD 14.9/b).

This situation can be partly explained by the perception of an oil supply surplus, created by the relative failure of OPEC members to restrain their production during late 1987 and beginning of 1988, while consumers were largely using their stocks: total OPEC production (including NGL) in the first quarter of 1988 is estimated at 19.2 Mbd, compared to 17.3 Mbd during the same quarter of 1987.

In our forecast, we assume a gradual tightening of the market, as a result of slowly increasing demand, leading to a USD 17/b price by the fourth quarter of 1987 (Table 3 and Graph 2).

Final energy prices

Table 3 shows the evolution of final consumer prices for different fuels.

Average prices of oil products, after a slight increase during the first three quarters of 1987, have decreased during the fourth quarter and the beginning of 1988. On a yearly basis they were slightly lower in 1987 than in 1986. Deriving from our assumption for crude-oil prices, we expect another slight decrease during 1988.

Statistical information actually available for internal final prices of other forms of energy is not, for the moment, very satisfactory. However, despite the statistical limitations, some general trends can be traced.

Because of time-lags in the link between oil and gas prices, the prices of natural gas fell sharply at the beginning of 1987. A further, but less substantial decrease can be expected for 1988.

Although the average price of imported steam coal was in 1987 more than USD 5/tce lower than in 1986, inland final prices of hard coal decreased only slightly. A relative stabilization of coal prices is now assumed for 1988.

Overall energy

As indicated earlier, first estimates for 1987 show a rapid increase of energy consumption in the fourth quarter of 1987. But because there is only limited statistical information it is difficult, for the moment, to understand fully the exact reasons for this outcome. Nevertheless, deliveries data seem to indicate that demand from both the industrial and transportation sectors was growing. Box B compares this outcome with our previous forecasts published in the last issue of *Energy in Europe.*

The new perception of economic activity during 1988 is the main factor underlying our present forecast.

Under the combined effects of higher growth and lower oil prices, oil consumption may grow rapidly during the first half of 1988, approaching 2% for the whole year. At the same time, global consumption of hard coal could remain at the same levels, even if consumption for power generation could continue to grow. Natural gas demand has been seriously affected by the mild weather during the first months of 1988 and seems unlikely to reach its high level of 1987. Finally, due to new capacities, production of nuclear power could start to grow faster during the second part of the year, reaching an average annual growth rate of 3.5%.

The overall picture now emerging for 1988 is, therefore, one of relatively important growth of total energy demand after the first quarter of the year (Table 4 and Graph 3). In annual terms, total energy consumption could grow by about 1.4%. In that case, the global energy ratio, defined as the ratio between total primary energy consumption and GDP, could decline by about 1% (Table 1).

Net imports as a proportion of total primary energy consumption in 1988 could be around 45%, slightly higher than in 1987 (Table 4).

Oil

Oil demand for all products, with the notable exception of heavy fuel oil, surged during the last quarter of 1987. Total inland deliveries increased by more than 4%, compared with the fourth quarter of 1986 (Tables 5 and 8, Graph 5). This growth came mainly from the transportation sector and the 'other products', covering partly non-energy industrial uses.

Prospects for oil deliveries in 1988, by product, are as follows:

After a significant increase of new car purchases, and a moderate fall of real prices, motor gasoline deliveries could grow rapidly during the first half of 1988 (Graph 6). Provisional data, from some countries, tend to confirm this trend. In the UK, for example, motor spirit deliveries rose by 9.4% during the first quarter of 1988, compared to the same quarter of 1987. On an annual basis, an overall 1.8% increase for EUR 12 is expected.

For similar reasons, demand for transportation diesel oil is growing fast. French data, for example, show a 15% increase for the first four months of 1988. Demand for aviation kerosene is also growing fast.

Demand for heating oil early in the year was certainly affected by the climate. However, due to a certain cyclical phenomenon related to consumer stocks, which unfortunately is very difficult to quantify, we could expect an important increase of deliveries during 1988. Total deliveries of gas/diesel oil in 1988 could increase by 4% (Graph 7).

On the other hand, deliveries of fuel oil could decrease again (Graph 8). The structural reasons explaining this phenomenon were discussed in the December 1987 issue of *Energy in Europe* No 9.

It is difficult to have a clear idea regarding the 'other' oil products, which represent a very heterogeneous group. We expect a small growth in deliveries, mainly in the first part of the year.

In conclusion, total inland oil deliveries could rise in 1988 by 8 Mt or 1.8%. In terms of gross inland consumption, total oil demand may rise by more than 9 Mt, or 2%. Given a small decline in production (about 1 Mt) and a probable decrease in stocks, net imports could increase by 5 to 6 Mt (Table 5).

Finally, it should be noted that as a result of the shift to lighter products, the above growth rate for gross inland consumption is slightly higher when expressed in terms of 'toe' (Tables 4, 8 and 9).

Natural gas

Gross inland consumption of natural gas increased rapidly during 1987 (Table 5 and Graph 9). Different factors could explain this phenomenon: favourable movements of relative prices (mainly during the first half of the year) weather conditions, development of the grid, etc.

During the first quarter of 1988, exceptional weather conditions affected the demand for natural gas. Provisional data for some countries show a 10 to 15% decrease in total natural gas sales. However, the other factors generating high levels of demand for natural gas still prevail. For this reason, we can expect a revitalized demand for natural gas during the second part of the year. In annual terms however, total consumption during 1988 could be down 1.5% from 1987.

Solid fuels

As has been noted in previous issues of *Energy in Europe*, a statistical change made at the beginning of 1987, to include the black lignite produced in Spain under the hard coal figures, is affecting the data for solid fuels which are therefore not directly comparable with those of 1986.

Available data for 1987 (Table 6 and Graph 10) show a substantial decrease in total inland deliveries of hard coal. With the exception of the industrial sector, all other uses were affected, especially coking plants and domestic consumption. However, data for deliveries do not reflect exactly the situation of real consumption (Box A). Stock changes in power plants must be considered. According to provisional estimates, stocks of hard coal in power plants decreased in 1987 by 4 Mt after an increase in 1986 of more than 8 Mt. In other words, when those stock movements are taken into account, the resulting consumption of hard coal by power stations would seem to be higher in 1987.

If, however, we adjust the 1986 figures by adding production of Spanish lignite, total consumption in 1987 appears to be 2 to 3 Mt less than in 1986.

According to our actual forecast, consumption of hard coal by the industrial sector and by the power stations will continue to grow in 1988. For that reason gross inland consumption could remain at the same levels as in 1987. However, due to a decrease in production, estimated at 4 to 5 Mt, and a smaller decrease of stocks, net imports could increase by 8 Mt.

Provisional data for 1987 show an important decrease of lignite production in the fourth quarter of 1987 (Table 6) but those data are not yet confirmed. In our forecast, we consider a return to a more 'normal' production path in 1988.

Under these assumptions, total consumption of solid fuels, expressed in terms of oil equivalent, may slightly increase in 1988.

Electricity

Electricity demand in the Community increased in 1987 by 3.3% (Tables 7 and 9 and Graph 11). Given the GDP growth, estimated at 2.6%, the overall 'electricity intensity' rose in 1987. A part of this evolution is certainly attributable to the weather conditions during the first quarter of the year.

The main characteristic of the electricity sector during the last year is the slower growth rate of the nuclear sector. Gross production of electricity from nuclear plants grew, in 1987, by only 3%, against 8.1% in 1986 and total production of nuclear heat increased by only 2.8% against 6.8% in 1986. Different factors explain this situation: a relative slackening in the pace of new plant commissioning, the Italian referendum, maintenance closures, etc. For example, in the UK, production of nuclear heat decreased by more than 5%.

A 2.5% growth in electricity demand is forecast in 1988. On the basis of officially announced new installations of nuclear plants, a 3.5% increase in the production of nuclear heat is expected.

New tables and definitions

From this issue, the short-term outlook is presented in nine tables, giving quarterly and annual data. In all tables, observed values are printed in **bold face** and forecasts in *italic*.

These tables are:

Table 1: Summary of main assumptions and results, on an annual basis.

Table 2: Macroeconomic, oil price and weather assumptions.

Macroeconomic variables are based on Eurostat figures, the average import oil price and degree days have been estimated by DG XVII.

Table 3: Energy prices.

These figures are based on data collected by DG XVII and by the OECD.

Tables 4-7: These tables replace Tables 1 to 5 in the previous edition.

As was explained in *Energy in Europe* No 9, the main source of these data is the monthly Eurostat publication 'Energy: Monthly statistics'. However, in some cases, slight adjustments to the original data have been made.

Due to important differences when compared with published annual balance sheets, a new line called 'Adjustment to annual figures' has been added in Table 4 (for all fuels), Table 5 (for oil and natural gas), Table 6 (for hard coal) and Table 7 (for heat). This line corresponds to the difference between apparent consumption, as estimated by the following equation below, and gross inland consumption, as published in the annual balance sheets for the period 1984-86 (last revision, May 1988).

Apparent consumption = primary production + recovered production + net imports − change in stocks − bunkers (oil only)

The figures for apparent consumption in Table 4 correspond to those of gross inland consumption in former Tables 1 and 2.

Table 4: Primary energy balance.

This table corresponds to the former Tables 1 and 2. The data in those tables were calculated directly from the monthly data in specific units and, for the moment, they do not correspond totally to the quarterly balance sheets published by Eurostat and based on a country-by-country calculation.

Two main modifications have been made to these tables: an adjustment to annual data (see the above discussion), and the inclusion of a new line called 'Others', following the definition adopted by Eurostat in its annual energy balance sheets. A minor modification is also made in the nuclear sector, now called 'heat'. Following the Eurostat methodology, Italian geothermal heat is also added in this line. In that way, total production of heat is somewhat greater than the production of nuclear heat (see also Table 7).

Table 5: Oil and natural gas.

Table 5 corresponds to former Table 3. Apart from quarterly information and adjustment to annual gross inland consumption, some additional lines are given: Input and production of refineries and an estimation of final consumption, calculated using the following equation:

Final consumption = total inland deliveries − (total transformation input − input to refineries)

The information makes it possible to identify the relationship between gross inland consumption and deliveries:

Gross inland consumption = total inland deliveries + (input to refineries − net output of refineries) + statistical difference

Table 6: Solid fuels.

Table 6 corresponds to former Table 4. Apart from quarterly information and adjustment to annual gross inland consumption, some additional lines for hard coal are given:

Final consumption = (deliveries to households + patent fuels) + (deliveries to all industries + 'other' deliveries − transformation for power generation in industry)

The information makes it possible to identify the relationship between gross inland consumption and deliveries:

Gross inland consumption = total inland deliveries − change in stocks in power plants + statistical difference

Total consumption in power plants is given by the equation:

Consumption in power stations = deliveries to power plants + transformation for power generation in industry − change in stocks in power plants

Table 7: Electricity and heat.

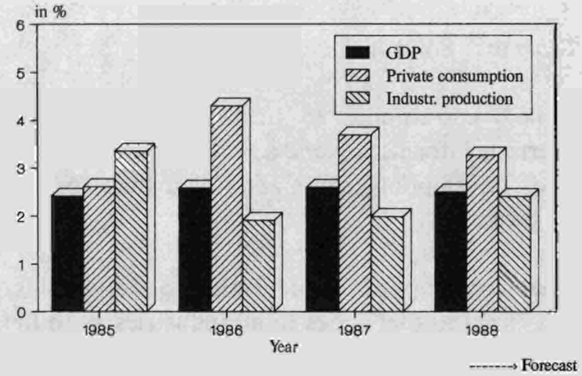
Table 7 corresponds to former Table 5. Apart from quarterly information, some additional lines give the flow from gross generation to estimated final consumption of electricity.

The difference between production of nuclear heat and total production of heat corresponds to the Italian production of geothermal heat used for the production of electricity.

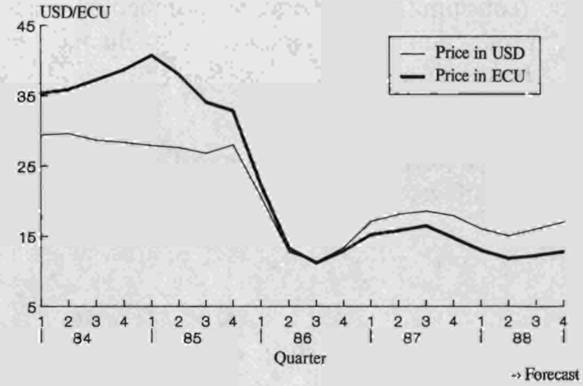
Tables 8 and 9: Main variables: Quarterly growth rates

Table 8 presents the quarterly growth rates for main variables relative to the same quarter of the previous year.

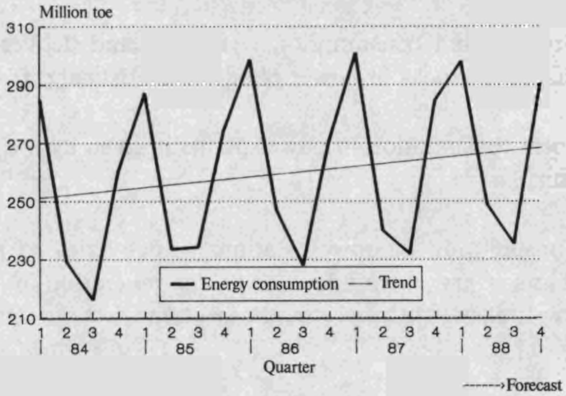
Graph 1 — EUR 12: Macroeconomic indicators Annual percentage change



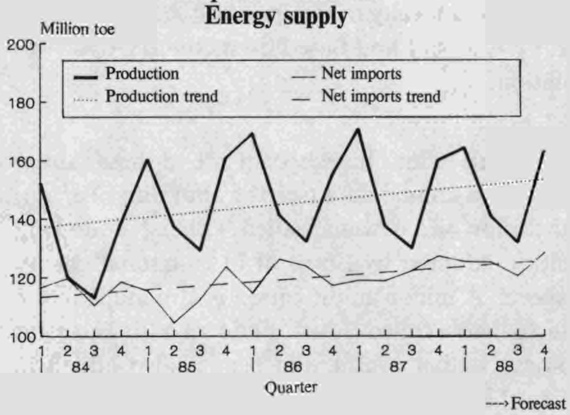
Graph 2 — EUR 12: Average crude oil import price/barrel (cif)



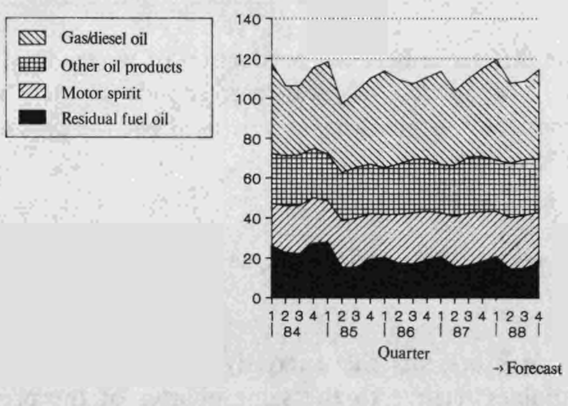
Graph 3 — EUR 12: Total gross inland energy consumption



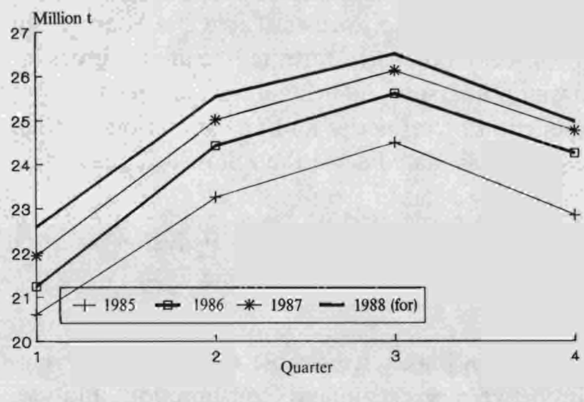
Graph 4 — EUR 12: Energy supply



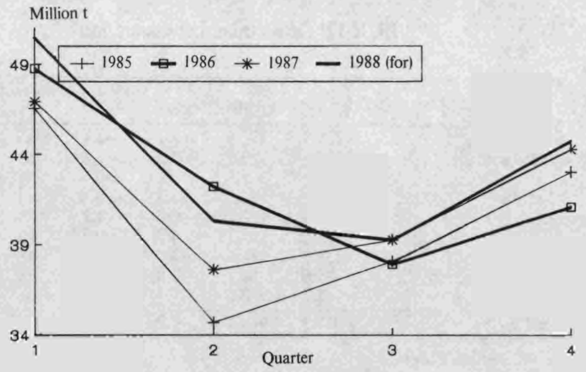
Graph 5 — EUR 12: Total inland oil deliveries



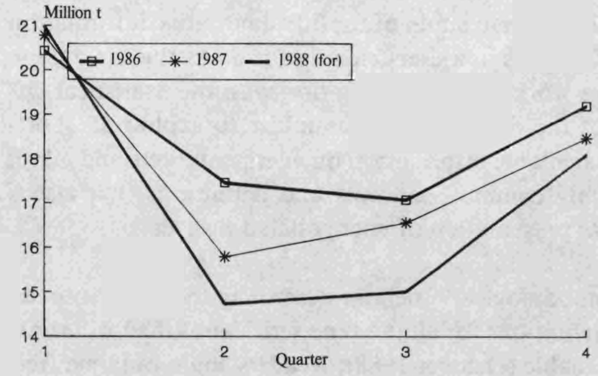
Graph 6 — EUR 12: Motor spirit (gasoline) Inland deliveries



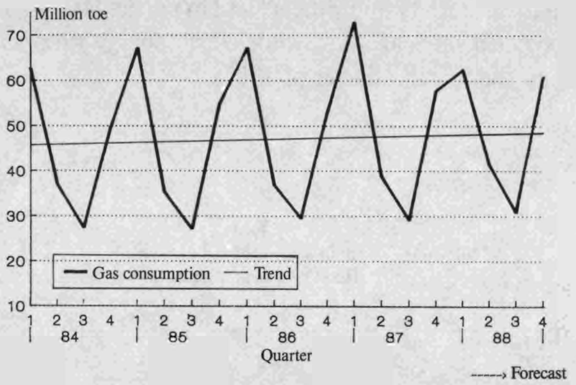
Graph 7 — EUR 12:
Gas/diesel oil
Inland deliveries



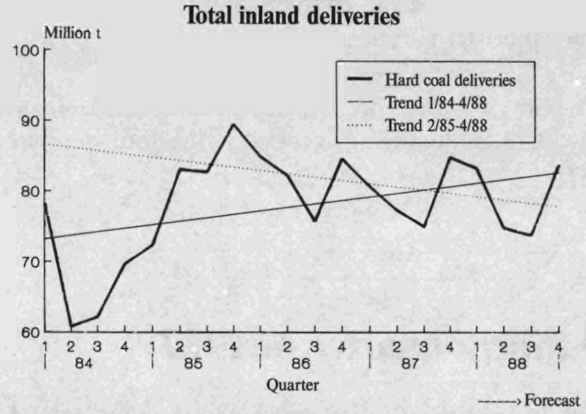
Graph 8 — EUR 12:
Residual fuel oil
Inland deliveries



Graph 9 — EUR 12:
Natural gas — Gross inland consumption



Graph 10 — EUR 12:
Hard coal
Total inland deliveries



Graph 11 — EUR 12:
Electricity
Production and consumption

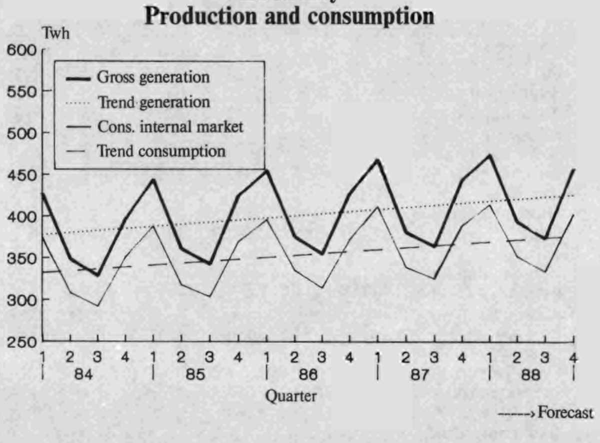


Table 9 presents quarterly **to date** growth rates for the same variables.

We are continuously trying to improve the contents and the presentation of our short- term outlook. Our goal is to publish a maximum of useful quantitative information and forecasts in a user-friendly form. At the same time, we are working in collaboration with the Statistical Office of the European Communities to exploit all short-term available information on energy markets and adopt not only common concepts and definitions, but also a similar presentation of energy balance sheets.

A methodological brochure describing the exact sources and definitions for all the time series published will soon be available (October 1988). Readers could obtain a free copy on request from the Editor (see address inside front cover).

We should be happy to receive readers' remarks and proposals concerning the contents and the presentation of future short-term outlooks.

This report is based on statistical data available at 25 May 1988 and covering, generally, the four quarters of 1987.

The fourth quarter of 1987

According to provisional data, total gross inland consumption of energy in 1987 was 9.2 Mtoe higher than expected when we published *Energy in Europe* No 10.

This difference is due to a higher than anticipated growth during the fourth quarter of 1987.

The following table divides this difference into three elements:

(1) data revisions and adjustments for the first three quarters of 1987;

(2) different effects to those expected of 'exogenous' variables (economic activity, oil price and weather). This column has been obtained by running the same version of the STEM 12 model, used in the preparation of the short-term outlook published in *Energy in Europe* No 10 and replacing the values for the main exogenous variables by their observed values;

(3) remaining difference, which corresponds to the effect of other factors.

EUR 12: Gross inland consumption

Mtoe

	1987			Difference		
	EE 11	EE 10	Total	(1)	(2)	(3)
Solids	229.9	232.6	—2.7	—2.4	0.9	—1.2
Hard coal	199.1	199.6	—0.5	—1.1	0.8	—0.2
Coke	—1.2	—1.3	0.1	—0.6	0.0	0.7
Lignite	31.9	34.2	—2.3	—0.8	0.1	—1.6
Oil	471.9	472.2	—0.3	—1.2	0.4	0.5
Natural gas	198.9	194.2	4.7	0.2	3.2	1.3
Heat	138.3	134.6	3.7	1.4	0.0	2.3
Primary electricity	16.6	14.6	2.0	0.5	0.0	1.5
Other	1.7	0.0	1.7	1.3	0.0	0.4
Total	1 057.3	1 048.1	9.2	—0.2	4.5	4.9

EE: *Energy in Europe.*
(1) Data revisions and adjustments, first three quarters.
(2) Effect of 'exogenous' factors.
(3) Other: Total difference —(1) —(2)

As can be seen from this table, only 4.5 Mtoe can be mechanically explained by the difference in 'exogenous' factors. Another 4.2 Mtoe come from the electricity sector (heat, primary electricity and 'others') and in particular, a higher than expected nuclear and hydroelectric energy production during the fourth quarter of 1987.

Table 1:
Summary of main assumptions and results — EUR 12
(Last revision: 9 June 1988)

	1985	1986	1987	1988	*Annual % change* 1986	1987	1988
I. Main assumptions							
GDP (1980=100)	107.0	109.8	112.6	115.4	2.6	2.6	2.5
Private consumption (1980=100)	107.5	112.1	116.2	120.0	4.3	3.7	3.3
Industrial production (1980=100)	103.4	105.3	107.4	110.0	1.9	2.0	2.4
Consumer prices (1980=100)	153.6	159.1	163.7	168.7	3.6	2.8	3.1
Imported crude-oil price							
(USD / b)	27.54	14.51	17.93	16.00	-47.3	23.6	-10.8
(ECU / b)	36.40	14.91	15.55	12.44	-59.0	4.2	-20.0
II. Main results							
Oil							
Total inland deliveries (Mt)	429.2	441.1	442.7	450.7	2.8	0.3	1.8
Hard coal							
Total inland deliveries (Mt)	327.5	327.3	317.4	315.2	-0.1	-3.0	-0.7
Natural gas							
Gross consumption (Mtoe)	184.5	186.8	198.9	195.9	1.3	6.5	-1.5
Electricity							
Consumption internal market (Twh)	1 377.9	1 415.7	1 462.6	1 499.7	2.7	3.3	2.5
Nuclear heat							
Production (Twh)	1 440.3	1 537.5	1 580.4	1 635.7	6.8	2.8	3.5
Total energy							
Gross inland consumption (Mtoe)	1 029.5	1 044.2	1 057.3	1 072.5	1.4	1.2	1.4
Energy ratio							
Total gross inland consumption/GDP (1984 * 100)	101.4	100.3	99.0	98.0	-1.1	-1.3	-1.0

Table 2
Macroeconomic, oil price, and weather assumptions — EUR 12
(Data available: 25 May 1988)

											Year		
	1 Q 87	2 Q 87	3 Q 87	4 Q 87	1 Q 88	2 Q 88	3 Q 88	4 Q 88	1984	1985	1986	1987	1988
A. Macroeconomic variables													
1. Gross domestic product (GDP) (1980 = 100)	111.2	111.9	113.4	114.1	114.5	115.0	115.8	116.5	104.5	107.0	109.8	112.6	115.4
Percentage change													
from prior year	2.7	2.0	3.0	2.7	3.0	2.8	2.1	2.1		**2.4**	2.6	2.6	2.5
from prior quarter (x4)	0.4	2.5	5.5	2.5	1.4	1.7	2.7	2.5					
2. Private consumption (1980 = 100)	114.0	115.6	117.1	118.0	118.6	119.4	120.5	1 21.5	104.7	107.5	112.1	116.2	120.0
Percentage change													
from prior year	3.5	3.2	3.8	4.1	4.0	3.3	2.9	2.9		**2.6**	4.3	3.7	3.3
from prior quarter (x4)	2.4	5.6	5.1	3.2	1.9	2.9	3.5	3.2					
3. Industrial production (1980 = 100)	109.4	109.4	97.4	113.5	113.1	111.8	99.3	115.9	100.0	103.4	105.3	107.4	110.0
Percentage change													
from prior year	1.3	1.8	1.9	3.0	3.4	2.2	1.9	2.1		**3.4**	1.9	2.0	2.4
from prior quarter (x4)	-2.9	0.0	-43.9	66.1	-1.4	-4.6	-44.9	67.0					
4. Iron and steel industry (1980 = 100)	90.8	96.1	84.3	94.5	100.4	97.0	85.1	95.4	94.2	96.7	91.9	91.4	94.5
Percentage change													
from prior year	-6.6	-2.0	2.2	4.9	10.6	1.0	1.0	1.0		**2.6**	-4.9	0.6	3.4
from prior quarter (x4)	3.3	23.2	-49.0	48.4	25.1	-13.6	-49.0	48.4					
5. Chemical industry, SA (1980 = 100)	116.6	119.1	120.7	121.0	122.7	124.1	124.3	124.4	111.3	115.2	115.8	119.4	123.9
Percentage change													
from prior year	1.3	2.8	4.6	3.5	5.2	4.2	3.0	2.8		**3.5**	0.5	3.0	3.8
from prior quarter	-1.0	8.6	5.4	1.0	5.5	4.7	0.7	0.2					
6. Consumer price index (1980 = 100)	162.1	163.4	164.0	165.1	166.1	168.8	169.4	170.5	144.8	153.6	159.1	163.7	168.7
Percentage change													
from prior year	2.9	2.9	2.9	2.7	2.5	3.3	3.3	3.3	6.1	3.6	2.8	3.1	
from prior quarter (x4)	3.5	3.2	1.5	2.7	2.4	6.5	1.5	2.7					
7. Exchange rate (1 ECU = xx USD)	1.125.0	1.150.0	1.128.0	1.214.0	1.233.0	1.270.0	1.310.0	1.330.0	0.790.0	0.762.0	0.983.0	1.154.0	1.286.0
B. Oil price													
Imported crude oil (cif, US D/barrel)	17.12	18.13	18.58	17.88	15.99	15.00	16.00	17.00	28.98	27.54	14.51	17.93	16.00
C. Weather													
Degree days	1 451	401	0	924	1 134	431	0	1 012	2 748	2 806	2 711	2 776	2 577
Difference from average	195	-30	0	-88	-122	0	0	0	49	107	12	77	-122

Source: Eurostat, DG XVII.

Table 3
Energy prices — EUR 12
(Last revision: 9 June 1988)

											Year		
	1 Q 87	2 Q 87	3 Q 87	4 Q 87	1 Q 88	2 Q 88	3 Q 88	4 Q 88	1984	1985	1986	1987	1988
1. Imported crude oil (cif)													
USD/barrel	17.12	18.13	18.58	17.88	15.99	15.00	16.00	17.00	28.98	27.54	14.51	17.93	16.00
ECU/barrel	15.22	15.77	16.47	14.73	12.97	11.81	12.21	12.78	36.77	36.40	14.91	15.55	12.44
Growth rate from previous quarter, in %													
USD/barrel	27.8	5.9	2.5	-3.8	-10.6	-6.2	6.7	6.3		-5.0	-47.3	23.6	-10.8
ECU/barrel	17.9	3.6	4.5	-10.6	-11.9	-8.9	3.4	4.7		-1.0	-59.0	4.2	-20.0
Real prices in ECU													
(in 1980 prices)	9.4	9.6	10.0	8.9	7.8	7.0	7.2	7.5	25.4	23.7	9.4	9.5	7.4
(in 1986 prices)	14.9	15.4	16.0	14.2	12.4	11.1	11.5	11.9	40.4	37.8	14.9	15.1	11.7
Growth rate from previous quarter, in %													
(in real ECU)	16.9	2.8	4.1	-11.2	-12.5	-10.4	3.0	4.0		-6.5	-60.4	1.2	-22.3
2. Imported steam coal													
USD/tce	43.20	44.00	42.49	42.85	43.61	44.34	44.59	44.33	50.98	51.60	48.30	43.14	44.22
ECU/tce	38.40	38.26	37.67	35.30	35.37	34.91	34.04	33.33	64.70	68.15	49.30	37.41	34.41
3. Oil products — final consumer prices													
Gasoline (ECU/1 000 lt)	609.4	621.1	624.8	614.6	601.6	598.6	598.7	600.5	722.2	752.4	624.5	617.5	599.8
Diesel (ECU/1 000 lt)	384.6	382.6	390.2	387.8	403.7				481.4	505.9	396.4	386.3	403.7
Heating oil (ECU/1 000 lt)	243.1	236.4	256.2	245.9	229.0	223.8	223.8	226.2	370.3	395.8	258.0	245.4	225.7
Residual fuel oil (ECU/t)	110.0	115.7	127.0	112.5	91.3	101.2	101.1	103.6	242.4	243.4	122.1	116.3	99.3
Growth rate from previous quarter, in %													
Gasoline	1.5	1.9	0.6	-1.6	-2.1	-0.5	0.0	0.3		4.2	-17.0	-1.1	-2.9
Diesel	6.0	-0.5	2.0	-0.6	4.1					5.1	-21.6	-2.5	
Heating oil	8.0	-2.8	8.4	-4.1	-6.8	-2.3	0.0	1.0		6.9	-34.8	-4.9	-8.0
Residual fuel oil	4.2	5.2	9.8	-11.4	-18.9	10.8	-0.2	2.5		0.4	-49.8	-4.8	-14.6
4. Natural gas — final consumer prices													
Households (1984 = 100)	84.9	84.6	83.7	83.1	80.4	80.3	80.0	72.1	103.2	108.2	101.0	84.0	78.2
Industry (1984 = 100)	69.8	67.7	67.7	67.6	66.1	63.9	61.6	60.2	103.9	112.8	93.1	68.2	63.0
Growth rate from previous quarter, in %													
Households	-8.2	-0.3	-1.1	-0.7	-3.2	-0.2	-0.3	-9.9		4.9	-6.7	-16.7	-6.9
Industry	-8.1	-3.0	-0.1	0.0	-2.3	-3.3	-3.6	-2.3		8.5	-17.5	-26.7	-7.7

(cont'd)													
5. Coal — final consumer prices													
Households (ECU/t)	196.0	191.3	196.2	195.1	193.3	186.2	179.5	178.8	193.8	203.6	199.1	194.6	184.4
Industry (ECU/t)	88.8	88.9	90.0	90.1	89.9	88.3	88.5	88.7	94.1	96.6	92.7	89.5	88.8
Growth rate from previous quarter, in %													
Households	0.0	-2.4	2.6	-0.6	-0.9	-3.7	-3.6	-0.4		5.1	-2.2	-2.2	-5.2
Industry	-0.8	0.1	1.2	0.1	-0.3	-1.8	0.2	0.2		2.7	-4.1	-3.5	-0.7

Sources: IEA; DG XVII estimates.

Table 4
Primary energy balance — EUR 12
(Last revision: 9 June 1988)

Mtoe

	1 Q 87	2 Q 87	3 Q 87	4 Q 87	1 Q 88	2 Q 88	3 Q 88	4 Q 88	1984	1985	Year 1986	1987	1988
Primary production													
Solid fuels:	43.6	41.4	38.9	42.7	43.1	40.7	38.3	43.3	145.0	169.7	173.5	166.6	165.4
Hard coal	35.5	33.8	31.0	35.4	34.8	33.1	30.4	34.7	107.4	133.8	139.6	135.7	133.0
Lignite	8.1	7.6	7.9	7.3	8.4	7.6	7.9	8.5	37.6	35.9	33.9	30.9	32.4
Oil	37.7	35.1	37.0	38.2	37.6	35.2	37.1	37.2	145.5	149.2	150.1	148.0	147.1
Natural gas	46.6	25.7	19.5	36.7	41.0	26.7	20.3	39.6	119.4	126.7	123.6	128.5	127.6
Heat	38.9	30.9	30.5	38.0	37.9	33.0	32.3	39.7	97.8	126.0	134.4	138.3	143.1
Primary electricity	3.4	4.0	3.5	3.9	4.1	4.7	3.3	2.6	14.8	14.4	14.0	14.8	14.7
Other	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	1.6	1.7	1.7	1.7	1.7
Total	170.7	137.4	129.8	159.9	164.1	140.7	131.7	162.9	524.0	587.5	597.4	597.9	599.5
Recovered production													
Hard coal	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	2.4	3.3	3.1	2.0	2.0
Oil	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.3	1.6	1.2	1.3
Total	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	2.6	3.6	4.7	3.2	3.3
Net imports													
Solid fuels:	14.1	14.5	14.5	15.1	17.5	13.7	16.4	17.7	56.4	62.1	59.4	58.2	65.4
Hard coal	13.9	14.3	14.6	14.7	16.9	14.1	16.8	16.5	55.8	62.3	59.3	57.5	64.3
Oil	85.1	85.3	93.3	91.7	90.7	92.3	88.2	91.9	349.8	333.3	356.2	355.4	363.1
Natural gas	19.6	18.3	13.7	20.1	17.6	18.0	15.0	18.1	57.3	59.4	64.8	71.8	68.7
Electricity	0.2	0.5	0.7	0.3	-0.6	1.0	0.7	0.5	1.5	1.2	1.3	1.8	1.6
Total	119.0	118.7	122.2	127.3	125.2	125.0	120.3	128.3	465.1	456.0	481.6	487.1	498.8
Change in stocks													
Solid fuels:	-5.2	2.5	2.8	-3.2	-4.1	2.3	4.1	-1.5	-14.9	-5.0	6.2	-3.1	0.7
Hard coal	-5.1	2.5	2.0	-3.2	-4.6	2.1	3.4	-2.2	-12.2	-1.3	4.9	-3.9	-1.3
Coke	0.2	0.1	0.7	-0.2	0.5	0.1	0.6	0.6	-3.5	-2.6	1.5	0.8	1.8
Oil	-5.2	2.1	6.2	0.1	-7.5	4.2	1.2	-1.3	-3.5	0.7	3.7	3.1	-3.5
Natural gas	-6.8	5.2	4.1	-1.1	-3.8	3.2	4.3	-3.3	0.4	1.6	1.6	1.4	0.4
Total	-17.3	9.8	13.1	-4.2	-15.4	9.7	9.6	-6.2	-18.1	-2.7	11.6	1.4	-2.4
Bunkers	6.9	7.2	7.8	7.6	7.7	8.1	7.9	7.8	23.8	26.2	30.5	29.5	31.5
Apparent gross consumption													
Solid fuels:	63.4	53.9	51.1	61.6	65.3	52.6	51.1	63.1	218.8	240.0	229.7	229.9	232.0
Hard coal	55.0	46.2	44.1	53.8	56.8	45.6	44.2	53.9	177.8	200.7	197.1	199.1	200.5
Coke	-0.4	-0.1	-0.9	0.2	-0.3	-0.4	-1.0	0.0	2.7	1.2	-2.6	-1.2	-1.7
Lignite	8.7	7.8	7.8	7.6	8.7	7.4	7.9	9.1	38.3	38.1	35.2	31.9	33.2
Oil	121.4	111.4	116.6	122.5	128.3	115.6	116.6	123.0	475.3	455.9	473.7	471.9	483.5
Natural gas	73.1	38.8	29.2	57.9	62.5	41.5	30.9	61.0	176.2	184.5	186.8	198.9	195.9
Heat	38.9	30.9	30.5	38.0	37.9	33.0	32.3	39.7	97.8	126.0	134.4	138.3	143.1
Primary electricity	3.6	4.5	4.2	4.2	3.5	5.6	4.0	3.1	16.3	15.6	15.3	16.6	16.3
Other	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	1.6	1.7	1.7	1.7	1.7
Total	300.8	240.0	231.9	284.6	297.9	248.8	235.4	290.4	986.0	1023.6	1041.7	1057.3	1072.5
Adjustment to annual figures													
Solid fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	-1.1	1.9	0.0	0.0
Oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.1	7.0	0.5	0.0	0.0
Natural gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0
Nuclear	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	-0.2	0.1	0.0	0.0
Primary electricity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	5.9	2.6	0.0	0.0
Gross inland consumption													
Solid fuels	63.4	53.9	51.1	61.6	65.3	52.6	51.1	63.1	219.4	238.9	231.7	229.9	232.0
Oil	121.4	111.4	116.6	122.5	128.3	115.6	116.6	123.0	472.3	462.8	474.3	471.9	483.5
Natural gas	73.1	38.8	29.2	57.9	62.5	41.5	30.9	61.0	176.7	184.7	186.8	198.9	195.9
Nuclear	38.9	30.9	30.5	38.0	37.9	33.0	32.3	39.7	104.4	125.7	134.4	138.3	143.1
Primary electricity	3.6	4.5	4.2	4.2	3.5	5.6	4.0	3.1	16.6	15.8	15.4	16.6	16.3
Other	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	1.6	1.7	1.7	1.7	1.7
Total	300.8	240.0	231.9	284.6	297.9	248.8	235.4	290.4	990.9	1 029.5	1 044.2	1 057.3	1 072.5
Net imports as % of consumption													
Hard coal	25.2	31.0	33.2	27.3	29.7	30.9	37.9	30.6	31.4	31.0	30.1	28.9	32.0
Oil	66.3	71.9	75.0	70.5	66.6	74.6	70.9	70.3	70.1	69.1	70.6	70.9	70.5
Natural gas	26.9	47.3	47.0	34.8	28.2	43.4	48.5	29.7	32.5	32.2	34.7	36.1	35.1
Total	38.7	48.0	51.0	43.5	41.0	48.7	49.5	43.0	46.1	43.4	44.9	44.8	45.2
Oil imports as % of total energy consumption	27.6	34.5	38.9	31.4	29.7	35.9	36.3	30.8	34.6	31.7	33.2	32.7	32.9

Table 5
Oil and natural gas: supply and disposal — EUR 12
(Last revision: 9 June 1988)

	1 Q 87	2 Q 87	3 Q 87	4 Q 87	1 Q 88	2 Q 88	3 Q 88	4 Q 88	Year 1984	1985	1986	1987	1988
1. Oil (Mt)													
Primary production	37.5	35.0	36.9	38.1	37.4	35.2	37.0	37.0	144.2	147.9	150.0	147.5	146.7
of which: crude	35.8	33.4	35.4	36.7	35.8	33.6	35.5	35.4	140.3	144.2	143.7	141.2	140.3
Change in stocks	-5.4	2.1	6.3	0.1	-7.4	4.1	1.2	-1.3	-3.5	0.7	3.8	3.1	-3.5
Net imports	84.9	85.1	93.0	91.5	89.9	91.6	87.5	91.2	349.5	332.6	355.4	354.6	360.2
Bunkers	7.1	7.4	8.0	7.9	8.0	8.4	8.1	8.1	24.5	27.0	31.4	30.4	32.5
Apparent consumption	120.7	110.6	115.6	121.7	126.9	114.2	115.2	121.5	472.7	452.9	470.2	468.5	477.9
Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.3	7.3	0.7	0.0	0.0
Gross inland consumption	120.7	110.6	115.6	121.7	126.9	114.2	115.2	121.5	470.4	460.1	470.9	468.5	477.9
Transformation input	125.1	119.3	129.7	133.4	133.7	124.0	125.4	126.6	517.7	492.1	515.6	507.6	509.7
of which:													
Refineries	113.3	110.7	120.4	122.8	120.9	115.9	115.8	114.9	462.3	448.9	476.1	467.1	467.5
Power generation	11.3	8.2	8.7	10.1	12.3	7.6	9.0	11.2	52.9	41.1	37.3	38.3	40.1
Refineries gross output	112.7	110.0	119.5	122.0	120.7	115.5	115.4	114.4	456.6	444.6	473.1	464.3	466.0
Refineries net output	105.9	103.5	112.7	114.9	113.7	108.6	108.6	107.4	430.9	419.8	445.7	437.1	438.2
Available final consumption	101.5	94.8	98.7	103.1	106.9	98.8	98.5	102.3	383.5	387.8	401.0	398.0	406.4
Final consumption (estimate)	101.8	95.2	100.7	104.6	106.8	99.6	99.1	102.9	390.1	386.0	401.6	402.2	408.5
Statistical difference	-0.3	-0.4	-2.0	-1.4	0.0	-0.8	-0.7	-0.6	-6.6	1.9	-0.7	-4.2	-2.1
Inland deliveries:													
Motor gasoline	21.9	25.0	26.1	24.8	22.6	25.5	26.5	25.0	91.6	91.2	95.5	97.8	99.6
Gas/diesel oil	46.9	37.6	39.2	44.3	50.5	40.3	39.2	44.7	155.9	162.3	169.9	168.0	174.7
Heavy fuel oil	20.8	15.8	16.6	18.5	21.0	14.7	15.0	18.1	98.2	78.1	74.2	71.6	68.8
Kerosenes	5.4	5.9	6.7	6.0	5.7	6.2	6.9	6.1	21.0	21.7	22.8	24.0	25.0
Other products	18.6	19.6	21.3	21.7	19.9	21.0	21.0	20.7	78.9	76.0	78.8	81.2	82.6
Total	113.6	103.9	109.9	115.2	119.7	107.7	108.7	114.6	445.6	429.2	441.1	442.7	450.7
2. Natural gas (Mtoe)													
Primary production	46.6	25.7	19.5	36.7	41.0	26.7	20.3	39.6	119.4	126.7	123.6	128.5	127.6
Change in stocks	-6.8	5.2	4.1	-1.1	-3.8	3.2	4.3	-3.3	0.4	1.6	1.6	1.4	0.4
Net imports	19.6	18.3	13.7	20.1	17.6	18.0	15.0	18.1	57.3	59.4	64.8	71.8	68.7
Apparent consumption	73.1	38.8	29.2	57.9	62.5	41.5	30.9	61.0	176.2	184.5	186.8	198.9	195.9
Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0
Gross inland consumption	73.1	38.8	29.2	57.9	62.5	41.5	30.9	61.0	176.7	184.7	186.8	198.9	195.9
of which:													
Power stations:	7.1	5.5	4.7	5.6	6.3	5.9	5.2	5.9	24.8	22.7	21.9	22.9	22.3
Final consumption (estimate)	62.8	31.6	23.2	49.8	54.4	33.8	24.4	52.5	145.6	154.8	156.8	167.3	165.0

Table 6
Solid fuels: supply and disposal — EUR 12
(Last revision: 9 June 1988)

	1 Q 87	2 Q 87	3 Q 87	4 Q 87	1 Q 88	2 Q 88	3 Q 88	4 Q 88	Year 1984	1985	1986	1987	1988
1. Hard coal (Mt)													
Primary production	58.0	55.2	50.7	57.9	56.8	54.1	49.7	56.8	172.6	217.5	228.2	221.8	217.3
Recovered production	1.2	1.1	1.0	1.2	1.1	1.1	1.0	1.1	5.4	7.4	6.8	4.4	4.3
Change in stocks:													
Collieries	0.8	1.3	-1.1	-3.8	0.4	1.8	2.4	-0.7	-8.0	-10.3	0.3	-2.8	3.9
Power plants	-9.6	2.9	4.5	-1.7	-8.4	1.8	3.5	-3.0	-13.0	8.1	8.2	-3.9	-6.1
Total	-8.9	4.2	3.4	-5.5	-8.0	3.7	5.9	-3.7	-21.1	-2.2	8.4	-6.7	-2.2
Net imports	21.5	22.1	22.6	22.7	25.6	21.3	25.4	25.0	86.4	96.4	91.7	89.0	97.4
Apparent consumption	89.5	74.2	70.9	87.3	91.6	72.9	70.2	86.7	285.5	323.5	318.3	321.9	321.3
Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-1.8	1.8	0.0	0.0
Gross inland consumption	89.5	74.2	70.9	87.3	91.6	72.9	70.2	86.7	285.4	321.7	320.1	321.9	321.3
Transformation input	79.7	64.7	61.5	74.7	81.3	63.4	61.0	75.6	245.7	272.8	277.0	280.7	281.2
of which													
Power generation	60.8	46.2	43.1	55.8	62.7	45.1	43.3	58.3	167.9	188.1	195.5	206.0	209.4
Coke	18.1	17.8	17.7	18.0	17.7	17.6	17.0	16.3	75.1	81.3	78.1	71.7	68.6
Production patent fuels	0.8	0.7	0.7	0.9	0.8	0.6	0.6	0.9	3.1	3.6	3.2	3.0	3.0
Available final consumption	10.5	10.2	10.0	13.4	11.1	10.1	9.8	12.0	42.7	52.5	46.2	44.2	43.0
Final consumption (estimate)	11.3	10.3	9.4	12.6	11.1	10.1	9.8	12.0	41.1	50.2	45.3	43.6	43.0
Industry	5.7	6.1	5.8	7.1	6.0	6.0	6.1	7.0	22.0	28.3	24.0	24.7	25.1
Domestic	5.5	4.2	3.6	5.5	5.0	4.1	3.8	5.0	19.0	21.9	21.3	18.9	17.9
Statistical difference	-0.7	-0.1	0.6	0.8	0.0	0.0	0.0	0.0	1.7	2.3	1.0	0.6	0.0
Deliveries of hard coal to:													
Power plants	49.2	47.0	45.6	51.7	52.2	44.8	44.7	52.8	146.5	189.2	195.3	193.5	194.5
Coking plants	18.1	17.8	17.7	18.0	17.7	17.6	17.0	16.3	75.1	81.3	78.1	71.7	68.6
Patent plants	0.8	0.7	0.7	0.9	0.8	0.7	0.7	1.0	2.8	3.4	3.4	3.0	3.2
All industries	7.2	7.9	7.6	9.1	7.8	7.7	7.8	9.1	28.8	33.6	30.9	31.9	32.3
Households	4.8	3.5	2.9	4.7	4.3	3.5	3.1	4.1	16.0	18.3	18.1	15.9	14.9
Other	0.5	0.4	0.3	0.4	0.4	0.4	0.4	0.4	1.6	1.8	1.4	1.5	1.5
Total	80.6	77.2	74.9	84.8	83.2	74.7	73.6	83.6	270.7	327.5	327.3	317.4	315.2
Power sector:													
Deliveries to power plants	49.2	47.0	45.6	51.7	52.2	44.8	44.7	52.8	146.5	189.2	195.3	193.5	194.5
Industry	2.0	2.1	2.1	2.5	2.1	2.1	2.1	2.5	8.3	7.1	8.4	8.6	8.7
Total	51.2	49.1	47.7	54.1	54.3	46.9	46.8	55.3	154.9	196.2	203.7	202.1	203.3
Change in stocks	-9.6	2.9	4.5	-1.7	-8.4	1.8	3.5	-3.0	-13.0	8.1	8.2	-3.9	-6.1
Consumption in power stations	60.8	46.2	43.1	55.8	62.7	45.1	43.3	58.3	167.9	188.1	195.5	206.0	209.4
2. Hard coke (Mt)													
Coking plants													
Production	13.6	13.6	13.3	13.3	13.4	13.4	13.0	12.8	56.2	60.8	58.4	53.9	52.6
Change in stocks	0.3	0.1	1.0	-0.3	0.7	0.2	0.9	0.8	-5.2	-3.9	2.2	1.2	2.6
Deliveries to the iron and steel industry	11.1	11.3	10.7	10.9	11.1	10.9	10.1	10.2	52.1	53.2	47.9	44.1	42.3
3. Lignite (Mt)													
Production	44.8	41.9	43.7	40.4	46.2	41.8	43.8	47.1	196.0	186.9	183.1	170.8	179.0
Consumption in power stations	41.3	37.4	38.4	34.9	41.6	36.1	38.6	42.6	174.9	172.3	163.9	152.0	158.9

Notes:
1. Final demand figures for hard coal include patent fuels.
2. From 1987 Spanish black lignite ('negro') is included in hard coal figures.

Table 7
Electricity: generation and disposal — EUR 12
(Last revision: 9 June 1988)

	1 Q 87	2 Q 87	3 Q 87	4 Q 87	1 Q 88	2 Q 88	3 Q 88	4 Q 88	Year 1984	1985	1986	1987	1988
Electrical power (TWh)													
Total gross generation	468.0	380.6	363.3	443.3	473.1	393.3	372.8	456.3	1 499.9	1 571.1	1 611.0	1 655.1	1 695.5
Net imports	2.3	6.2	8.6	3.4	-6.6	11.4	8.5	5.8	18.0	14.3	15.1	20.5	19.0
Gross inland consumption	470.3	386.8	371.9	446.6	466.5	404.7	381.2	462.2	1517.9	1585.4	1626.1	1675.6	1714.5
Pumping	3.7	4.0	4.0	4.3	4.4	4.4	3.7	4.2	17.0	18.8	17.3	16.0	16.6
Losses	25.0	19.9	20.2	25.4	25.8	21.4	20.3	24.9	80.4	84.8	89.9	90.5	92.4
Available for internal market	441.6	362.8	347.7	417.0	436.3	378.9	357.2	433.1	1 420.5	1 481.8	1 518.9	1 569.1	1 605.5
Distribution losses	30.1	24.5	23.4	28.5	22.6	27.4	24.3	31.4	95.6	103.9	103.2	106.5	105.8
Consumption internal market	411.5	338.3	324.3	388.5	413.7	351.5	332.9	401.7	1 324.9	1 377.9	1 415.7	1 462.6	1 499.7
Energy branch	20.0	16.3	15.5	18.9	20.3	16.9	16.0	19.6	60.3	67.4	68.8	70.7	72.9
Final consumption (estimate)	391.5	322.1	308.8	369.6	393.3	334.5	316.9	382.1	1 264.6	1 310.5	1 346.9	1 392.0	1 426.8
Total gross generation net of pumping	464.3	376.5	359.3	439.0	468.7	388.9	369.0	452.2	1 482.9	1 552.3	1 593.7	1 639.1	1 678.9
of which:													
Primary:	39.8	46.7	40.2	45.7	47.3	54.3	38.1	30.8	172.1	167.4	163.2	172.3	170.4
Hydro (net of pumping)	39.1	46.0	39.4	44.9	46.6	53.5	37.4	30.0	169.3	164.7	160.4	169.3	167.5
Geothermal	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.7	2.8	2.7	2.8	3.0	2.9
Derived:	424.5	329.9	319.2	393.3	421.4	334.7	331.0	421.4	1 310.8	1 384.9	1 430.5	1 466.9	1 508.5
Nuclear	153.5	119.5	117.6	147.5	149.0	128.5	125.5	156.4	399.0	483.2	522.5	538.2	559.4
Conventional thermal	271.0	210.3	201.5	245.8	272.4	206.2	205.5	265.0	911.7	901.7	908.1	928.7	949.1
Total net production	443.0	360.6	343.1	417.9	447.3	371.8	352.4	431.5	1 419.5	1 486.3	1 521.1	1 564.6	1 603.1
Input to conventional thermal power stations (Mtoe)													
Hard coal	35.1	26.7	24.9	32.2	36.2	26.0	25.0	33.6	96.9	108.6	112.9	118.9	120.8
Lignite	7.5	6.8	7.0	6.4	7.6	6.6	7.0	7.8	33.9	33.1	31.1	27.7	29.0
Petroleum products	10.8	7.8	8.4	9.6	11.8	7.3	8.6	10.7	50.6	39.3	35.6	36.6	38.4
Natural gas	7.1	5.5	4.7	5.6	5.3	5.9	5.2	5.9	24.8	22.7	21.9	22.9	22.3
Derived gas	1.1	1.2	1.3	1.3	1.1	1.3	1.4	1.4	5.4	5.5	5.5	5.0	5.2
Geothermal	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	2.2	2.1	2.2	2.3	2.4
Other	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	1.6	1.7	1.7	1.7	1.7
Total	62.7	49.0	47.3	56.1	63.0	48.0	48.2	60.5	215.4	213.0	210.9	215.1	219.8
Heat (TWh)													
Production nuclear	446.0	352.2	347.6	434.6	434.3	377.5	369.2	454.7	1 111.0	1 440.3	1 537.5	1 580.4	1 635.7
Production total	452.8	359.0	354.4	441.3	441.1	384.2	376.2	462.0	1 136.8	1 464.6	1 562.6	1 607.6	1 663.5
Adjustment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.9	-2.6	0.9	0.0	0.0
Gross consumption	452.8	359.0	354.4	441.3	441.1	384.2	376.2	462.0	1 214.7	1 462.0	1 563.5	1 607.6	1 663.5
Nuclear capacity (GW)	85.6	85.8	87.8	92.4	92.4	95.0	96.9	100.7	65.0	75.8	85.6	92.4	100.7

Table 8
Main variables: growth rates from same quarter of previous year in % — EUR 12
(Last revision: 9 June 1988)

	1 Q 86	2 Q86	3 Q 86	4 Q 86	1 Q 87	2 Q 87	3 Q 87	4 Q 87	1 Q 88	2 Q 88	3 Q 88	4 Q 88
A. Specific units												
1. Hard coal												
Production	27.2	4.7	-6.0	-2.1	-2.6	-3.0	-4.2	-1.5	-2.0	-2.0	-2.0	-2.0
Net imports	-1.1	7.0	-9.5	-14.4	2.4	-14.8	1.7	1.0	19.2	-3.7	12.2	10.2
Apparent consumption	18.6	-4.0	-8.6	-11.2	-4.5	0.4	5.1	5.0	2.3	-1.8	-1.0	-0.7
Gross inland consumption	19.9	-2.9	-7.5	-10.3	-5.0	-0.2	4.4	4.4	2.3	-1.8	-1.0	-0.7
Transfer power generation	28.7	-2.9	-3.4	-6.4	-0.7	10.5	9.4	5.1	3.1	-2.4	0.4	4.5
Deliveries coking plants	1.9	3.2	-10.4	-10.0	-10.6	-15.2	-4.4	-1.7	-2.2	-1.0	-4.3	-9.5
Deliveries all industries	2.0	-13.1	-12.7	-7.5	-10.1	6.7	6.7	9.1	7.4	-1.9	1.9	-0.6
Deliveries domestic	11.1	-0.9	-0.5	-11.6	-12.6	-17.2	-22.8	0.9	-10.4	-1.2	5.6	-12.4
Deliveries total	17.4	-1.0	-8.5	-5.4	-5.0	-6.1	-1.0	0.2	3.2	-3.2	-1.7	-1.3
2. Coke												
Production	4.5	-2.2	-7.7	-9.7	-10.1	-8.2	-7.5	-4.9	-1.5	-1.8	-2.5	-3.9
Deliveries to iron and steel	-3.1	-8.4	-18.4	-14.5	-12.7	-9.5	-5.4	-2.9	-0.7	-4.1	-5.2	-6.3
3. Lignite												
Production	1.3	2.6	-6.9	-4.8	-8.6	-4.9	2.8	-15.0	3.2	-0.2	0.3	16.7
Transfer power generation	-4.8	-5.8	-8.8	-0.3	-7.1	0.1	2.2	-21.7	0.6	-3.5	0.5	22.3
4. Oil												
Production	3.5	0.3	6.5	-4.4	-4.7	-3.4	-2.1	3.8	-0.2	0.5	0.4	-2.6
Net imports	-3.0	27.6	13.6	-7.1	2.5	-9.6	-1.8	9.3	5.9	7.6	-6.0	-0.4
Apparent consumption	1.8	13.2	-3.2	4.6	-1.3	-6.1	1.8	4.3	5.1	3.3	-0.3	-0.1
Gross inland consumption	0.5	11.4	-4.5	3.1	-1.5	-6.2	1.7	4.2	5.1	3.3	-0.3	-0.1
Deliveries												
Motor gasoline	3.1	5.0	4.5	6.1	3.3	2.4	2.0	2.1	2.9	2.1	1.4	0.9
Gas/diesel oil	4.8	21.7	-0.5	-4.5	-3.8	-10.9	3.6	7.8	7.5	7.2	0.0	1.0
Heavy fuel oil	-26.9	13.7	11.3	-1.2	1.7	-9.6	-3.0	-3.8	1.0	-6.7	-9.4	-2.0
Kerosenes	6.2	8.4	3.8	2.5	3.8	4.3	5.0	8.1	5.2	5.3	3.8	2.4
Other products	-1.3	4.0	5.3	6.6	1.9	0.2	4.5	5.4	7.3	7.0	-1.5	-4.6
Total	-3.9	12.3	3.8	0.6	-0.2	-5.0	2.4	4.1	5.3	3.7	-1.2	-0.5
Transfer power generation	-43.2	17.2	26.2	5.9	15.7	8.6	-4.3	-7.2	8.6	-6.6	3.3	11.1
5. Natural gas												
Production	-6.1	2.8	14.2	-9.2	7.5	-0.3	-4.8	7.9	-12.0	4.0	3.7	8.1
Net imports	9.7	3.4	11.7	11.3	11.9	22.7	-2.8	10.6	-10.2	-1.9	9.4	-10.0
Apparent consumption	0.2	4.5	9.1	-3.4	8.5	5.4	-1.1	8.9	-14.5	6.9	6.0	5.4
Gross inland consumption	0.1	4.4	8.9	-3.4	8.5	5.3	-1.2	8.9	-14.5	6.9	6.0	5.4
Transfer power generation	-12.5	-12.0	5.2	8.0	19.2	21.4	-10.4	-9.2	-24.6	7.8	9.0	5.0
Final consumption	1.1	6.7	9.2	-5.3	7.4	3.0	1.0	11.3	-13.4	6.7	5.4	5.5
6. Heat												
Production nuclear heat	11.1	7.6	5.3	3.1	5.9	-1.3	1.2	4.4	-2.6	7.2	6.2	4.6
7. Electricity												
Total gross generation	2.4	4.0	3.6	0.6	3.0	1.4	2.5	3.9	1.1	3.3	2.6	3.0
Total net production	1.9	4.0	3.5	0.5	3.4	1.6	2.6	3.6	1.0	3.1	2.7	3.3
Gross inland consumption	2.3	4.9	3.2	0.3	3.1	0.9	3.3	4.6	-0.8	4.6	2.5	3.5
Available internal market	1.9	5.1	3.2	0.4	3.9	1.2	3.5	4.5	-1.2	4.4	2.7	3.9
Consumption inernal market	2.1	5.4	3.4	0.6	3.9	1.1	3.5	4.5	0.5	3.9	2.6	3.4
Final consumption	2.1	5.5	3.4	0.6	4.0	1.1	3.5	4.6	0.5	3.9	2.6	3.4
Generation primary	-15.6	1.9	-3.5	12.8	-2.0	-15.0	10.8	45.2	19.0	16.3	-5.2	-32.6
Generation derived	4.6	4.6	4.6	-0.1	3.8	4.4	1.5	0.6	-0.7	1.5	3.7	7.1
Generation nuclear	11.8	9.8	6.7	4.4	6.7	-1.0	1.8	3.6	-2.9	7.5	6.6	6.1
Generation conventional thermal	1.1	1.6	3.4	-2.4	2.2	7.7	1.4	-1.1	0.5	-2.0	2.0	7.8
B. Toe												
Gross inland consumption												
Solids	13.2	-5.7	-9.3	-10.0	-5.9	-0.3	3.0	1.5	3.0	-2.4	0.1	2.4
Oil	0.4	11.7	-4.1	3.0	-1.4	-6.2	1.6	4.3	5.7	3.7	0.0	0.3
Natural gas	0.1	4.4	8.9	-3.4	8.5	5.4	-1.1	8.9	-14.5	6.9	6.0	5.4
Heat	11.2	7.8	5.5	3.4	5.9	-1.2	1.3	4.5	-2.6	7.0	6.1	4.7
Primary electricity	-16.0	7.0	-6.0	6.8	-0.2	-16.0	16.5	54.8	-3.2	24.1	-4.5	-25.4
Total energy	4.0	5.7	-2.7	-1.4	0.7	-2.8	1.7	5.1	-1.0	3.7	1.5	2.0

Table 9
Main variables: year to date growth rates in % — EUR 12
(Last revision: 9 June 1988)

	1 Q 86	2 Q 86	3 Q 86	4 Q 86	1 Q 87	2 Q 87	3 Q 87	4 Q 87	1 Q 88	2 Q 88	3 Q 88	4 Q 88
A. Specific units												
1. Hard coal												
Production	27.2	15.1	7.5	4.9	-2.6	-2.8	-3.2	-2.8	-2.0	-2.0	-2.0	-2.0
Net imports	-1.1	3.2	-1.2	-4.8	2.4	-7.1	-4.3	-3.0	19.2	7.6	9.1	9.4
Apparent consumption	18.6	7.4	2.3	-1.6	-4.5	-2.4	-0.2	1.1	2.3	0.4	0.0	-0.2
Gross inland consumption	19.9	8.7	3.5	-0.5	-5.0	-2.9	-0.8	0.6	2.3	0.4	0.0	-0.2
Transfer power generation	28.7	13.7	8.4	3.9	-0.7	3.9	5.4	5.3	3.1	0.7	0.6	1.7
Deliveries coking plants	1.9	2.6	-1.8	-3.9	-10.6	-12.9	-10.3	-8.3	-2.2	-1.6	-2.5	-4.3
Deliveries all industries	2.0	-5.8	-8.1	-7.9	-10.1	-2.1	0.7	3.0	7.4	2.6	2.4	1.5
Deliveries domestic	11.1	5.5	3.7	-0.7	-12.6	-14.6	-16.9	-12.4	-10.4	-6.5	-3.3	-6.0
Deliveries total	17.4	7.5	2.0	-0.1	-5.0	-5.6	-4.1	-3.0	3.2	0.1	-0.5	-0.7
2. Coke												
Production	4.5	1.0	-2.0	-4.0	-10.1	-9.2	-8.6	-7.7	-1.5	-1.6	-1.9	-2.4
Deliveries to iron and steel	-3.1	-5.8	-10.1	-11.2	-12.7	-11.1	-9.3	-7.8	-0.7	-2.4	-3.3	-4.1
3. Lignite												
Production	1.3	1.9	-1.0	-2.0	-8.6	-6.9	-3.8	-6.7	3.2	1.6	1.1	4.8
Transfer power generation	-4.8	-5.2	-6.4	-4.8	-7.1	-3.8	-1.9	-7.3	0.6	-1.3	-0.7	4.6
4. Oil												
Production	3.5	2.0	3.4	1.4	-4.7	-4.1	-3.4	-1.7	-0.2	0.1	0.2	-0.5
Net imports	-3.0	11.2	12.0	6.8	2.5	-3.9	-3.2	-0.2	5.9	6.7	2.3	1.6
Apparent consumption	1.8	7.1	3.6	3.8	-1.3	-3.7	-1.9	-0.4	5.1	4.2	2.7	2.0
Gross inland consumption	0.5	5.5	2.1	2.3	-1.5	-3.8	-2.0	-0.5	5.1	4.2	2.7	2.0
Deliveries												
Motor gasoline	3.1	4.1	4.3	4.7	3.3	2.8	2.5	2.4	2.9	2.5	2.1	1.8
Gas/diesel oil	4.8	12.0	8.0	4.7	-3.8	-7.1	-3.9	-1.1	7.5	7.4	5.0	4.0
Heavy fuel oil	-26.9	-12.5	-6.3	-5.0	1.7	-3.5	-3.3	-3.5	1.0	-2.4	-4.6	-3.9
Kerosenes	6.2	7.3	6.0	5.1	3.8	4.1	4.4	5.3	5.2	5.3	4.8	4.2
Other products	-1.3	1.4	2.7	3.7	1.9	1.0	2.2	3.1	7.3	7.1	4.0	1.7
Total	-3.9	3.4	3.6	2.8	-0.2	-2.5	-0.9	0.3	5.3	4.5	2.6	1.8
Transfer power generation	-43.2	-26.8	-14.4	-9.3	15.7	12.6	6.8	2.7	8.6	2.2	2.6	4.8
5. Natural gas												
Production	-6.1	-3.0	0.5	-2.4	7.5	4.5	2.4	3.9	-12.0	-6.3	-4.2	-0.7
Net imports	9.7	6.7	8.2	9.0	11.9	16.9	10.9	10.8	-10.2	-6.2	-2.1	-4.3
Apparent consumption	0.2	1.7	3.2	1.3	8.5	7.4	5.5	6.5	-14.5	-7.1	-4.4	-1.5
Gross inland consumption	0.1	1.6	3.1	1.2	8.5	7.4	5.5	6.4	-14.5	-7.1	-4.4	-1.5
Transfer power generation	-12.5	-12.3	-7.1	-3.3	19.2	20.1	9.9	4.5	-24.6	-10.4	-5.1	-2.7
Final consumption	1.1	3.0	4.2	1.3	7.4	5.9	4.9	6.7	-13.4	-6.6	-4.3	-1.4
6. Heat												
Production nuclear heat	11.1	9.5	8.2	6.8	5.9	2.6	2.2	2.8	-2.6	1.7	3.1	3.5
7. Electricity												
Total gross generation	2.4	3.1	3.3	2.5	3.0	2.3	2.3	2.7	1.1	2.1	2.2	2.4
Total net production	1.9	2.8	3.0	2.3	3.4	2.6	2.6	2.9	1.0	1.9	2.2	2.5
Gross inland consumption	2.3	3.5	3.4	2.6	3.1	2.1	2.5	3.0	-0.8	1.6	1.9	2.3
Available internal market	1.9	3.3	3.3	2.5	3.9	2.6	2.9	3.3	-1.2	1.3	1.8	2.3
Consumption internal market	2.1	3.6	3.5	2.7	3.9	2.6	2.9	3.3	0.5	2.0	2.2	2.5
Final consumption	2.1	3.6	3.6	2.8	4.0	2.6	2.9	3.3	0.5	2.0	2.2	2.5
Generation primary	-15.6	-6.4	-5.6	-2.5	-2.0	-9.5	-3.9	5.6	19.0	17.5	10.3	-1.1
Generation derived	4.6	4.6	4.6	3.3	3.8	4.0	3.3	2.5	-0.7	0.2	1.3	2.8
Generation nuclear	11.8	10.9	9.6	8.1	6.7	3.2	2.8	3.0	-2.9	1.6	3.1	3.9
Generation conventional thermal	1.1	1.3	1.9	0.7	2.2	4.5	3.6	2.3	0.5	-0.6	0.2	2.2
B. Toe												
Gross inland consumption												
Solids	13.2	3.9	-0.3	-3.0	-5.9	-3.4	-1.6	-0.8	3.0	0.5	0.4	0.9
Oil	0.4	5.6	2.3	2.5	-1.4	-3.8	-2.1	-0.5	5.7	4.8	3.2	2.4
Natural gas	0.1	1.6	3.1	1.2	8.5	7.4	5.5	6.5	-14.5	-7.1	-4.4	-1.5
Heat	11.2	9.6	8.3	6.9	5.9	2.7	2.2	2.8	-2.6	1.7	3.0	3.5
Primary electricity	-16.0	-3.6	-4.3	-2.5	-0.2	-9.7	-2.2	7.9	-3.2	12.0	6.4	-1.7
Total energy	4.0	4.8	2.4	1.4	0.7	-0.9	-0.1	1.2	-1.0	1.1	1.2	1.4

'Swapping' nuclear material

In January and February of this year, there were allegations in magazine articles that the European Atomic Energy Community (Euratom) had circumvented conditions placed on Australian, Canadian and US origin material by international safeguard agreements. It was alleged that Euratom had 'swapped flags' — denoting an exchange of nuclear safeguards obligations — between quantities of material of different national origin, that South African uranium had been 'laundered' by swapping labels, that new nuclear material had been 'swapped' with nuclear wastes and that the need to obtain suppliers' consent before highly enriching uranium had been circumvented.

In a statement to the Press in February, the Commission categorically denied that it or its services had permitted operations under its control concerning nuclear material to take place illegally or in breach of Euratom's agreements with supplier countries.

In a statement on Australian nuclear safeguards in April, John Kerin, the Australian Minister for Primary Industries and Energy, remarked that the allegations appeared to have arisen through a lack of understanding of the complexities of international trade in nuclear material, confusion between internal and international flag swaps and failure to understand the equivalence principle used in nuclear material accounting. Mr Kerin then went on to say that on the basis of the investigations made and information available to the Australian Government, there is no evidence that any material subject to Australia's bilateral safeguards agreements has been diverted from peaceful use, or that Australia's safeguards requirements have been breached.

To help to dispel some of the 'air of mystery' surrounding such 'swaps' — or, more correctly, 'exchange of obligations' — and to try to avoid further misunderstandings, the text of a statement made by the Commissioner for Energy, **Nic Mosar**, before the European Parliament's Committee of Enquiry into the Transnuklear/Mol affair on 26 April is reproduced below.

'Mr Chairman,

As I mentioned in my letter of 12 April, I am convinced that flag swaps have nothing to do with either the Transnuklear/Mol affair or the management of radioactive waste in general.

I am sorry to see that confidential documents on specific swaps have been leaked widely outside this Committee of Enquiry. Not only was the Commission not contacted beforehand but also I have no evidence that the documents were released with the consent of Nukem's legal representatives. In any case, the documents are incomplete and could be misinterpreted in view of the highly complex subject-matter. Nevertheless I can well understand that this complexity is puzzling for more than one member of this Committee of Enquiry.

In response to your legitimate concern and to maintain the close collaboration between our two institutions, I agreed to come today, Mr Chairman, to give you a brief account of 'exchanges of obligations', as practised in connection with the supply and management of nuclear materials.

First, I must stress that the exchange of obligations is a long-standing, perfectly legal practice which no one has ever sought to cover up. On the contrary, it is a well-known method of ensuring optimum management of the nuclear fuel cycle on the international market. Such operations are not exceptional, have been practised for almost 15 years and go beyond the Community's jurisdiction.

Naturally, they have become more frequent in recent years, as the nuclear fuel cycle industry has grown.

Now let us get to the crux of the matter. What do we mean when we speak of 'flag-swaps' or, more correctly, the 'exchange of obligations'?

They are essentially a bookkeeping device for interchanging the safeguards applicable to two equivalent consignments of nuclear material. Neither the ownership nor the origin of the consignments is affected. This operation is carried out case by case and only with the express prior approval of the Euratom Safeguards Directorate.

It must be remembered that the general Euratom safeguards regime laid down in Chapter VII of the Treaty has given rise to specific safeguards regimes identified by codes or obligations for nuclear materials. These specific obligations arise from the commitments given in the international agreements concluded by the Community (with the USA, Canada and Australia) or in the contracts concluded by the Supply Agency.

Before explaining the reasons for 'flag swaps' and describing how the procedures work, I must, from the start, make clear the distinction between 'exchanges of obligations' (flag swaps) and 'ownership swaps'. Ownership swaps are an actual exchange of title over two consignments of nuclear material. They in no way affect the safeguards applicable to each consignment nor their physical location. Consequently, this type of swap, governed by Chapter VI of the Euratom Treaty, raises no problems in connection with either Euratom safeguards or in relation to the international agreements concluded by the Community. It makes no difference which operator owns the materials provided that the relevant rules, which apply to the physical holder of the materials, are observed.

Ownership swaps therefore pose no problems from the safeguards viewpoint.

Having cleared up this point, let us return to the subject of 'exchange of obligations'. In some ways obligation exchanges are a logical scientific consequence of the fungibility of nuclear materials. As to the operators in the nuclear sector, such swaps are justified on economic grounds, for example, in terms of savings on transport costs. There are also management and operational reasons for swaps as a means of placing the entire reactor charge under the same obligations. Finally, the 'exchange of obligations' has definite advantages for the responsible public authorities concerned with physical protection, since they reduce the number of movements of nuclear materials.

Each of these reasons needs to be examined in closer detail. I am therefore going to expand this point a little by describing examples supporting each of the reasons I have just given.

The swap principle can be accepted very simply on the basis of the fungibility of nuclear materials of the same nature, where the atoms are interchangeable. In this way, this physical reality can be taken as a simple reason for supporting the practice of exchanges or swaps. Operations in the course of the fuel cycle inevitably entail the simultaneous treatment and physical mixture of materials governed by different safeguards regimes. Afterwards, it is no longer possible to continue to distinguish physically between the materials, according to their initial safeguards regime. Consequently, no one can reasonably dispute the application of the fungibility principle. This implies that each of the initial legal safeguard regimes should continue to apply to a quantity of materials equivalent to the amount fed in for treatment.

The important point from the safeguards angle is that at the end of the process the same safeguards obligation should continue to apply to a quantity and quality of nuclear material equivalent to the original materials.

Consequently, I can see no reason to refuse to apply the same fungibility principle, as in cases of obligation exchanges, where the materials are not physically mixed.

From the operational point of view, the complexity of the nuclear fuel cycle forces operators to resort to obligation exchanges. There are many different possible scenarios but here are just two typical examples.

First example: for obvious reasons, to simplify matters, any nuclear power station operator may well wish all the fuel elements fed into a reactor to be subject to the same safeguards regime. If this is impossible with the fuel he has, he could proceed to an obligation exchange with other material, whether inside or outside the Community, where it is subject to the requisite safeguards regime.

Second example: a supplier providing fuel element conversion or fabrication services agrees to supply a customer, after processing, with materials which are subject to specific safeguards. If no materials covered by those safeguards are available immediately, he could well wish to exchange obligations to avoid delays in delivery of the end-product.

As to the economic reasons, such 'exchanges' can provide an obvious alternative to physical transfers of materials while attaining the same practical results. Consequently, the primary aim is to save on transport costs, which can be very high if, for example, the materials have to cross the Atlantic.

Finally, 'obligation exchanges' have advantages for the physical protection and safeguards authorities too. Elimination of unnecessary movements of materials enhances their physical security. It also reduces the accident risk and the chance of foul play or diversion of materials, where possibilities are higher when nuclear materials are transported.

Finally, avoidance of movements of materials in this way makes it easier for the safeguards authorities to keep track of materials.

I think you must admit that these technical and economic arguments provide very solid reasons for 'obligation exchanges'. But is the practice accepted under international and, in particular, Community law? The answer is clearly yes.

For example, all the agreements concluded between the Vienna-based International Atomic Energy Agency and countries which are not party to the Non-Proliferation Treaty explicitly allow the substitution of nuclear materials subject to IAEA safeguards by materials not subject to them.

In the Community, the Commission statement interpreting Regulation No 3227/76 concerning the application of the provisions on Euratom safeguards declared obligation exchanges to be in line with Community law, provided they were compatible with any international commitments made and, in particular, reduced neither the quantity nor quality of materials subject to the most restrictive utilization commitments.

If one turns, more particularly, to the international agreements concluded by the Community, a distinction must be drawn between intra-Community and international 'exchanges' or 'swaps'. Intra-Community swaps involve only materials located in the Community. International swaps involve a consignment outside the Community.

On intra-Community 'exchanges', I must mention in passing that a member of this Committee asked the US and Australian authorities about such operations. They replied without the slightest reservation that the operations were legal; they are also implicitly allowed by the agreement between Euratom and Canada.

International 'exchanges' are always subject to the assent of the supplying country which concluded an agreement with the Community.

(a) The USA has recognized such exchanges as being compatible with its Agreement with Euratom;
(b) the Agreement between Canada and Euratom expressly provides for international exchanges of obligations;
(c) Australia, on the other hand, has yet to agree to any international exchanges of obligations. Consequently, no such operation has yet been carried out.

It therefore follows that the 'exchange of obligations' option is well-established in both international and Community law. What is more, there are convincing technical and economic reasons for this practice. All that remains now is to describe the general principles applied by the Commission in assessing the acceptability of 'obligation exchanges' proposed by nuclear operators.

In the Community, the Commission authorizes or refuses obligation exchanges case by case, on the basis of the relevant rules in Chapter VII of the Euratom Treaty, of Regulation 3227/76, of the Commission statement interpreting this Regulation and of the specific safeguard commitments given by the Community in its supply agreements with the USA, Canada and Australia.

The 'obligation exchange' principles in force in Community law are based on the two fundamental principles which I mentioned earlier: fungibility and equivalence.

I have no intention of embarking on a technical and scientific explanation of how my services apply these principles when they receive applications for the exchange of obligations. However, I can tell you the key factors on which the Commission bases its decisions on such proposals. First, 'obligation exchanges' are not automatic. They are authorized by the Commission case by case with the sole aim of facilitating more efficient exploitation.

Second, such 'obligation exchanges' must not reduce the quantity or quality of materials subject to the most restrictive safeguards obligations. The current order of precedence for the various safeguard systems in the Community is as follows, in decreasing order of application:

(i) materials subject to the international agreements between Euratom and the USA, Canada and Australia;
(ii) materials subject to a peaceful use commitment only;
(iii) materials subject to no such commitment but subject to Euratom safeguards.

Everything must be done to ensure that all the international commitments are honoured. Finally, the Commission has issued standing orders to its staff strictly to observe the letter and spirit of each and every legal provision on 'obligation exchanges' while respecting the legitimate interests of the nuclear power industry which, I remind you, generates 35% of the Community's electricity.

Mr Chairman, may I remind your Committee that the Community is one of the best safeguarded regions in the world, since it is subject to two multinational safeguard systems: that of Euratom and that of the IAEA. The Community enjoys the trust and respect of the leading non-Community suppliers (Australia, USA and Canada), each known for their attachment to non-proliferation.

These then, Mr Chairman, are the general points on 'obligation exchanges' which I wanted to make to your Committee. I can now answer any general questions you may have. Any more technical questions about general practice in this area can be dealt with by Mr Caccia Dominioni and Mr Gmelin later on. However, for obvious confidentiality reasons they are not authorized to disclose, under any circumstances, details of specific cases where obligation exchanges have been carried out in the course of individual transactions.

That said, I hope that the information which I have given you and the possible further explanations to follow will provide you with a fuller picture of what we mean by 'obligation exchanges' and their role. In other words, I hope that I have dispelled some of the mystery surrounding this normal practice in the nuclear industry which is an essential part of the sound management of the nuclear fuel cycle in a vigorously competitive international market. Thank you.'

Community news

Energy Council, Luxembourg — 9 June 1988

Energy Ministers from the 12 Member States and the Commission met in Luxembourg on 9 June under the Chairmanship of Martin Bangemann, Economics Minister of the Federal Republic of Germany. Commissioner **Nic Mosar**, assisted by Director-General **Constantinos Maniatopoulos**, led the Commission delegation.

Ministers gave a positive reaction to the Commission paper on the **Internal Energy Market** (COM(88) 238 final, 2 May 1988). The paper sets out actual and potential obstacles to the realization of the internal market in Energy by 1992. It also provides a four-point framework for action to tackle the problems identified. Given the enormous importance of the subject, it was to be expected that there were differences of opinion among Member States as to priorities and timing. No one, however, doubted the fundamental principles involved. It is a subject of great political importance and, as such, one which future Councils will be returning to in the months and years ahead.

Also on the Luxembourg 'menu' were the main findings of the Commission's **Review of Member States' energy policies** (COM(88) 174). The Commission carries out this exercise every two to three years. This Review was the first undertaken in the light of the Community energy policy objectives for 1995, agreed by the Council in September 1986 (*Energy in Europe* No 6). Two areas are giving rise to concern regarding the achievement of these objectives: energy efficiency and solid fuels. Unless positive action is taken by Member States, the Community is unlikely to meet its 1995 targets in these areas. The degree of agreement among Ministers was encouraging. A couple of points remain to be agreed but these should be settled in Brussels over the next few weeks.

Also on the agenda was a proposed Council Recommendation to promote cooperation between public electricity supply companies and **autoproducers of electricity**. It is hoped to finalize conclusions on this in Brussels in the coming weeks.

The Council reached agreement on the need to encourage investments in the use of **solid fuels** in industry, public buildings and in district heating systems. Ministers also agreed a Recommendation on developing the exploitation of **renewable energy sources**. Such sources have in their favour the fact that they are indigenous and their use can have a beneficial impact on diversification, security of supply and the development of less-favoured regions in the Community.

Commissioner Mosar made a statement on the Commission's Recommendation to encourage the use of **third-party financing** as a method with significant potential for achieving energy savings (see article in this issue).

European Parliament

The Committee on Energy, Research and Technology organized a public hearing on 'European coal policy' on 1 and 2 December 1987, in the context of the report being prepared by Norman West (*S*/UK).

Representatives from the IEA, the Financial Times, British Coal, Kempense Steenkohlenmijnen (Belgium), Charbonnages de France, the Spanish Ministry of Industry and Energy, Italy's AGIP, the German Gewerkschaft Sophia-Jacoba and Bergbau AG, Bradford University, the Coalfield Communities Campaign (UK), the International Miners' Organization and the Miners' International Federation took part in the hearing.

The Committee Chairman Michel Poniatowski (*LDR*/FR) said, when concluding the hearing, that Europe needs a true energy policy which will ensure its political and economic independence, to maintain its energy production capacities and to diversify its supply sources. Mr West's report will be adopted by Committee in June and will probably be debated in plenary in September 1988.

The Committee is organizing, with a view to current preparations for the creation of the single internal market in 1992, a public hearing in October 1988 on the subject of 'Energy and the internal market'.

Recent activities include the adoption of the Bloch von Blottnitz (*ARC*/D) report on developing the exploitation of renewable energy sources in the Community, which is likely to be adopted in the May part-session; and a report by Paul Staes (*ARC*/B) on timber stocks and deforestation in the light of energy policy in the Third World which may be adopted in plenary in June.

The Committee, in an Opinion by Mr Seligman (*ED*/UK) on a proposed directive on information on the energy efficiency of buildings, strongly supported the Commission's wish for a mandatory form of energy audit, given that the building sector accounts for 38% of final energy consumption in the Community.

An own-initiative report by Mr Seligman (*ED*/UK) is currently in preparation on fast breeder reactors, with the first session in October as the likely time for discussion in plenary.

The Committee will also have an external meeting in Rome on 24 to 26 May during which Italian energy policies, with particular reference to nuclear policy in the light of the results of the Italian referendum on the subject, will be discussed.

ECSC Consultative Committee

At its 268th Session, held on 22 and 23 March 1988, the Committee, consulted by the Commission under Article 55(2)(c), gave a favourable opinion on the programme of technical ECSC coal research for 1988. As first priority, 61 projects are to be financed at a total cost of 22 MECU; as a second priority, 15 projects to a value of 5.4 MECU are to be financed according to the availability of funds. Projects include research into mining engineering (e.g. roadway drivage, ventilation, coal mining) and product upgrading (e.g. coal preparation and use). At the same Session, the Committee also considered the Commission services' draft report on the market for solid fuels in the Community in 1987 and the outlook for 1988.

New structure of DG XVII

Since the publication of the establishment plan for DG XVII in issue No 10 of *Energy in Europe*, several changes have been made.

Division A3 (formerly *contracts, budgets and financial management*) under Rolf Meijer has moved out of Directorate A and reports directly to the Director-General with the new title of *resource management*.

A new unit (A3) — *energy planning* — has been established in Directorate A. The tasks of this specialized service — previously part of Division A1 — are to carry out energy planning cooperation with developing countries and to support energy planning within European regions.

Directorate E — *energy saving and new and renewable energy sources, electricity and heat* — has been restructured. There are now three units: E1 — *electricity* — remains as a division under Hans Eliasmöller who is also appointed Adviser to the Director; E2 — *energy saving* — and E3 — *new and renewable energy sources* — are both specialized services.

In addition to these changes in structure, additional responsibilities have been given to the Deputy Director-General, **Clive Jones**, and the Director for Nuclear Energy, **Fabrizio Caccia Dominioni.** As well as his deputy role across the board, Clive Jones now has particular responsibility for supervising the work of Directorate B — *coal and other solid fuels*, Directorate E (see above) and also the new unit A3. Fabrizio Caccia Dominioni, is now also responsible for internal coordination of matters concerning the supply of nuclear materials and Euratom safeguards, as well as his existing responsibilities in Directorate D.

A new version of the establishment plan will be published in the next issue.

EC-Japan energy discussions

A delegation from the European Communities, led by **Constantinos Maniatopoulos**, the Commission's Director-General for Energy, visited Tokyo from 14 to 20 April for discussions on energy issues with senior officials of Gaimusho, MITI and other principal private and public-sector energy interests in Japan. Vice-Minister Kitamura (Gaimusho) also received the EC mission.

Given the similarity in the energy situation of both regions (i.e. high dependency on energy imports), the EC and Japan have a common interest in working closer together. The purpose of the mission was to strengthen relations in the energy area with Japan. In a press briefing given in Tokyo at the end of the visit, **Mr Maniatopoulos** said that the EC Delegation had been impressed by the very positive attitude they had found among all those they had met in deepening EC-Japan energy contacts.

Referring to the Japanese determination to continue to work to improve security of energy supplies, **Mr Maniatopoulos** said that this was similar to the energy policy goals being pursued in the Community.

Reviewing the short- and longer-term oil market outlook both sides expressed their interest in achieving stable and secure supplies. The EC delegation said that satisfaction had been expressed at the way in which the opening of the Japanese market to oil product imports had contributed to the development of a common open market approach by consuming countries.

The EC side had heard with interest details of the proposed restructuring of the Japanese domestic oil industry. Considerable restructuring has taken place in this sector in the Community as well. The emergence of producers as significant downstream investors has been a feature in the Community.

Mr Maniatopoulos said that he had been struck by the Japanese determination to continue with research, development and demonstration on new energy technologies despite today's more relaxed energy market situation. Already there was some cooperation between the EC and Japan in the area of fuel cell technology and he said that both the EC and Japan would continue to examine energy technology areas where practical cooperation between the EC and Japan may be possible.

Other issues touched on by the delegation during discussions included EC/GCC discussions, energy and environmental issues, the outlook for coal and nuclear developments in EC and Japan and electricity issues.

The discussions provided an opportunity for an exchange of views on current energy issues which should lead to closer contacts between both sides in the time ahead. Further meetings are expected in the future.

During the visit, the delegation also met with local representatives of some of the major European energy companies (BP, Cogema, Elf, Petrofina, Shell and Total).

Retirement of Dr Michael Davis

Dr Michael Davis, who retired as Director of DG XVII/E on 1 July, has had a long and influential career in the energy world. His responsibilities have extended across a variety of energy sectors, including nuclear power, energy conservation, electricity and renewable energy sources

Michael Davis graduated from Exeter University in the UK in 1943 and then served with distinction with the Royal Navy in the Pacific until the end of the War. He resumed his studies at Bristol University and obtained his Doctorate in Physics there before moving to Toronto University to take part in the Canadian Atomic Energy Project. On returning to the UK in 1951 he worked at the Admiralty Research Laboratory and then joined the UK Atomic Energy Authority in 1956.

In the course of a wide-ranging career with UKAEA Dr Davis worked on many different aspects of nuclear power before being appointed as Technical Adviser to its Chairman from 1965 to 1973. In that role he was concerned, *inter alia*, with nuclear research, materials control, uranium exploration and the world uranium market. As one of a number of international activities he prepared a report for the New Zealand Government in 1967 on the introduction of nuclear power in that country.

Following the UK's entry to the European Community in 1973, Dr Davis was appointed as Director in DG XVII responsible for both nuclear power and the electricity sector. His responsibilities in this post covered the range of DG XVII's work under the Euratom Treaty, both within Europe and internationally, as well as key electricity issues such as power station siting, the choice of power station fuels, electricity trade and pricing.

In 1981, in response to the growing volume of work in these areas, nuclear policy was transferred to a newly created Directorate and Dr Davis became Director in charge of energy conservation and renewable energies, as well as continuing with his responsibilities for the electricity sector. In this new role he launched a number of new initiatives in all three policy areas, as well as taking the lead in managing the Community's rapidly growing and highly successful energy technology demonstration programme, which now includes over 1 400 projects in the energy efficiency and renewable energy fields, and in coal technologies.

The constantly expanding volume of work under Dr Davis's charge is reflected in the recent decision, reported elsewhere in this issue, to expand to three the number of branches in his Directorate. The three areas of electricity, energy conservation and renewable energies are widely viewed as the key to the European Community's long-term energy future. It will not be easy to find a successor to Michael Davis who can bring to these tasks the same all-round qualities of knowledge, experience, management skills and, above all, personal commitment and enthusiasm.

Visit by Christopher Harding, BNFL Chairman

Christopher Harding, the Chairman of British Nuclear Fuels plc (BNFL), visited DG XVII on 18 April. He had formal meetings with a team of officials from the DG, led by Mr Caccia Dominioni (Director: Nuclear), covering a wide range of nuclear-related topics. Mr Harding also had a more informal meeting with Clive Jones (Deputy Director-General).

Because BNFL is one of the two companies in the world offering commercial reprocessing of spent nuclear fuel (the other is Cogema in France), Commission officials were especially interested in BNFL's present plans for, and thoughts on the so-called 'back-end' of the nuclear fuel cycle (storage and reprocessing of spent fuel, storage and disposal of radioactive wastes). One possibility under discussion within the UK was the storing of the radioactive wastes in a man-made structure or repository under the company's site at Sellafield. It appeared that public opinion in the UK was more in favour of storing wastes — in a form in which could be retrieved at a later date — rather than disposing of them definitively.

For his part, Mr Harding was particularly interested in the working paper prepared by the Commission on the internal market for energy and its possible implications for his company. (See article on pp. 13-14).

European conference on development of energy conservation technologies — Athens, 28 and 29 April 1988

The European conference on the development of energy conservation technologies took place on 28 and 29 April 1988 at the American College of Greece in Athens. This event was organized by the American College of Greece, sponsored by the Commission of the European Communities, and was under the aegis of the Ministry of Energy, Industry and Technology of Greece.

The participation in the Conference amounted to nearly 500 participants of all Member States and of several non-Community countries (Sweden, Algeria, Morocco, Cyprus, Tunisia, Israel, USA and China).

At the opening session of the conference, the Minister for Energy, Industry and Technology of Greece Mr A. Peponis referred to the subject of energy development in his country and to the efforts made by the government to improve the situation in cooperation with the European Community.

Director-General for Energy of the Commission Constantinos Maniatopoulos referred to the great improvements achieved by the European Community in the energy-saving field since 1973 and the ambitious goals set for the next decade. He mentioned the efforts made by the Commission in terms of demonstration projects, the Sesame data base, the Energy Bus, third-party financing, and programmes such as Brite and Valoren which aim at promoting technological advances in the field of energy efficiency. Mr Maniatopoulos concluded that the southern members of the EEC can contribute significantly to these advances, and that this will be a decisive factor in their development programmes.

Keynote speakers included Mr J. Bouvet, President of l'AFME, France, Mr W. Birner, Director, Federal Minister for Economics, FRG, Mr D. Glynn, Assistant Chief Executive of Eolas, Ireland, Mr A. Bendahane, Cabinet du Ministre chargé des relations avec la CCE, Morocco, Mr P. Overgaard, Managing Director of Rockwool International, Denmark, and Mr W. M. Currie, Head of the ETSU, UK.

A thorough presentation on Cogeneration was made by Professor E. Gyftopoulos, Massachusetts Institute of Technology, USA.

Topics covered in the conference included energy efficiency policies in Europe and the Mediterranean, energy management and financing, energy auditing, renewable energies, energy efficiency, and finally case studies.

Among the 29 technical presentations, 16 were related to Community demonstration projects and three to other activities of DG XVII in the field of dissemination of information, of financing and energy auditing.

During the conference, a panel exhibition on Community demonstration projects was presented, and the participants retrieved information from the Sesame data base.

In the conclusions of the conference, Mr M. Davis, Director for Energy Saving, Alternative Sources of Energy, Electricity and Heat of the Commission emphasized the need for information of all parties involved in the production and use of energy. He said that it was made clear in the conference that energy technologies are available, and that the future is very challenging for Greece to benefit from such technologies.

At the formal dinner at the end of the conference, Mr Maniatopoulos referred extensively to the new situations that may arise in the future in terms of energy efficiency and supply, and the flexibility that each country must have to adapt to such new conditions. He emphasized the fact that energy is a scarce commodity, which must be used with care and wisdom. The efficient use of energy must be developed and promoted, he concluded.

Modern management in coal mines

The Commission of the European Communities held an information symposium at the Jean Monnet building, Luxembourg, on 'Improving productivity through technology: Modern management in the coal mines of the European Community' on 4 to 6 May 1988. The symposium was opened by Mr Lahure, Secretary of State for Luxembourg and Mr Sierra, Director of Coal, DG XVII.

There were 250 participants from 14 countries. Due to the rapid development of microelectronics and communication technologies, many participants stressed the need for closer cooperation in the EC in order to harmonize technical standards to enable different computer-based systems to be interconnected.

The closing address, given by **Mr E. Horton** (Area Director, South Yorkshire Area, British Coal Corporation), highlighted the main conclusions of the symposium. The text of this address is reproduced below.

'Gentlemen, I now have the task of drawing some conclusions and looking at the future. After listening for almost two and a half days to some excellent technical papers it seems that we all have a great deal in common.

We face the same problem.
We have the same enemies.
We all have the same solution.

The problem that we face in the coal industries in Western Europe is that of survival. Our existence is being threatened by our common enemies, the alternative forms of energy that are available, particularly coal from elsewhere in the world.

And the solution that we all have is to continue to reduce the costs of production.

It is easy to say that, and can be difficult to achieve, but I am very optimistic about the future in the coal industry.

The international price of coal is very low at present, because of massive investment in production capacity following the war in 1973 in the Middle East, and the consequent increase in the price of oil, but I believe that the present world price of coal cannot be sustained. Only 7% of the total world production of coal is traded internationally and any attempts to buy large amounts would destabilize the price.

Freight rates are beginning to increase and the present weakness of the American dollar will not be sustained.

All these factors will work in our favour but we cannot afford to rely on these alone. We have got to continue our efforts to reduce the costs of production.

In the UK in the last two years we have improved productivity by 43%. But a lot of the strategies that have been employed are no longer available to us.

There is a limit to how many low productivity mines can be closed, we cannot reduce the numbers of men at the same rate as in the past, because the remaining mines have to be staffed, and we cannot continue to spend money to buy our way out of trouble.

The solution does not lie simply with cutting costs, that in itself will not be sufficient. **We have got to accept that we have the equipment, we have the technology, and it is now the job of the engineers in mining to make it work.**

We have a phrase (that I hope will translate): 'We have to make the machinery sweat'. In other words, we must make it work harder.

I would like to illustrate that statement by concentrating on one particular aspect of the symposium.

I have listened with great interest to the papers on seismic exploration, on maintenance systems, and on remote control and monitoring, and all have the same thing in common, they reduce uncertainty.

This is vital in the mining industry and is extremely important to us, but I would like to concentrate on the second technical session, the management information systems — concerning colliery operations.

I would like to be even more selective now, and whilst I recognize the value of computers in areas such as personnel records, monitoring the mine environment, and so on, it is particularly the use of computers in the detection and analysis of delays to the production process that I think the future lies.

It seems obvious that wherever possible we should automate the mining processes where it is cost effective. In my own area we have 12 faces where the coal-cutting machines are steered within the seam automatically, and data transmission systems exist to indicate to the surface machine position, direction, and speed and the electrical and hydraulic health of the machine.

We have powered supports moved automatically and we are once again experimenting with automatic face alignment. We not only get a guaranteed work rate, but the quality of work is better, with a consequential improvement in the performance indices of the equipment.

It also seems obvious from the papers that where we cannot automate them we should monitor constantly the health of the machinery, either on line or at periodic intervals according to experience.

However a modern coal face is a complex mixture of electrical, mechanical, hydraulic and electronic engineering operating in a hostile environment and interruptions to production will occur.

It is this area that offers the most opportunity for improvement.

The potential of a coal face is derived by looking at the machine speed, the face length, the turn-round times at the ends, and calculating the number of passes that can be achieved in a working shift if there are no interruptions.

The management information systems in my own area are concentrating on the gap between actual production and potential production.

We have in the past measured ourselves against previous achievements, we are now measuring ourselves against the possible.

If a face should achieve eight passes in the shift and actually achieves six, then the management information system should account for 25% of time lost during the shift.

The software is also being written to assist the operator to determine true cause rather than record the effect.

All this requires a change in the style of management. Mining engineers are traditionally aggressive managers, **that aggression has to be channelled into a more analytical approach.**

Our management are receiving training in how to use management information in prediction of potential problems, in problem solving, and decision making.

Gentlemen, I am optimistic about the future because such a gap exists between what is actually being achieved and what is possible.

I am optimistic because mining engineers are by tradition dedicated and committed to their occupation, and they will reduce that gap. The prize is tremendous — in my own area of 18 collieries, 1% improvement achieves UKL 10 million increase in revenue.

More importantly, it reduces the cost of production and enables us to explore the sensitivity of the market.

Gentlemen, we have the equipment, we have the technology, the future depends on the management'.

Wind demonstration programme contractors' meeting — Mykonos, Greece, 25 and 26 April 1988

A contractors' meeting on the CEC demonstration projects on 'Autonomous and wind-diesel systems' was organized on Mykonos Island on 25 and 26 April 1988. The meeting was held with the collaboration of the Greek Public Power Corporation (PPC). It was chaired by **Hubert Nacfaire**, the Commission's coordinator for wind energy projects. There were 55 participants from nine Member States.

The meeting was opened by **Mr A. Kravaritis** (Deputy Director-General of PPC) who referred to the existing plans to install 18 MW of various size wind turbines within the European Community programmes. **Dr Davis** (Director: Energy saving and alternative energy sources, electricity and heat) welcomed the participants on behalf of the Commission.

The objectives of the meeting were:

(a) to assess the state of advancement of the projects, aiming at wind-diesel systems (including projects where wind turbines are connected to a diesel-based grid) and autonomous systems;

(b) to share the experience gained by contractors;

(c) to favourize a possible cooperation between manufacturers;

(d) to inform the utilities of the state of the art;

(e) to stimulate the replication of successful projects;

(f) to visit the realization in Mykonos.

Presentations were made on 17 projects. There were also presentations by three invited speakers. The first speaker, Professor L. H. Lipman, presented a paper 'Overview of wind-diesel activities'. The second speaker, Dr G. Cramer, presented a paper on 'Control and load management systems on wind power plants connected to diesel-based grids' and the third speaker, Mr S. E. Andreasen, described the experience gained from the realization of a wind-diesel project in China (project WE/512/85 UK, financed by DG VIII).

Particular attention was given to successful cooperation between utilities, manufacturers and users. There were lively discussions with many useful exchanges of ideas. The proceedings of the workshop will be published.

Conclusions which could be drawn from the meeting include:

1. Wind penetration could be as much as 30 to 35% in terms of installed power in a diesel-based grid without causing special problems.

2. Wind penetration, in terms of generated energy, could be as high as 50% leading to an almost equivalent amount of fuel savings.

3. In most applications, a rather sophisticated load and control management is required, sometimes with the addition of dump loads. The latter should be as useful as possible so that it could be considered as a useful application and have a positive contribution to the economics of the project.

4. Applications which have an inherent character of storage, such as desalination, refrigeration or pumping, should be preferred compared to applications which require direct use of the wind energy.

5. Battery storage is still considered as very expensive and its use is advisable only if there is no other alternative.

6. There is still much work to be done in the R,D&D field in order to achieve a deeper knowledge of these systems.

7. It was emphasized that greater collaboration is needed between manufacturers and researchers in the field. Furthermore, standardization of the wind-diesel system would lead to more reliable and cost-effective systems.

There was a visit of the installation on Mykonos. The design, construction and demonstration of this 108 kW, horizontal axis, three-bladed wind turbine has been supported by the Commission as part of the Demonstration Project programme.

Recovery of energy from municipal and industrial waste through combustion — Cambridge, United Kingdom, 21 to 24 June 1988

In recent years, the need for greater environmental protection has led to a general review of waste combustion systems, with substantial technological changes which have affected process energy balances. Technologies which seemed reliable and proven have been questioned — this applies not only to mass combustion but also to RDF production and, more particularly, its use. Increasing concern is being expressed in various EEC countries about the pollution hazards of emissions and ash. A variety of theories and approaches have emerged. Experimental projects have been conducted and monitored, producing a mass of results from which an overview of the subject can now be attempted.

The CEC, the Warmer Campaign and the UK Department of Energy organized an international seminar to present the state of the art in the municipal and industrial waste combustion sector, including refuse-derived fuel (RDF). The seminar included guided tours of energy-from-waste plants in the UK, followed by presentations in paper and poster form.

The aim of the seminar was to identify themes and subjects on which action is still considered essential at Community or national level. It provided a technical forum for authorities, public bodies, manufacturers, research workers, institutions and all other relevant organizations so that they can capitalize on experience for the common good.

The seminar focused on the energy aspects of waste combustion and was directed specifically towards building upon the experience of experts to set the agenda for future R&D pilot and demonstration and information transfer activities within the Community. Achievements of non-EEC countries were also considered in order to assess potential for their adaptation to European requirements.

Further information about this seminar can be obtained from:

G. L. Ferrero
Directorate-General for Energy
Commission of the European Communities
200 rue de la Loi
B-1049 Brussels
Tel. (02) 235 79 72
Telex COMEU B 21877
Telefax (02) 235 01 50

Eighth annual meeting of the EC Network for energy planning in developing countries — New Delhi, India, 11 to 15 April 1988

The Tata Energy Research Institute (TERI) invited the member institutes of the EC Network for energy planning in developing countries to New Delhi for the Network's eighth annual meeting.

The EC Network for energy planning in developing countries

This Network, which was set up in 1980, has since then been supported by the European Commission's Directorate-General for Energy.

The research is carried out in a Network which consists of 10 research institutes in Asia, Africa, Latin America and Europe; the project has provided an opportunity for continuing cooperation, both South-South and North-South. Research has respected the complete academic freedom of the participating bodies and has been enriched by their diversity. Finally, the joint work has concentrated on research into methods and instruments for analysis, forecasting and decision-making, tailored to the energy situations of developing countries and the aims which they set for themselves. While there is great diversity between them, which the approach adopted fully respects, these countries have common features in which they differ fundamentally from the industrialized countries.

The institutes belonging to the Network are:

the Arab Centre for Energy Studies, Kuwait;
the Asian Institute for Technology, Bangkok;
the COPPE-AIE Energy Department of the University of Rio de Janeiro;
the Enda Institute, Dakar;
the IDEE of the Bariloche Foundation in San Carlos de Bariloche, Argentina;
the IEJE of Grenoble University, France;
the IIE at Cuernavaca, Mexico;
the INET Energy Institute of Qinhua University, Peking;
the SPRU of the University of Sussex, Brighton, UK; and
the TERI, New Delhi.

Other institutes and organizations have been invited to take part in the work of the Network, such as the Junta of the Andean Pact, the Asean-EC Centre for Training and Research on Energy Management in Jakarta, the ISET in Tianjin, China and the DEC Institute at Zhejiang University in Hangchow, China.

These institutes have exchanged the results of their work and discussed guidelines for the programme in the future. Their activities involve chiefly:

(i) methodological research and studies on the energy/development and energy/environment interfaces;
(ii) drawing up energy balances, setting up data bases, and drafting supply and demand analyses and energy plans;
(iii) training managers in energy planning;
(iv) providing technical assistance in drafting energy plans/analyses for governments of developing countries and international organizations.

Some 50 researchers and experts are currently cooperating within the Network on about 30 projects cofinanced by the European Commission (DG for Energy). Over the last 12 months this work has been supported with 1.5 MECU of aid.

European combustion pollution conference

With financial backing from the Commission on 16 and 17 May the European Federation of Energy Management Associations (EFEM) and VDI — *Gesellschaft Energietechnik* held a conference in Hamburg on new methods of reducing pollution caused by the combustion of various fuels.

This event provided an opportunity for a Europe-wide exchange of information on clean-air and energy-saving technologies. Not only the specific environmental problems but also a number of energy issues closely associated with them were discussed.

The conference was opened by Georges Fournier, President of the EFEM, Mr Stroetmann, Secretary of State in the Federal Ministry of the Environment, Nature Protection and Reactor Safety and by Senator Jörg Kuhbier, Chairman of the Hamburg Environmental Protection Agency.

Energy efficiency in inland transport

An international conference on energy efficiency in inland transport was held in Luxembourg from 16 to 18 May. A total of 35 papers were given to some 170 delegates from the car industry, research institutes and the public sector. Nic Mosar, the Commission Member with special responsibility for energy policy, opened the conference. The first session was chaired by Constantinos Maniatopoulos, the Director-General for Energy.

Energy efficiency in new buildings: comparison of requirements in force in the Member States

The Directorate-General for Energy has published a report summarizing insulation and ventilation requirements for new buildings in the Member States of the Community.

The report makes a detailed analysis of the legislation in force (situation at 31 December 1986), and compares the different systems with one another: in order to achieve this, a yardstick, i.e. a common method for expressing requirements, was prepared. This was necessary because of the great variety of the criteria used: 'overall heat loss', 'net heating energy needs' or 'energy consumption'.

All the systems of rules were converted, using the following parameters:

V (m^3) = gross volume of building

A (m^2) = total surface area in building through which heat is lost

U_m(W/m^2K) = transmission heat losses per unit surface area

Compactness (m) = V/A

By representing these rules on a common graph (vertical axis U_m, horizontal axis V/A), it is possible to draw a number of conclusions:

(a) all the standards (except the Greek) are represented by straight lines, but these do not yet reach a plateau under limiting conditions (extreme values of compactness coefficient);

(b) the (positive) slope of the line is lower the stricter the insulation requirements;

(c) the simple empirical rule, under which the value of U_m doubles as the compactness coefficient rises from 1 to 4 is confirmed very well by the results for four Member States (Denmark, the Netherlands, Portugal and the United Kingdom), fairly well for four others (FR of Germany, Spain, Ireland and Italy) and less well for the last three States involved (Belgium, Greece and France — there are no specific rules in Luxembourg).

Thus each system of rules can be briefly summarized by giving the value of U_m which corresponds to compactness coefficient V/A = 1.

The report is available, in English, from the Directorate-General for Energy: 'Thermal insulation and ventilation in buildings: A comparison of requirements in EEC Member States. Situation 1986' (Ref. BAT 01/87, September 1987).

Forthcoming events

Euroforum new energies '88

By the year 2000, energy derived from the sun, from the wind, from the oceans and from organic materials should be making a noticeable contribution to Europe's energy demands.

With the turn of the century little more than a decade away and with over 10 years of research, development and demonstration experience in this important field of renewable energy, the CEC has decided that now is an appropriate time to hold a major congress to access work carried out to date and to consider the prospects and further technology developments which are needed for this energy sector up to the century's end.

The Congress will be opened by Vice-President Narjes of the Commission, Mr Mosar, Member of the Commission responsible for energy, and Mr Lafontaine, Prime Minister of Saarland.

At the end of the Congress, Commissioner Mosar will hold a press conference on the commercialization of renewable energies.

This congress — to be known as 'Euroforum new energies' — will be held in Saarbrücken, Federal Republic of Germany on 24 to 28 October 1988 and will consist of two parts:

(i) on the first four days consideration will be given to R&D in renewable energies by providing detailed analyses of progress in the European Community over the last 12 years including consideration of the products, processes and procedures developed, cost and economics of the systems produced. The conference will also offer the opportunity of assessing the probable prospects for new energy technologies to the end of the century by discussing in detail R&D strategies and the credibility of the technologies and systems developed;

(ii) on the last day a description and evaluation of the European Community's demonstration project programme in renewable energies will be presented. A panel of distinguished speakers will then, in the light of information presented at the conference, debate the future role which different renewable energies could play, how they could be more effectively commercialized and how various obstacles should be overcome to achieve a more significant role.

To achieve these aims, specialists from all sectors of the field of new and renewable energies will present the results of their work at the congress in order that this cross-fertilization of ideas will result in a full and comprehensive understanding of the systems developed and of the problems encountered in the separate fields of this energy sector.

The organizers consider that it will be particularly important to familiarize specialists with research work in fields adjacent to their own if the congress is to succeed in setting out a global perspective for the renewable energy technologies.

To this end, the technological areas to be discussed will include:

(a) solar energy systems including solar thermal, solar architecture and solar photovoltaics;
(b) biomass;
(c) wind power;
(d) ocean energy;
(e) geothermal energy;
(f) hydrogen production;
(g) small hydro power;
(h) landfill gas production;
(i) waste incineration for power generation;
(j) photoelectric chemistry;
(k) co-generation and district heating.

In addition to these presentations — taking the form of both oral and poster presentations — a series of overview papers will be presented and each session will end with a Round Table discussion, each one considering a separate relevant issue connected with the renewable energy technologies. In all oral sessions interpretation into German, French and English will be provided.

In parallel with the congress, an exhibition of the principal technologies developed under the CEC's renewable energy research, development and demonstration programmes will be mounted to help participants familiarize themselves with products and processes now available in all the separate fields of renewable energy technology.

The congress is sponsored jointly by the CEC and the State Government of Saarland, Federal Republic of Germany. It will also be supported by BMfT, Bonn and AFME, Paris.

For further information, please contact:
H. S. Stephens & Associates
Conference Organizers
Agriculture House
55 Goldington Road
Bedford MK40 3LS
United Kingdom
Tel. (0234) 49474

International conference on pyrolysis and gasification — Luxembourg, 15 to 17 November 1988

The Commission of the European Communities is organizing an international conference on the **pyrolysis and gasification of waste materials (including plastics, rubber and wood wastes, various forms of biomass and other low-grade solid fuels)** as a potential resource for:

(i) the production of storable fuels, chemical intermediates, synthesis gas, monomers, or activated carbon;

(ii) the fuelling of spark-ignited engines, gas turbines or retrofitted boilers.

The conference will be held in Luxembourg from 15 to 17 November 1988.

Discussion of these themes, in particular those related to energy or the environment, will assist the Commission in defining its course for further action.

The emphasis of the conference will be on the practical results of past and current work in the EEC and worldwide, rather than on fundamental analysis. The latter will be amply covered by a few invited contributions.

Further details of the conference programme were published in *Energy in Europe* No 7.

Those who would like to participate in the conference or receive the final programme should write to Professor A. Buekens, Vrije Universiteit Brussel, Pleinlaan 2, Brussel; Tel. (02) 641 3250/(02) 641 3247, or G. L. Ferrero, Commission of the European Communities, Directorate-General for Energy, 200 rue de la Loi, B-1049 Brussels; Tel. (02) 235 7972; Telex COMEU B 21877.

Commission workshops on demonstration projects

The Commission organizes a number of workshops on successful demonstration projects.

Date:	1 July 1988
Location:	Tralee, Ireland
Subject:	Multifuel fluidized bed boiler using indigenous solid fuels with a steam/diesel turbine
Contractor:	Kerry Cooperative Creameries Ltd
Project:	EE/251/81-IR

Date:	21 to 23 September 1988
Location:	Grenoble, France
Subject:	Photovoltaic electricity for mountain refuges
Contractor:	Club alpin français, La Grande Traversée des Alpes
Project:	SE/501/85-FR and SE/696/84-FR

Date:	18 October 1988
Location:	Marsciano (PG), Italy
Subject:	Conveyor network and plant for energy recovery and manure regeneration of 86 farms
Contractor:	CEAM and Municipality of Marsciano
Project:	BM/016/83-IT

Date:	20 October 1988
Location:	Rimini, Italy
Subject:	Medium temperature heat recovery from cupola furnaces
Contractor:	Consorzio Fonderie SCM SpA
Project:	EE/083/81-IT

Further information can be obtained from:

T. Van Rossum
Commission of the European Communities
Directorate-General for Energy
200 rue de la Loi
B-1049 Brussels

European conference on recent advances in heat exchangers — Grenoble, 12 and 13 October 1988

EFEM (European Federation of Energy Management Associations) and GRETh (Group for Research on Heat Exchangers) are organizing a conference as a part of TEC 88 (European Forum of Competitive Technology).

The conference is intended for users, contractors and manufacturers of heat exchangers as well as research laboratories.

The authors will come from European industrial firms and research laboratories concerned with:

(i) improvements of the performance and/or the technology of heat exchangers; and
(ii) new concepts of heat exchangers,

which have industrial applications.

Possible topics are improvements to existing heat exchangers, new concepts for low or high temperature heat exchangers, heat transfer process intensification, and fouling prevention.

The papers will deal with all kinds of heat exchangers: gas or liquid heat recuperators, evaporators, condensers, compact heat exchangers, air-cooled heat exchangers, cooling towers, fluidized bed heat exchangers, etc.

TEC 88 will be a European event sponsored by the City of Grenoble, the Isère Department, the Rhône-Alpes Region and the Grenoble Chamber of Commerce and Industry on 12 to 15 October 1988. The attendees will be able to visit any or all of:

(a) six halls featuring exhibitions of advanced technology;

(b) one general interest hall presenting applications;

(c) one hall to illustrate what the company needs are for implementing the new technologies;

(d) 15 conferences or discussion meetings on how to achieve competitiveness; 'Recent advances in heat exchangers' is one.

For full details of TEC 88, please contact:
TEC 88
1 Place André-Malraux
BP 297, F-38016 Grenoble Cedex
Tel. 76 87 59 27/76 47 20 36
Telefax 76 46 06 78

or J. Sirchis
Commission of the European Communities
Directorate-General for Energy
200 rue de la Loi
B-1049 Brussels
Tel. (02) 235 3633
Telex COMEU B 21877.

Utilization of waste heat from power stations — Gembloux, Belgium, 13 to 15 March 1989

Waste heat from power stations is a source of energy little used at the present time. Put to judicious use, this source could make for appreciable energy savings. Individual uses of this heat have already confirmed the validity of upgrading technologies and enabled economic operating balances to be established. Before undertaking new projects in this sector, however, it is time to take stock of the experience gained, to verify the economic and energy balances and to compare the problems encountered and the solutions found.

This is the aim of an international seminar being organized in March 1989 by the Commission of the European Communities, Directorate-General for Energy, the European Cooperation Networks for Agriculture and Energy of the United Nations Food and Agriculture Organization, and *La recherche agronomique de Belgique*, with the participation of the State Faculty of Agricultural Sciences at Gembloux. This should allow us to examine the state of the art of the technologies employed and their economic viability and thus help to formulate conclusions and recommendations to guide future activities in this sector, especially those connected with demonstration and commercial exploitation projects.

The seminar will be limited to the use of low-temperature waste from power stations with a power greater than 100 MW. The use of steam or high-temperature hot water is thus not included.

Seminar organization

The seminar will cover the following sectors:

1. **Aquaculture**
   1.1. Fish breeding for fresh water;
   1.2. Fish breeding for sea water;
   1.3. Seaweed cultivation;

2. **Agriculture** (horticulture, market gardening)
   2.1. Crops under glass;
   2.2. Field crops;

3. **District heating;**

4. **Economic and institutional aspects.**

The seminar will be held at the State Faculty of Agricultural Sciences in Gembloux. It will comprise a full session of selected oral reports on the aspects of most interest in the above fields plus a session of selected posters designed to present specific results of research and development work, demonstrations or commercial, acting at full-scale operation. It will be highlighted by a visit to an operating site.

For further information, please contact Professor J. Deltour, Secrétariat séminaire rejets thermiques, Faculté des Sciences Agronomique de l'Etat, 8 avenue de la Faculté, B-5800 Gembloux; Tel. 32 81 622 497; Telex 59482 FSAGX, or G. L. Ferrero, DG XVII, Commission of the European Communities, 200 rue de la Loi, B-1049 Brussels; Tel. (02) 235 7972; Telex COMEU B 21877; Telefax (02) 235 0150.

Document update

Main Commission energy documents, proposals, directives

588DCO175	Communication from the Commission: Accelerating discrete energy efficiency investments through third-party financing COM(88) 175 final — OJ L 122 of 12 May 1988, p. 75
588PCO225	Proposal for a Council Recommendation to the Member States to promote cooperation between public electricity supply companies and auto-producers of electricity COM(88) 225 final
588DCO185	Commission Report on the implementation by Member States of the Council Recommendations of 24 May 1983 on the encouragement of investments in the use of solid fuels in industry (83/250/EEC) and in public buildings and in district heating systems (83/251/EEC) COM(88) 185 final
COM/88/107	Proposal for a Council Decision amending its decision of 18 June 1963 on the conferring of advantages on the 'Kernkraftwerk RWE — Bayernwerk GMBH' (KRB) joint undertaking on the transfer of knowledge by that undertaking
COM/88/174	Communication from the Commission — The main findings of the Commission's review of Member States' energy policies — The 1995 Community energy objectives
COM/88/0238	Commission working document — The internal energy market

New energy publications
European Community demonstration projects for energy saving and alternative energy sources

No 64	Group solar heating in London Highlands Close, Islington (Project SE/179/81-UK)
No 65	Superheated steam beet pulp drier with mechanical vapour recompression (Project EE/244/84-F)
No 66	Recovery of heat from the process of magnetizing reduction of pyrite cinders in the form of superheated water for steam generation (Project EE/224/80-I)
No 67	Anaerobic digestion of brewery wastewater (Project EE/093/82-B)
No 68	Energy saving in malt drying: by recovering heat from the air discharged from malthouses using a heat pump (Project EE/095/81-F)
No 69	Photovoltaic electrification of 40 isolated dwellings in France (Project SE/466/83-FR)
No 70	Incineration of solid waste to raise steam for industrial use (Project EE/288/81-F)
No 71	Use of heat accumulators based on 'Serrolithe' in hothouses for flower growing (Project EE/667/83-I)
No 72	Low-energy houses ('Solpac' project) (Project EE/290/79-FR)
No 73	Continuous heat recovery from the boiling of beer-wort (Project EE/658/83-D)
No 74	Geothermal district heating project at Metanopoli (Milan) (Project GE/002/79-I)

Statistics

Energy statistical yearbook 1986
Luxembourg, 1988. 114 pp.
ISBN 92-825-8091-1

Principles and methods of energy balance sheets
Luxembourg, Office for Official Publications of the EC, 1988. 16 pp.
ISBN 92-825-7962-X

Research & development

La politique de recherche et de développement technologique de la Communauté européenne (troisième édition)
André, Michel. Commission des CE, *Documentation européenne*, No 2. Luxembourg, Office for Official Publications of the EC, 1988. 74 pp.
ISBN 92-825-8038-5

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