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# ENERGY IN EUROPE

Energy policies and trends in the European Community

Number 6 December 1986

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) |
| **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 |

| | |
|---|---|
| **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 |

# Farewell message from C. J. Audland

When I retired on 1 October 1986, I had spent 13 years in the service of the Commission, first as Deputy Secretary General and then from 1981 as Director-General for Energy. Moreover, before joining the Commission, I had, as a United Kingdom diplomat been closely concerned with the process of European integration for some 25 years. So when the editor of *Energy in Europe* asked me for some valedictory thoughts I felt I would like to devote some space not only to energy but also to the development of the European Community.

It is difficult to form a balanced view of the Community's progress. The media tend to focus on the controversies, and to pay less attention to the advances. Often over the years people have asked me why the Community appears to be permanently stuck. The answer of course is that, even if it gives this impression to some, it is in fact constantly developing.

Perhaps I can best illustrate this by simply listing a few of the main developments in Community life since I started working in the Commission at the time of British entry in 1973:

- Three successive enlargements. I have seen the Community move from the six original Member States to a family of 12 nations with a population of 320 million. I doubt whether the Founding Fathers, even at an optimistic level, would have prophesied this.

- The position of the European Parliament has been substantially improved. It was given significant new powers in relation to budget-making by a Treaty of 1975. More important, it has been directly elected since 1979. This has led to a qualitative change. The MEPs are now elected specifically to deal with European Community affairs. They are mostly full time on the job. And there are more of them. Nowadays, the ratio of MEPs to citizens is about the same as that between US Congressmen and American citizens.

- It has become a rule that our Heads of Government should meet every six months to discuss European affairs. This is important because it means that these affairs are regularly considered at the very highest level of government.

- The Community institutions have been given many new and important tasks. These flow for example from:

  — the establishment of the European Monetary System;

  — the massive development of the Community system of borrowing and loans, especially to promote industrial growth;

  — the progressive development of a very large programme of Community support for research, development and demonstration which now spans a huge number of industrial sectors;

  — the development of a Community regional policy, underpinned by the Regional Development Fund;

  — a massive increase in the Community's programmes of aid for developing countries (where the Community and its Member States lead the world);

— the development of a Community programme of measures to enhance the environment;

— the development of a common fisheries policy.

- Alongside the Community's established by the ECSC, Euratom and ECSC Treaties, there has progressively developed during the last 15 years, a vast area of purely governmental cooperation between the 12 Member States which we call political cooperation.

This year our Heads of Government signed a treaty of substantial importance, known as the 'Single European Act', for the further development both of the Community and of political cooperation. In so doing they said that these two institutional arrangements had a single aim, and that they should be seen as steps towards the still wider concept of European union.

This list illustrates some of the new developments, and is not exhaustive. Of course, these new activities are additional to those which were already operating before 1973 — such as the common agricultural policy and the customs union.

A convinced European like myself always wants to see faster progress towards this goal of European union than naturally occurs. Yet even so, when one looks back, and when one compares this process of 'pre-federation' with the terrible discordances which have rent the European continent asunder so often in the past, we can surely take a good deal of satisfaction about the point we have reached. It is all the more remarkable when one considers that in moving towards union, we start, on the one hand, from a large common cultural heritage and yet, on the other, from enormous disparities in terms of language and economic and social development.

Let me now offer you some thoughts on how energy matters have progressed in the European Community during my tenure.

I became the Commission's Director-General for Energy in 1981. When I came to DG XVII it had a good reputation both within the Commission itself and in the energy world at large.

*On the administrative front* I set myself three targets. Firstly to improve the cost-effectiveness of the organization, secondly to supplement its analytical capabilities and thirdly to disseminate information on energy technology more widely and provide a better service to the public. I believe substantial progress has been made on all three fronts. A massive injection of electronics into DG XVII has helped in every case both to digest, analyse and disseminate a wealth of information about the Community's energy markets in an efficient and imaginative way. *Energy in Europe* itself is an example of this. Likewise, much effort has been made to disseminate knowledge of our energy technology projects - particularly using the Sesame data base, which is now progressively going public. I am delighted that Sesame now covers not only Community funded projects but also those funded by the different Member States.

*On the energy policy front* it was clear five years ago, as it is clear now, that the Community as a major importer and user of oil for the foreseeable future would be very vulnerable to turbulent world oil markets. Indeed when I took over the job in 1981, the price of imported crude oil was over 35 ECU/barrel and the Community was stuttering into the worst economic recession since the 1930s.

The thrust of Community energy policy, then, as now, has been to limit our use of energy, and particularly oil. The instruments the Community has developed to do this with the constant prompting by DG XVII and the Commission have been to encourage energy saving, diversify energy supplies, encourage the use of alternative energies, promote energy research, limit hydrocarbon use in power generation and support the peaceful use of nuclear energy for which the Community has unique competence under the Treaties.

How has the Community responded to these energy policy imperatives since 1981? Although the going has been rough at times, we have made real progress. We have set ourselves qualitative energy objectives and attained them. We have managed to get various energy technology projects multi-annually funded. We are maintaining a substantial energy research programme. We are prime movers in many international energy forums (for example the IEA, the IAEA) and have greatly extended our energy relations with the oil producers, LDCs, China and other parts of the world. And we are better prepared, today, to deal with energy crises in general. Recently the Community has set itself new energy objectives for 1995 — among which is the objective to improve energy efficiency in the Community by 20% by 1995 (see first article in this issue). This is a bold step and spells out the European Community's political commitment to continue its long-term energy restructuring.

But most important I believe these energy policies are working. The Community energy balance today has been radically and favourably restructured — perhaps irreversibly. For example, nuclear energy is now worth 3 Mb/d of oil equivalent to the Community and today, compared to 1979, we need 15% less energy to produce one unit of Community GDP. Substantial achievements yes, but the end of the story, no.

Take developments in 1986 as an example. Within the space of the first five months of 1986, oil prices had halved and the world witnessed the worst civil nuclear accident in its history at Chernobyl. These two events provide new challenges to international energy policy makers. For example, could oil demand surge again and how can international cooperation improve mechanisms for dealing with nuclear accidents?

Energy is a vital, strategic industry and there are plenty of new challenges ahead. For example, the challenge to complete the progress already made towards the completely free movement of goods in a unified market. Of course, energy will have an important place. Energy is also big business which will always produce argument, controversy and sensitive problems. There will always be issues for the international policy-maker and the European to deal with.

Let me summarize with four policy conclusions that I derive from my five-year European energy experience. These are:

— that continuous, strong energy policies in the European Community are working and should be maintained;

— that our energy policies should be guided by the long term, just like the thinking of the Founding Fathers of the European Community were. We should not allow ourselves to be blown off course by short-term disruptions;

— that the energy world is interdependent; all countries, rich and poor alike, must make efforts to use a finite resource, sparingly;

— that we should retain enough flexibility in our energy systems to cope with unpredictable situations.

One final remark. Having directly observed some of the initial architects of Europe at work, people like Adenauer, Schuman, Monnet, Spaak and Luns led me in the 1950s to believe firmly in the merit of establishing a strong European Community.

I am happy to have been able in the last few years to play a modest part in its construction. The task is often difficult but I have found it both enriching and rewarding. I have been helped throughout by marvellous support from Commission officials who worked for me, and I close by expressing my warm gratitude to them.

**C.J. Audland**

# The Commission's new Director-General for Energy, Mr Constantinos S. Maniatopoulos

The Commission's new Director-General for Energy is **Mr Constantinos S. Maniatopoulos** from Greece. Mr Maniatopoulos took up his post on 17 November 1986, replacing Mr Christopher J. Audland who has retired.

Mr Maniatopoulos was born in Patras in 1941 and is married with one son. He has degrees in Mechanical and Electrical Engineering from the Technical University of Athens, in Business Administration from the Graduate School of Economics and Business Sciences, and in Operations Research and Statistics from the Institut Statistique de l'Université de Paris, France and is trilingual (Greek, French, English). Mr Maniatopoulos taught at the Technical University of Athens from 1971 to 1978 and was nominated Professor of Operations Research at the Postgraduate Centre between 1973 and 1978.

Mr Maniatopoulos has extensive industrial and energy experience. He has worked for oil companies (in Paris for 1 year and Greece for 12 years) and was appointed Special Adviser to the Greek Minister for Energy on oil matters between August 1982 and March 1984.

In March 1984 Mr Maniatopoulos was nominated Chairman and Managing Director of the EKO group of companies — the company set up after the purchase of ESSO by the Greek State. The EKO Group has extensive interests in investment, refining, chemicals, oil marketing and industry and it is one of Greece's largest companies with over 1 300 employees. Mr Maniatopoulos leaves the EKO group to join the Commission of the European Communitites.

During his working career Mr Maniatopoulos has also been General Secretary of the Technical Chamber of Greece, Chairman of the Board of the Greek School Buildings Organization and Member of the Boards of the Hellenic Society for Operations Research, the Hellenic Organization for Standardization and other organizations. He was also the Secretary of the Greek Committee of the World Energy Conference between 1978 and 1982.

Mr Maniatopoulos will preface the next edition of *Energy in Europe* (due out in April 1987).

# New Community energy policy objectives for 1995

A detailed review was given in *Energy in Europe No 2* of the Commission's proposal concerning new Community energy policy objectives for 1995 and the philosophy and approach underlying the proposal. After more than a year of negotiations the Council adopted the new 1995 objectives on 16 September in a unanimous Resolution.

*The fact that the Council adopted the new energy objectives unanimously is an impressive confirmation of its determination to continue to pursue an efficient energy policy.* The present situation on the energy market, characterized in particular by the fall in oil prices and the Chernobyl accident, has not called into question the long-term objectives of the Community's energy policy such as oil-substitution and energy efficiency. Nevertheless, it was necessary for the Community to frame the energy objectives for 1995 flexibly, so that long-term structural changes in the energy situation can be allowed for.

The Commission will continue to review national energy policies in order to monitor progress towards the new energy objectives. [1] All the Community Member States are called upon in the Resolution to make comparable efforts to achieve these new objectives, so as to ensure that in 1995 the Community's energy situation is secure. The objectives adopted were:

## General energy objectives

- **Security of supply**

To maximize security of supply and reduce the risks of sudden fluctuations in energy prices through:

— the development of the Community's own energy resources under satisfactory economic conditions,

— geographical diversification of the Community's external sources of supply,

— appropriate flexibility of energy systems and, *inter alia*, the development, as necessary, of network link-ups,

— effective crisis measures, particularly in the oil sector,

— a vigorous policy for energy-saving and the rational use of energy,

— diversification between the different forms of energy.

## Specific energy objectives

- **Energy efficiency**

To achieve even greater energy efficiency in all sectors and act to highlight specific energy-saving possibilities.

*The efficiency of final energy demand [2] should be improved by at least 20% by 1995.*

**• Cost efficiency**

Cost efficiency in the implementation of energy policy measures.

**• Energy pricing**

The application, in all consumption sectors and to all forms of energy of the Community's energy pricing principles approved by the Council.

**• Internal energy market**

Greater integration, free from barriers to trade, of the internal energy market with a view to improving security of supply, reducing costs and improving economic competitiveness.

**• Environment**

A search for balanced solutions as regards energy and the environment, by making use of the best available and economically justified technologies and by improving energy efficiency, as well as taking account of the desire to limit distortions of competition in the energy markets by a more coordinated approach in environmental affairs in the Community.

**• Oil**

To keep net oil imports from third countries within reasonable proportions by maintaining a policy of oil substitution and by continuing and, if need be, stepping up oil exploration and production in the Community, particularly in promising areas not yet exploited.

*Oil consumption should be kept down to around 40% of energy consumption and net oil imports thus maintained at less than one-third of total energy consumption in the Community in 1995.*

**• Natural gas**

*To maintain the share of natural gas in the energy balance* on the basis of a policy aimed at ensuring stable and diversified supplies and continuing and, if need be, stepping up, natural gas exploration and production in the Community.

**• Solid fuels**

To pursue efforts to promote consumption of solid fuels and improve the competitiveness of their production capacities in the Community, taking into account the new possibilities opening up on the market for uses of solid fuels with greater added value.

*The share of solid fuels in energy consumption should be increased.*

**• Electricity generation**

To continue with, and step up, the measures taken to reduce as much as possible the share of hydrocarbons in the production of electricity.

*The proportion of electricity generated from hydrocarbons should be reduced to less than 15% in 1995.*

Taking account in this regard of the substantial part played by nuclear power in the Community's energy supply, it is agreed that, on the basis of highest standards of safety, appropriate measures

• **Regional development**

The implementation, in appropriate frameworks, for those regions which are less-favoured, including those less-favoured from the point of view of energy infrastructure, of measures designed to improve the Community's energy balance.

• **Technological innovation**

The continuous and reasonably diversified promotion of technological innovations through research, development and demonstration and by rapid and appropriate dissemination of the results throughout the Community.

**External relations**

The development of the Community's external relations in the energy sector by virtue of a co-ordinated approach, in particular on the basis of regular consultations between Member States and the Commission.

must ensure that all aspects of planning, construction and operation of nuclear installations fulfil optimal safety conditions;

• **Renewable energy sources**

*To maintain the development of new and renewable energy sources, including conventional hydroelectricity*, in particular by continuing with the effort made by placing greater emphasis on arrangements for disseminating results and reproducing successful projects.

The output from new and renewable energy sources in place of conventional fuels should be substantially increased, thereby enabling them to make a significant contribution to the total energy balance.

These Community energy objectives for 1995 are ambitious but feasible. If the current reduction in energy prices persists for some time, the Community will have to consider whether policies should be strengthened in order to offset weakening market signals, and thus to ensure that the agreed objectives are achieved.

1 Readers who wish to see what changes the Council of Ministers has made in the Commission's proposals should refer to document COM(85)245. The Council Resolution of 16 September 1986 concerning new Community energy policies for 1995 has been published in *Official Journal of the European Communities*, C 241 of 25 September 1986.

2 Ratio of final energy demand to gross national product.

# Oil and energy prospects in the European Community: possible pressure points in 1995

*If oil prices stay low, stronger efforts could be needed to maintain the impetus towards more diversified and efficient energy demand and supply in the Community. This is the main implication of a new examination by the staff of DG XVII of energy prospects to 1995. Assuming oil prices over the next 10 years rise only modestly in real terms from their 1986 levels, oil consumption in the Community of Twelve could grow by well over 1 million barrels per day from its 1985 level of 9.7 million; dependence on net oil imports for total energy supply could be up to 35-37%; and energy saving improvements could slow down, perhaps sharply. The* **transport** *sector seems likely to be the single most important source of pressure on oil demand.*

Earlier this year the staff of DG XVII made an assessment of the Community energy outlook to 1990 on the working hypothesis that crude oil import prices could stabilize at around $15 per barrel (1986) prices. On that assumption, it was projected that oil demand in EUR 12 could increase by 0.7 Mb/d (35 Mtoe) or more by the end of the decade. *(Energy in Europe No 5*, September 1986).

More recent staff work has pushed the analysis forward to 1995, (1) the aim being to explore once again the implications of **sustained** low oil prices, this time against the backdrop of the new long-term energy objectives for the Community described elsewhere in this issue.

## The oil price path

The new and still preliminary estimates derive from one stylized scenario for low oil prices, which presupposes a slow growth in nominal and real terms from less than $15 in 1986 to a level in 1995 which is around half that assumed in the Commission's earlier study *Energy 2000* (2):

Oil price paths

*$ fob*

| | 1986 | 1990 | 1995 |
|---|---|---|---|
| **Energy 2000** | | | |
| Nominal prices | 32 | 38 | 55 |
| Real 1986 prices | 32 | 32 | 36 |
| **Low oil price scenario** | | | |
| Nominal price | 13 | 18 | 26 |
| Real 1986 prices | 13 | 15 | 18 |

This is, of course, neither a forecast of the long-term oil price, nor an estimate of a theoretical 'equilibrium' price for oil. Some analysts believe that such a low price would be unsustainable over a 10 year period because of the build-up of oil demand and decline in higher cost non-OPEC oil supplies at such a price level. Another doubt in any case, is whether prices in the real world would adjust so smoothly to changes in demand and supply — more probable perhaps are sharper, more spasmodic movements. The objective of the exercise, however, was to simulate what might happen in a world in which European consumers and investors became accustomed to much 'lower' oil and energy prices than previously expected, and adjusted their behaviour accordingly.

Other essential features of the scenario are summarized in the box below:

### Keys to the scenario

**Macro-economic growth** assumed to average out at around 2.6% per year over the 10-year period, after rising to a level of 2.8% in 1987. A confident investment climate and steady, though not spectacular, growth in industrial production.

The **rate of exchange** of the dollar against European currencies more or less stable ($1 = 1.07 ECU).

**Oil product taxation levels** unchanged in real terms from their September 1986 levels. Specific oil taxes assumed to rise in line with inflation only.

No major changes to objectives, measures or instruments of **energy policy**: e.g. continuing limitations on oil and gas use in power generation, maintenance of existing regulatory environment for energy saving, but no strengthening of sectoral policies.

## More oil use: how much and where?

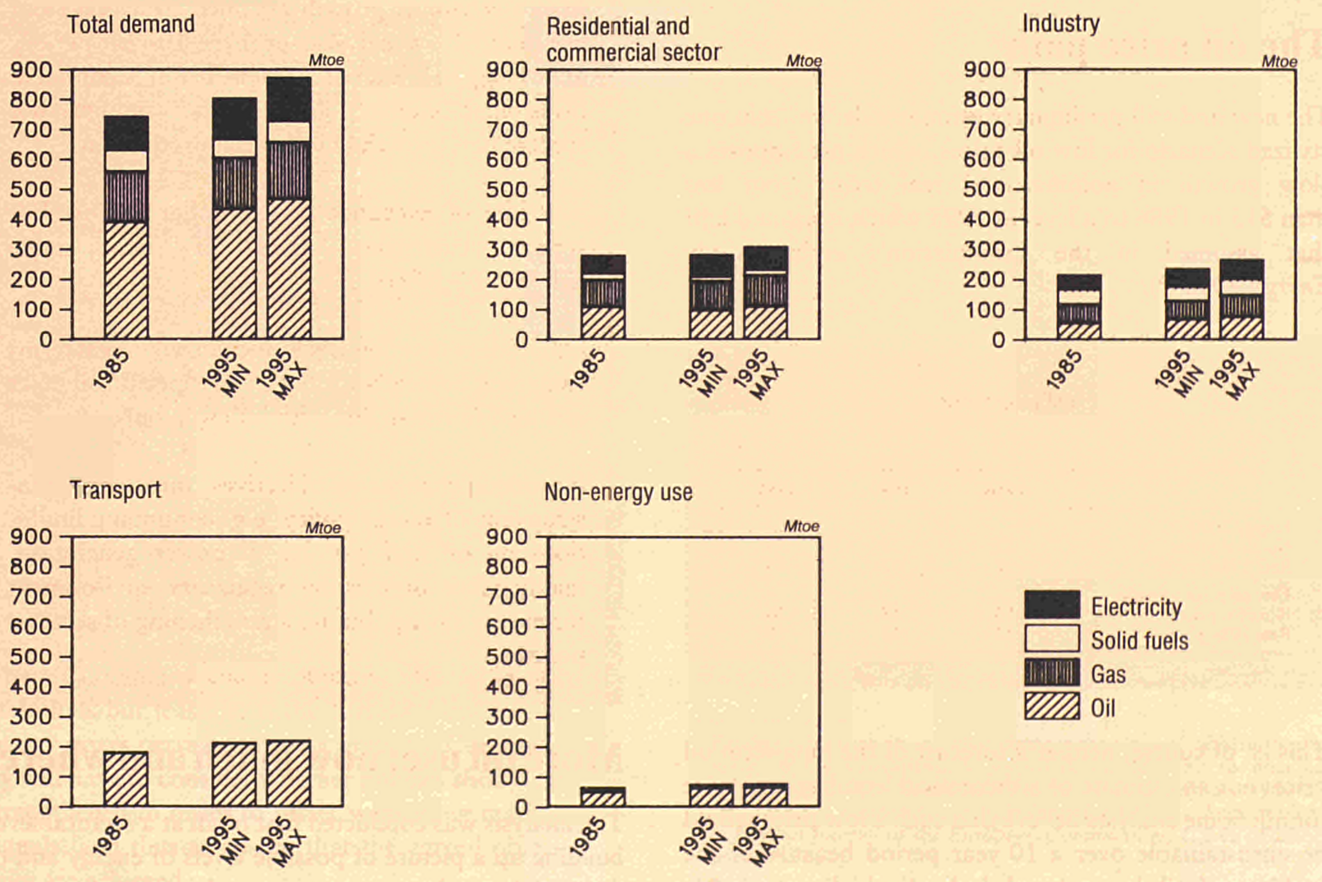
The analysis was conducted first of all at a **sectoral** level, building up a picture of possible levels of energy and oil demand by end consumers in each of the four main sectors (residential and commercial, industry, transport and feedstocks) on different assumptions about the importance attached to energy saving.

The results of the analysis are set out in the bar charts in graph 1:

It will be seen that:

- the **industrial sector** could make the largest call on additional energy requirements in the Community — between 33 and 48 Mtoe (0.7 and 1 Mb/d) over the period 1984-90. The precise increase will depend heavily on the rate of growth of industrial output, its composition (light versus energy-intensive industries) and the degree to which, in a low price environment, energy savings potential continues to be exploited. Oil would provide some 11-20 Mtoe of this additional demand, while natural gas and electricity should continue to make a good deal of headway (gas prices will follow downward those of oil, much of electricity demand growth will be a function of factors other than price — technical changes, falling requirements for bulk process-heat, etc.);
- in the **residential and commercial sector** the additional energy requirements could be very similar to those of industry (32-47 Mtoe or 0.6-0.95 Mb/d) depending on the rate of progress in improving the quality of the building stock (energy improvements in older housing at least could slow down in a lower price environment) and possible changes in consumer habits (how far will thermostats be turned up?). But oil use is unlikely to rise significantly and, more probably, it will continue to fall, with natural gas and electricity developing fast, the former as a result of growing pipeline networks and competitive prices, the latter through untapped potential for specific electricity use, steady growth of commercial demand as well as increased space-heating use in some Community countries (notably, of course, France);

Graph 1 – Final energy demand 1985 & 1995 – EUR 12
(Low oil prices)



- by far the largest volume of **additional oil consumption** seems likely to be derived, therefore, from the **transport sector** (35-43 Mtoe or 0.7-0.9 Mb/d), the bulk of it in road transport. This would reflect strong growth of diesel fuels both for road haulage **and** in the passenger car market (because of a continuing shift towards diesel cars). But it would also mean an increase in motor gasoline consumption (by perhaps 10% over the period 1985-95). This would follow from an expansion of the car stock, some 'trading up' from smaller to larger models in the case of of 'first' or family cars, and more 'discretionary' driving in an economic environment in which prices stay relatively low and real purchasing power continues to rise steadily. A further factor that could increase motor gasoline consumption is tougher legislation on exhaust emissions.

- incremental **feedstock** requirements for oil will be much less significant than those of the transport sector (8-10 Mtoe, or around 0.2 Mb/d), but they are far from negligible.

These results — obtained with the help of the Midas energy model — are tentative and are now to be refined in the light of discussions with experts from Member States. But they already give some indication of the likely pressure on energy and specifically oil demand from end users of energy.

They underline the particular importance of **energy saving improvements in a low price environment**:

- in the residential and commercial sectors at least one-third of the projected increase in energy demand (15 Mtoe or 0.3 Mb/d) could be saved by sustaining existing progress in improving the housing stock;

- and in industry a similar amount is at issue.

They also show how critical will be the evolution of demand for **road transport fuels** and the consequent importance of policies to ensure that they are used as efficiently as possible (without of course affecting economic growth). The policy questions that arise are discussed more fully in a recent Communication by the Commission to the Council ([3]) which is summarized elsewhere in this issue. In view of the complexity of the interactions in the transport field between the evolution of prices, incomes, industrial growth, infrastructural development and technical progress, the Commission staff will be focusing particular attention on the prospects for transport fuel demand in their further refinement of sectoral demand analysis.

# Electricity generation

The future needs of end consumers include, of course, their use of electricity but not the fuels used to generate that electricity.

Could the electricity sector itself be a further point of pressure on oil supplies?

Probably not.

Our current assessment is that the lower oil price environment should not lead to any large-scale switch-back in Europe to the use of heavy fuel oil in existing generating plant, and still less to the construction of new oil-fired stations (which would run counter to Community legislation dating back to 1975). The electricity utilities themselves do not generally wish to go down such a route and as a rule the economics will still be against widespread operation of reserve or moth-balled oil capacity at the price levels envisaged. Oil use in 1995, however, could still be a little higher than previously expected if oil capacity currently in use is phased out more slowly. And natural gas use could increase a little (particularly if gas is less successful than we expect in penetrating industrial markets) because of plentiful supply, competitive pricing and environmental advantages.

**Electricity sector (energy inputs) 1985 and 1995, EUR 12**

*Mtoe*

| | 1985 | 1995 (Energy 2000) | 1995 (Low prices) |
|---|---|---|---|
| Total: | 348 | 443 | 430-457 |
| Oil | 40 | 23 | 18-30 |
| Natural gas | 22 | 19 | 21-32 |
| Solid fuels | 145 | 194 | 187-205 |
| Nuclear | 123 | 187 | 179-185 |
| Hydro, etc. | 17 | 19 | 19 |

All this presupposes, of course, that there are no major changes to the current programmes in Member States for the construction and operation of nuclear and solid-fuel fired electricity generating capacity, in so far as they are expected to affect capacity levels in 1995.

As far as nuclear is concerned, the projections in the table assume that all plants currently under construction in the

Community will be completed and brought on stream and that there will be no accelerated decommissioning of any existing stations. This would lead to net nuclear capacity in 1995 of 115 GWe (EUR 12).

On this basis nuclear would be supplying the equivalent of 179-185 Mtoe or 40-42% of total power station fuels, with solid fuels 187-205 Mtoe or 43-46%, the latter heavily dependent on rates of growth of electricity demand. Even if electricity demand grew by a little less than GDP (the bottom of our range) demand for solid fuels in the electricity-generating sector would increase by around 40 Mtoe; and more bullish growth of electricity demand could raise solid fuel burn by up to 40% or 60 Mtoe over its 1985 level even if nuclear plant is steadily introduced. This incremental demand in the electricity sector would by far outweigh the possible stagnation in consumption of steam coal in the industrial heat markets in a low price environment and the downward pressure on consumption of coking coal in iron and steel.

A lower nuclear contribution would tend, other things being equal, to increase still further demand for coal and other solid fuels. But it would also lead to increased oil and gas use in power stations, adding to the pressures on oil demand coming from final energy consumers.

# Community energy production

The new analysis concentrates on the effect of low prices on demand for the different fuels. No attempt has been made to quantify precisely the possible impact on Community production of either solid fuels or hydrocarbons. But for the purpose of assessing possible future levels of dependence on imported oil the staff work has had to make a working hypothesis about future levels of Community oil production in 1995.

Before the fall in oil prices it was estimated that Community oil production would decline from a peak of 150 Mtoe (3 Mb/d) in 1985 and 1986 to around 110-120 Mtoe (2.2 to 2.4 Mb/d) in 1995, largely as a result of falling output on the United Kingdom continental shelf.

What has happened since? And what could happen now?

Few existing oil field developments have been affected so far by the fall in oil prices because of their very low marginal production costs. Over the period to 1990, and probably a little beyond, total production levels will be more heavily influenced by what happens to these fields in terms of incremental investment (infill drilling, well workovers, satellite developments) than to the prospects for purely new developments. The low oil price path in the new scenario should still allow much of this relatively cheap incremental investment to go ahead, which will tend to extend the production profiles from existing fields (thus maintaining the trend of the past few years).

At a $15 real oil price, some new oil and gas fields may just be economic (on the basis of a minimum 10-15% real post-tax rate of return) assuming substantial reductions in development costs (technological and design improvements, reduced drilling rates, lower prices in construction yards, increased competition among equipment suppliers, etc.) induced, to a large extent, by the lower price environment. But many of the companies may now regard it as prudent to plan only on the basis of a price of $10 real, at which few known new oil and gas developments appear to be economic. Against this background some new projects previously expected to go ahead in the next one to two years in the Netherlands, Denmark and the United Kingdom are already being retimed or restructured. On the scenario described they could still be expected to go ahead in some form, but there is likely to be some reduction in previously expected production from these fields in the mid-1990s.

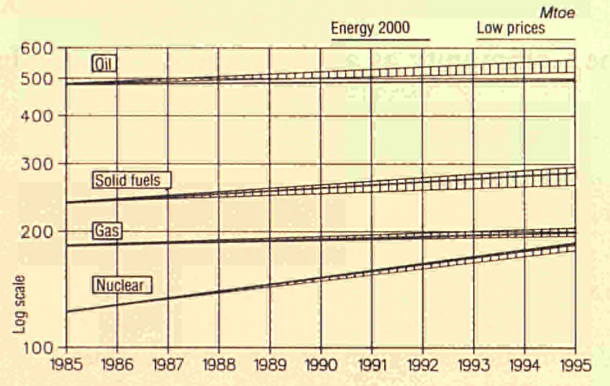
The effect on new discoveries is difficult to assess. Oil exploration and development expenditure in the Community has been cut back by around 20-30% in 1986 (slightly less than in the USA). The number of exploration and appraisal wells drilled and the number of rigs operating in the North Sea this year are well down. Moreover, recent surveys of companies in this field have suggested lowered levels of expected capital expenditure on North Sea facilities as a whole over the next five to six years. The price environment considered here provides no basis for raising those expectations. Reduced spending on exploration would not necessarily mean significantly reduced production from new discoveries in the 1995 horizon. Lower expenditure levels could be offset, to some extent, by improved finding rates and lower exploration costs. But it seems reasonable to suppose that there will be some negative effect on expected production even in the period to 1995 (earlier projections included a not insignificant element of production from new discoveries).

All in all, the balance of probability is in favour of a somewhat more accelerated rate of decline in oil production than previously assessed, leading to a level of perhaps around 100 Mtoe only in 1995.

# Total energy requirements

The pressures that might be created by sustained low prices are illustrated by a comparison between previous expectations of future total primary energy demand in the Community and the results of the low price case (see Graph 2). Column B in the table below gives the projections emerging from the latest available submissions from Member States (most of which predate the fall in oil prices) and Column C a summary of the reference case in the Commission study *Energy 2000*. The differences in projected oil demand and in projected dependence on net oil imports between these projections and the more recent analytical work (Column D) are striking.

Primary energy balance 1985 & 1995 – EUR 12




It should be emphasized once again that these figures are not a forecast of the most likely outcome but rather a preliminary attempt to assess the impact which low prices could have in the absence of appropriate policy responses. Further work will now be needed both to identify the pressure points more clearly and, ultimately, to consider what policy action may be necessary at Community or national level.

**Primary energy balance 1985 & 1995 — EUR 12**

*Mtoe*

| | 1985 A | 1995 B (Member States)[1] | 1995 C (Energy 2000)[2] | 1995 D (Low prices)[3] |
|---|---|---|---|---|
| | | EUR 12 | | |
| **Total:** | **1 048** | **1 138** | **1 192** | **1 205-1 255** |
| *Primary demand* | | | | |
| Oil | 484 | 470 | 496 | 520-560 |
| (of which bunkers) | 27 | 27 | 28 | 32 |
| Natural gas | 184 | 190 | 200 | 195-205 |
| Solid fuels | 238 | 287 | 286 | 265-295 |
| Nuclear | 124 | 165 | 188 | 179-185 |
| Hydro, etc. | 18 | 24 | 24 | 22-23 |
| *Domestic production* | | | | |
| Oil | 148 | 113 | 114 | (100) |
| Natural gas | 126 | 110 | 112 | not estimated |
| Solid fuels | 173 | 196 | 192 | not estimated |
| Nuclear | 124 | 170 | 187 | 179-185 |
| *Net oil imports* | 335 | 373 | 382 | 420-460 |

[1] Submissions to the Commission in the context of the review of national energy programmes.
[2] Reference case, adjusted to include Spain and Portugal.
[3] New low oil price scenario.

(1) *The Community Energy Outlook to 1995: a preliminary re-examination*. Working document submitted to the High Level Energy Group of the Council of Ministers, 12 November 1986.
(2) *Energy 2000*: a reference projection and alternative outlooks for the European Community and the world to the year 2000, Cambridge University Press, Cambridge, and Economica, Paris, 1986.
(3) COM(86)393 final. Rational use of energy in road, rail and inland waterway transport.

# The Energy Council's statement on energy efficiency

At its meeting on energy on 26 November, the EEC Council of Ministers reviewed what progress the Community as a whole and the individual Member States had made on energy efficiency.

The Council noted that energy efficiency in the Community has improved by over 20% since the first oil crisis in 1973 after which the Council decided in 1974 that the Community and its Member States must carry through a structured and integrated energy-efficiency programme. This undertaking was reaffirmed in 1980 and 1985.

Despite the progress made, the Council felt that the present situation on the oil market might not continue and that in any case there were still numerous opportunities for taking cost-effective steps to use energy more efficiently. **Efficient use of energy increases security of supply, makes European industry more competitive and has a beneficial effect on the environment.** For all these reasons, it is even more important that the Community as a whole and each individual Member State should keep up and if necessary step up their efforts to improve energy efficiency by 20% by 1995, one of the objectives adopted by the Council in its Resolution of 16 September *(see article in this issue)*.

With this aim in view, the Council has agreed that the Community as a whole and each individual Member State:

— will make the public aware of the need for greater energy efficiency by providing all the necessary information and advice as to how to achieve this objective;

— will facilitate the application of good new and existing ways of saving energy so as to ensure that the potential contribution to further energy savings is exploited to the full;

— will hold regular exchanges of information and experience at all levels, in particular under the aegis of the Commission, on effective ways of improving energy efficiency so as to enable all interested parties to derive maximum benefit from them;

— will review present methods and examine new methods of private financing in this area.

The Council reiterated the need to facilitate technological innovation in various ways through research, development and demonstration and the rapid dissemination of results throughout the Community. The Council reaffirmed the importance of the programmes now being conducted at national and Community level.

The Council also noted that the Member States and the Commission will ensure that a special effort is made to inform the public of the steps which they intend to take in order to fulfil these commitments.

# The rational use of energy in road, rail and inland waterway transport

## The importance of transport in the Community's energy situation

*Since 1973, major energy efficiency initiatives have resulted, directly or indirectly, in at least a 20% improvement in industry's use of energy.* **And industry is now using much less oil as well** *(24% of all industry's energy use was oil in 1973, compared to no more than 17% today).*

**But in the transport sector, consumption of energy has increased by over 25% since 1973 —** *and the sector's 98% dependence on oil has hardly changed (see Table 1 below). Transport now accounts for over half of the Community's oil consumption compared to one third in 1973 and will be the most important sector in determining future use of oil in the Community (see 1995 article in this issue). There is considerable scope for saving more energy in transport and it is important that the momentum to do so is kept up although this could prove difficult in a low oil price environment.* **This article examines the issues and considers the policy options. It is derived from the Commission's Communication to the Council on rational use in road, rail and inland waterway transport (COM(86)93).**

**Table 1**
**Sectoral energy use in the European Community**

| 1973 | Final energy consumption (Mtoe) | | | | | Proportion of oil products (Mtoe) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | EUR 10[1] | E[2] | P[2] | EUR 12 | % | EUR 10[1] | E[2] | P[2] | EUR 12 | % |
| Industry | 248.1 | 20.3 | 2.7 | 271.1 | 39.5 | 104.5 | 11.3 | 1.7 | 117.5 | 28.6 |
| Transport | 128.3 | 11.3 | 2.2 | 141.8 | 20.6 | 124.9 | 11.2 | 2.1 | 138.2 | 33.7 |
| Housing & Services | 264.7 | 7.3 | 1.2 | 273.3 | 39.9 | 149.1 | 5.0 | 0.6 | 154.7 | 37.7 |
| Total | 641.1 | 39 | 6.1 | 686.2 | 100 | 378.5 | 27.5 | 4.4 | 410.4 | 100 |

| 1985 | Final energy consumption (Mtoe) | | | | | Proportion of oil products (Mtoe) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | EUR 10[1] | E[2] | P[2] | EUR 12 | % | EUR 10[1] | E[2] | P[2] | EUR 12 | % |
| Industry | 190.5 | 17.8 | 3.0 | 211.3 | 32.3 | 47.0 | 7.3 | 1.9 | 56.2 | 16.7 |
| Transport | 160.3 | 15.2 | 2.6 | 178.1 | 27.2 | 157.3 | 15.0 | 2.6 | 174.9 | 52.0 |
| Housing & Services | 252.5 | 11.3 | 1.7 | 265.5 | 40.5 | 97.2 | 6.8 | 1.0 | 105.0 | 31.3 |
| Total | 603.3 | 44.3 | 7.3 | 654.9 | 100 | 301.5 | 29.1 | 5.5 | 336.1 | 100 |

[1] Source: Eurostat: Energy balance sheets
[2] Source: OECD-IEA: Energy balance sheets

## Traffic trends in the European Community

There are well-known difficulties in estimating road traffic. For example, there are problems in adopting uniform measuring techniques or units to be used (e.g. vehicle-kilometres or tonne kilometres). Complete, precise, and timely data are not often available.

Table 2 shows some harmonized data available for traffic on the railways, roads and inland waterways in EUR 10 during the period 1973-82. It shows that traffic on **non-urban roads** increased steadily over the period and that on average there has been at least a 30% increase in traffic since 1973.

**On the railways,** average Community traffic went through a period of decline and then recovered its 1973 level in 1979 and 1980 before declining again in the early 1980s — affected by the poor economic situation in the Community.

As for **inland waterways** the traffic at Community level declined from 1973 to 1982 at an annual rate of -1.6%.

It is difficult to draw firm conclusions about the energy efficiency of the various modes of transport from the data in Tables 1 and 2. This is because the data in Table 2 relates only to the non-urban transport sector. Improvements have undoubtedly been made in the manufacturing of more energy efficient road vehicles. One estimate in *Energy in Europe No 4* suggested that the Community's average motor vehicle efficiency using motor gasoline improved by about 11% over the 1979-85 period. Railways too have become more efficient. A simple calculation taking the ratio between the percentage increase (or decrease) in energy consumption and the percentage increase (or decrease) in traffic volume indicates an improved efficiency of 1%/annum or 11% for the period 1972-83. This improvement in railway energy efficiency is probably attributable to electrification implying limited room for further improvement in the Community.

# Energy efficiency objectives and the policy framework

### Objectives

Two energy efficiency objectives for the transport sector present themselves from the above discussion. They are:

— the need to continue to improve the energy efficiency of the Community's transport system;

— to encourage replacement of hydrocarbons wherever justified because of positive effects on the Community's primary energy consumption and because of related financial considerations.

### Policy framework

**The first point is response time.** Some measures such as easing traffic flow in towns and reducing speed limits should, in theory, prove effective in the short term. At the other end of the scale, technological innovations and widespread use of alternative fuels should be viewed as long term measures.

**The second point to be considered is the efficiency of any proposed improvement.** In other words, what percentage of the whole market, or at least the sub-sector, will be affected by the proposed measure? To what extent will this measure affect standard patterns of consumption or at least help to improve the energy efficiency of this specific section of the market?

**The third point is the user's role.** In some cases the user may play a passive role. But in other cases the user may have an important active role, for example, if the proposed measures can only be carried out with the co-operation (voluntary or otherwise) of the user.

# The main policy options present and future

### Easing urban traffic flow

Effective management of road traffic by employing devices which control and synchronize traffic lights would have a direct effect on traffic mobility (reduced journey time, less frequent stops, traffic flows more freely) and therefore on the amount of energy consumed.

Experiments carried out in different areas of the Community have demonstrated savings of between 5-10% at single intersections and 4-20% for 'green wave', i.e. synchronized systems.

Estimates suggest that if all 12 Member States of the Community insisted on proper control of intersection traffic lights, potential energy savings could be in the region of over 1.3 Mtoe per year. (This estimate is based on a total of 175 000 intersections in the Community).

Of course, there are costs involved in the installation and maintenance of traffic control systems. But the payback period for such an investment is estimated to be only about two years.

### Speed limits

Since the first oil crisis of 1973, virtually all Member States have adopted some level of speed limits on non-urban roads. These limits normally distinguish between three types of road (motorways, trunkroads and ordinary non-urban roads) and between four types of vehicle (cars, buses, lorries and motor cycles). Each Member State applies different limits to each of these categories. The range of speed limits extends from 100 km/h in Greece and 88 km/h in Ireland up to the 140 km/h allowed on Italian motorways. In Germany there are no speed limits on motorways at all.

It is difficult to quantify the energy (oil) savings that could be made from the imposition of stricter speed limits. But some preliminary work suggests that stricter speed limits could save 1-5% of the total consumption associated with road transport depending on the strictness of the limit and a host of other variables. A study being carried out on behalf of Commission aims to **better identify** this range.

## Easing non-urban traffic flow

The main factors which disrupt traffic and cause delays are roadworks, intersections, seasonal traffic peaks, stops at border crossings or toll-booths, failure to inform motorists about factors which may affect their proposed journey and different vehicle speeds reducing optimal use of road capacity. The two main responses to these problems are increased investment in infrastructure and equipment, and improved planning and information.

These two responses can include a wide range of measures from making roads straighter to replanning intersections and speeding up procedures at border crossings. Potential savings could be substantial.

## Technological progress

Two main areas can be identified where technological progress could substantially improve the rational use of energy in transport. In first place comes development of new equipment components and production processes which improve not only the ratio between the weight of the vehicle and its potential payload, but also its aerodynamic performance. Secondly is basic research into combustion, distribution and the kinetics of fuels. The main thrust of combustion research is to improve combustion chambers. Current technology has achieved outstanding results in this field but there are still two major problems. Firstly, combustion chambers are still very dirty and produce quantities of $NO_X$, CO and unburned material which are environmentally unacceptable. Secondly, the progress that has been made is mainly the result of empirical experimentation. There are still some stages of the combustion process about which virtually nothing is known. Some basic research is therefore es-

**Table 2**
**Use of infrastructure by the three modes of transport: 1973-82**

| | B | DK | D | F | GR | IRL | I | L | NL | UK | EUR 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Railways: in '000 million gross tonnes carried per km | | | | | | | |
| 1973 | 42.3 | 13.1 | 323.7 | 302.8 | | 3.4 | 131.6 | 2.3 | 29.1 | 159.9 | 1 008 |
| 1974 | 44.5 | 13.1 | 322 | 311.8 | | 3.4 | 134.4 | 2.6 | 28.8 | 159.9 | 1 021 |
| 1975 | 39.2 | 12.7 | 283.6 | 288.6 | | 3.4 | 126.5 | 2.1 | 27.7 | 162.9 | 947 |
| 1976 | 39.7 | 13.2 | 292.8 | 303.6 | | 3.4 | 133.6 | 2.1 | 27.5 | 162.1 | 978 |
| 1977 | 39.6 | 12.9 | 286 | 295.9 | | 3.3 | 135.7 | 2 | 27.2 | 162.1 | 965 |
| 1978 | 38.2 | 12.2 | 291.8 | 301 | | 3.5 | 135.3 | 2.1 | 28.7 | 159.7 | 971 |
| 1979 | 40.7 | 12.3 | 316.3 | 309.9 | | 3.5 | 138.1 | 2.3 | 27.3 | 159.5 | 1 010 |
| 1980 | 39.9 | 12.4 | 317.3 | 309 | | 4.2 | 138.9 | 2.3 | 28.5 | 156.4 | 1 009 |
| 1981 | 43.1 | 12.4 | 308.9 | 297.1 | 3.1 | 4.5 | 133 | 2 | 29.3 | 151.7 | 985 |
| 1982 | 42 | 12.6 | 295.7 | 292.2 | 4.7 | 4.4 | 135.8 | 1.9 | 28.9 | 138 | 956 |
| | | | | Non-urban roads: in '000 million vehicles per km | | | | | | | |
| 1973 | 25.8 | 18 | 176.6 | 178.9 | | 11 | 123.4 | 1 | 32.2 | 122.1 | 689 |
| 1974 | 26.9 | 18.4 | 176.6 | 175.2 | | 11.2 | 121.3 | 1.2 | 32.8 | 118.5 | 682 |
| 1975 | 27.9 | 18.6 | 193.2 | 201.9 | | 11.5 | 126.1 | 1.1 | 36 | 121.3 | 738 |
| 1976 | 28.6 | 18.6 | 195.2 | 212 | | 11.6 | 128.9 | 1.1 | 35.9 | 127.1 | 759 |
| 1977 | 30.4 | 20.7 | 202.5 | 217.8 | | 12.9 | 131.7 | 1.1 | 38.8 | 128.3 | 784 |
| 1978 | 31.6 | 21.2 | 209.7 | 211.8 | | 14.3 | 136.4 | 1.2 | 41.8 | 135.8 | 804 |
| 1979 | 27 | 20.5 | 214.1 | 218.1 | | 15.3 | 142.8 | 1.2 | 44.1 | 136.2 | 819 |
| 1980 | 30.1 | 19 | 231.5 | 225 | | 15.7 | 147.6 | 1.3 | 46.3 | 146.4 | 863 |
| 1981 | 30.5 | 18.6 | 226.2 | 225 | 9.1 | 15.7 | 154.1 | 1.4 | 49 | 158 | 888 |
| 1982 | 30.7 | 18.8 | 227.7 | 225 | 9.1 | 15 | 154.1 | 1.5 | 49.7 | 163.3 | 895 |
| | | | | Inland waterways: in '000 million gross tonnes carried per km | | | | | | | |
| 1973 | 11.8 | — | 106.2 | 26 | | — | • | — | 72.9 | .2 | 217 |
| 1974 | 12.1 | — | 102 | 26 | | — | • | — | 73.5 | .2 | 214 |
| 1975 | 9.5 | — | 94.5 | 21.5 | | — | • | — | 65.4 | .2 | 191 |
| 1976 | 11.9 | — | 111.2 | 22.7 | | — | • | — | 82.5 | .2 | 229 |
| 1977 | 11.5 | — | 99.3 | 20.1 | | — | • | — | 73.6 | .2 | 205 |
| 1978 | 11.6 | — | 102.8 | 20.7 | | — | • | — | 81.4 | .2 | 217 |
| 1979 | 11.3 | | 98.4 | 21 | | | | | 74.7 | .2 | 206 |
| 1980 | 11.2 | — | 97.5 | 21.2 | | — | • | — | 74.7 | .2 | 205 |
| 1981 | 10.8 | — | 94 | 19.3 | — | — | • | — | 65.8 | .2 | 190 |
| 1982 | 10.1 | — | 93.9 | 18 | — | — | • | — | 66.1 | .2 | 188 |

sential for the development of clean, efficient engines. At present basic research on combustion is underway in 30 laboratories in the European Community. Much of this work is being supported by the Community's non-nuclear energy R&D programme and most of the main motor manufacturers are involved.

It should be mentioned that the motor manufacturers themselves have made substantial progress in improving the efficiency of new vehicles and reducing specific vehicle consumption. In this connection, the Community motor manufacturers set themselves, of their own volition, the goal of reducing specific consumption by 1985 by between 10 and 12% of the 1978 figures (the reference year). It appears that this objective has been easily reached.

Longer-term research is also taking place to achieve more efficient use of hydrocarbons. This research covers hydrocarbon behaviour in the engine, optimization of the use of motor fuel, new additives to increase octane rating, studies concerning fuel/engine matching and specific studies concerning combustion.

## Alternative fuels

In order to decrease the dependance of the transport sector on hydrocarbons, considerable attention is being paid to the potential of alternative transport fuels, i.e. **methanol and ethanol, LPG, biogas and hydrogen.** Interest in these fuels has been sufficient to justify the coordination of research inside and outside the Community. The *COST 304* programme has been set up to compare the main technical and scientific data produced not only in the EEC but also in Finland, Norway, Sweden and Switzerland.

Alcohol based fuels (**methanol and ethanol**) are probably the most likely alternative fuels because of their availability. Methanol is already being mixed with petrol in some markets and it has been demonstrated that the costs of the operation are generally justified, even taking into account the fact that an extender, like TBA (Tertio butyl alcohol), has to be used in addition to the methanol. Methanol can be produced from coal, natural gas and other materials which contain carbon. It has many advantages as a fuel including ease of handling, a high octane rating and is beneficial to the environment by reducing the proportion of lead in petrol. But a major impediment to the widespread use of methanol as a sole fuel are structural problems linked to the availability of extenders, like TBA, and the absence of widespread distribution outlets.

For the moment, it appears that production costs will limit the use of **ethanol** as an alternative fuel (both ethanol produced for synthetic use and that obtained from agricultural products, generally called bioethanol). Synthesis ethanol is more expensive than **methanol** and **TBA**, which are its main competitors. Nevertheless bioethanol is of considerable interest, particularly as it offers an outlet for some surplus agricultural products. To make bioethanol commercially attractive a comprehensive research and development programme will have to be undertaken.

**LPG (liquified petroleum** gas) has been used as a motor fuel in some countries for more than 40 years. It is basically a mixture of propane and butanes, the relative proportions of which can vary considerably. LPG is carried in a vehicle's fuel tank in the form of liquid under moderate pressure. Since LPG is an oil refinery by-product it is therefore closely linked to oil production. For example, the huge capacity of the refineries around Rotterdam, the Netherlands, means that every year about 2 million tonnes of LPG are produced, of which 850 000 tonnes are used as motor fuel. The advantage of LPG is that it can be used in both petrol and diesel engines and it is environmentally superior to both fuels. But the disadvantage is that LPG generally reduces maximum power by 10% and cold starting is more difficult. There is also no homogeneous product for the European market, i.e. the composition of LPG is different in different countries, and there is not, as yet, a widespread and efficient distribution network.

**Biogas** as a motor fuel is unlikely to be widespread in the short term. It is currently not economic and there are associated unsolved technical problems, i.e. when filling the tank biogas must be compressed to at least 200 atm.

At least three countries (France, the Federal Republic of Germany and the Netherlands) are currently carrying out research into the possibility of **using hydrogen** as a motor fuel. This research is still at an early stage and it is highly unlikely that hydrogen will be extensively used in road transport before the year 2000. It could however become an important fuel, mainly for environmental reasons. **Compressed natural gas** (CNG) also offers some interesting possibilities in the future. Indeed one-quarter of a million vehicles run on CNG in Italy today.

## Conclusions

The transport sector offers great potential for saving energy. However, the long response times associated with initiatives, the efficiency of the mechanisms chosen and the role of the user complicate the adoption of specific policies. Moreover, any action in the field of transport has important repercussions upon life-style, economic activity, the environment and town-planning. Therefore, these actions must be seen in the light of their relationship with other Community policies, particularly in the transport, environmental and research fields. The importance of the transport sector in improving the Community's energy balance today and in the future is clear and efforts to save energy in this sector must be maintained (*see article on* **oil and energy prospects in the Community in 1995** *in this issue*).

# The Chernobyl nuclear power station accident

*When* **Energy in Europe No 5** *went to the press reliable information was not yet available about the sequence of events leading up to the reactor explosion at the Chernobyl nuclear power station. Since then the Soviet authorities have lifted the veil of secrecy surrounding the accident, and at a meeting organized by the International Atomic Energy Agency (IAEA) in Vienna from 25 to 29 August provided essential information for an understanding of the accident. The Commission attended the meeting in question and recently reported on this subject to the Council and the European Parliament. (*[1]*) In its report the Commission also assesses the consequences of the accident within the Community.*

## Sequence of events leading up to the accident

The accident took place during the carrying-out of a test when the RBMK reactor was operating at low power just before being shut down for planned maintenance.

The aim of the planned test was to verify the possibility of using the mechanical inertia of the turbo-alternators as a source of electricity in the event of a sudden shutdown of the reactor, in order to ensure that the plant's essential safety systems were kept temporarily under voltage until the emergency diesel generators could take over. Generally speaking, nuclear power stations in the West do not go in for this practice and this type of test is therefore not carried out.

The Soviet authorities have admitted that the test itself had been poorly prepared and the appropriate authorizations had not been issued. Furthermore, although it was impossible to maintain the reactor's operating parameters within the authorized ranges, the plant staff attempted to proceed with the test nevertheless, and breached several operating rules and blocked some of the reactor's protection systems.

In an RBMK reactor, because of its intrinsic characteristics, such breaches and action inevitably lead to a sudden increase in power with catastrophic consequences. The RBMK reactor is intrinsicallly unstable at low power. The Soviet authorities have known about this weakness for a long time and it was even made public back in 1974. The United Kingdom considered this type of reactor in 1976 in the context of scientific cooperation with the USSR, but rejected it on safety grounds.

Let us now attempt to explain the specific features of this instrinsic instability. Chain nuclear reactions take place within a nuclear reactor. Each fission of a uranium atom produces neutrons which in turn generate further fissions. Whether this chain reaction is kept in equilibrium depends on the ability of the neutrons to generate a fission; this in turn depends on parameters such as temperature of fuel and density of coolant.

In an RBMK reactor the chain reaction may get out of control if the reactor is at low power and the control rods are withdrawn from the core: the slightest increase in power can then increase the quantity of steam in the core. This change in the parameters has a favourable effect on the ability of the neutrons to generate further fissions. The increase in power is hence intensified and the reactor goes out of control until it destroys its own structures. In technical terms, it may be said that the power coefficient is positive. The main safeguard protecting against such a disastrous event is compliance with the operating procedures by operators: low-power operation is prohibited and a number of control rods must remain inserted in the reactor.

The approach to safety is different in Western technology. In certain types of reactor (gas or sodium cooled) a cooling fluid is used which is not liable to undergo a change of phase, thus favouring stability. Where water reactors are concerned, the most common types of reactors in the Community, excessive evaporation or loss of coolant always results in a rapid stoppage of the chain reaction because the power coefficient is negative.

Because of these fundamental technical differences, the Chernobyl accident can scarcely be regarded as a precursor or warning for nuclear technology in the West. In this respect, it is radically different from the Three Mile Island accident whose external effects were virtually nil but which influenced certain design and operating features of European pressurized water reactors.

On the other hand, some important lessons can be learned from the very effective contingency plan implemented at Chernobyl. The way in which victims were treated, the population was evacuated and resources were mobilized may be regarded as exemplary in many respects. In addition, it should be possible to confirm the radiation-protection models which have been developed

## Chronology of the main stages leading up to the accident

25 April, 01.00 hours: reactor power reduction starts, in preparation for the test and the planned shutdown.

25 April, 13.05 hours: power reduction suspended: reaction maintained at 50% of nominal power at the request of the electricity supply grid control office (this half-power waiting period made it more difficult to comply with the test procedure because of neutron 'poisoning' of the reactor which increased spatial power disequilibrium and reduced reactivity and especially meant that the operator, in order to be able to continue with the test, subsequently had to withdraw the control rods from the reactor, in breach of the operating procedures).

25 April, 23.10 hours: power reduction resumed, with a view to achieving 23 to 35% of nominal power.

26 April, 0.28 hours: difficult to control the power reduction, reactor power falls to 1% of nominal power.

1.00 hours: operator succeeds in increasing reactor power but to no more than 7% of nominal power; to do this, the operator had to increase reactivity by withdrawing the control rods from the reactor, to such an extent that he breached the operating rules (the reactor is more unstable with the rods withdrawn).

1.03 hours: operator continues with the test, even though the reactor power is below the authorized limit (the lower the power the closer the reactor is to instability).

1.19 hours: operator blocks the first emergency protection signal relating to thermohydraulic parameters.

1.23.04 hours: test starts: the turbine steam feed valves are stopped; the turbine continues to rotate by mechanical inertia; the reactor is kept in operation so that the test can be redone in the event of failure: this entails blocking a second emergency reactor protection signal relating to turbine conditions (if this protection signal had operated the situation would have been saved).

1.23.21 hours: because of the test configuration, the flow of water to the reactor slowly starts to decrease, the temperature rises, and the gradual increase in steam in the reactor results in an increase in reactivity; the reactor became unstable; power grew slowly; automatic control rods were inserted into the reactor but could only partially offset the increase in reactivity.

1.23.31 hours: the control rods are completely inserted and can no longer offset the increase in reactivity; power increases more quickly.

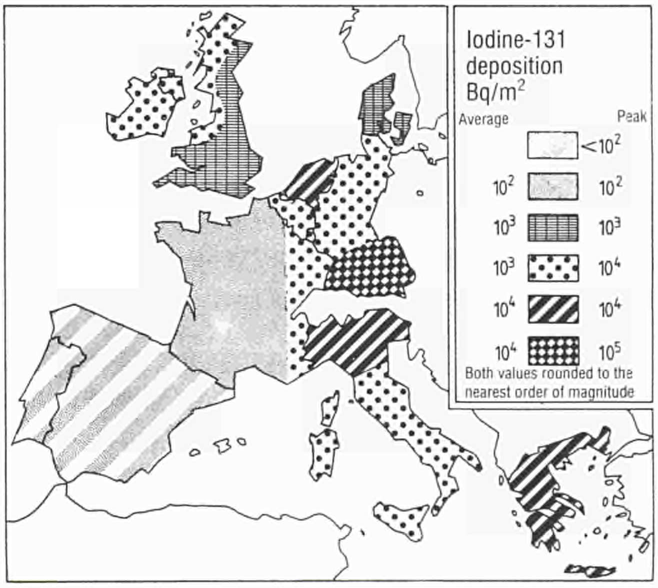
1.23.40 hours: operator pushes the emergency reactor shutdown button in vain (the emergency control rods withdrawn from the reactor can no longer act sufficiently rapidly).

1.23.44 hours: power builds up abruptly, reaching 100 times the nominal power, the reactor is destroyed.

by monitoring the Soviet citizens who received a significant dose. It is hoped that the Soviet authorities will make this data available to international experts. One thing is certain — the Chernobyl accident will result in greater international cooperation on nuclear safety.

## Radiation fallout from Chernobyl within the Community

With the detection of increased radioactivity levels in the air first of all in Sweden and later in the Community, the national authorities in the Member States began extensive monitoring of the environment. In accordance with Articles 35 and 36 of the Euratom Treaty, on 29 April the Commission requested from the Member States the regular communication of radioactivity readings.




Most of the radioactive emissions from Chernobyl were released during the ten-day period between 26 April and 5 May. During this period the meterological conditions over Europe changed considerably, and as a consequence the dispersion of radioactive material was widespread but very uneven, in particular because the pattern of deposition on the ground was greatly affected by localized rainfall.

The release of 26 April reached Scandinavia on 27 and 28 April. That of 27 April spread further southwards, passing through the Federal Republic of Germany and France, before turning through Belgium, the Netherlands, the United Kingdom and Ireland. The releases of 29 and 30 April reached Northern Italy before moving northwards. On 1 and 2 May the radioactive plume moved towards Greece. The releases of 3 and 4 May went towards the northwest, sparing the Member States; however, subsequent releases on 5 May reached Northern Greece and Italy between 9 and 11 May.

Levels of surface contamination in the Member States by the most important radionuclides, namely iodine 131 and caesium 134/137, as reported to the Commission by the national authorities following the accident, are illustrated in Figures 1 and 2.

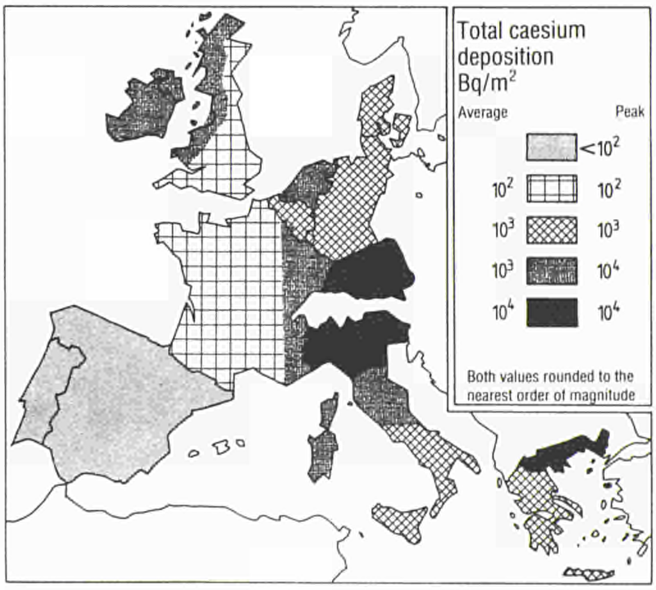
The Commission has asked the **National Radiological Protection Board** in the United Kingdom to estimate the resulting radiation exposure for the following pathways:

— external radiation from the cloud and deposited material;

— internal radiation from inhalation of airborne material during the passage of the cloud;

— internal radiation from ingestion of contaminated foodstuffs.

The latter pathway is the most important.




Doses have been estimated for three representative age groups, namely the one-year old infant, the ten-year old child and the adult. The effects on exposure of countermeasures taken by the authorities have been taken into account, but the reduction in dose achieved by precautionary measures taken by individual members of the public as a reaction to the contamination resulting from Chernobyl is difficult to quantify and has therefore been ignored. Table 1 gives the individual effective doses received in the first year for each of the three age categories considered. Table 2 gives the cumulative dose in each Member State which an adult will receive over the next 50 years. The average lifetime dose (over 50 years) varies from 0.0003 to 0.61 mSv depending on the Member State.

The collective effective dose equivalent to the Community population, which is a measure of the potential health impact of the exposure, amounts to about 85 000 man-Sv.

Table 1
Average individual effective dose equivalents caused by Chernobyl during the first year after the accident (mSv)

| Country | Infant | Child | Adult |
|---|---|---|---|
| Belgium | 0.110 | 0.059 | 0.051 |
| Denmark | 0.110 | 0.076 | 0.063 |
| France | 0.068 | 0.042 | 0.038 |
| Germany | 0.230 | 0.190 | 0.190 |
| Greece | 0.420 | 0.350 | 0.350 |
| Ireland | 0.130 | 0.100 | 0.100 |
| Italy | 0.160 | 0.180 | 0.210 |
| Luxembourg | 0.120 | 0.077 | 0.061 |
| Netherlands | 0.089 | 0.078 | 0.068 |
| Portugal | 0.0004 | 0.0003 | 0.0002 |
| Spain | 0.0027 | 0.0017 | 0.001 |
| United Kingdom | 0.055 | 0.037 | 0.033 |

By way of comparison, the average annual individual doses from other sources are as follows (mSv):

Natural exposure: 1 to 2 mSv per annum

Medical exposure: 0.3 to 0.5 mSv per annum

Table 2
Average adult effective dose equivalent commitments caused by the Chernobyl accident over the next 50 years (mSv)

| | |
|---|---|
| Belgium | 0.090 |
| Denmark | 0.100 |
| France | 0.074 |
| Germany | 0.410 |
| Greece | 0.580 |
| Ireland | 0.170 |
| Italy | 0.370 |
| Luxembourg | 0.100 |
| Netherlands | 0.110 |
| Portugal | 0.0003 |
| Spain | 0.0012 |
| United Kingdom | 0.048 |

By way of comparison, average individual lifetime doses from other exposure sources are as follows (mSv):

Natural exposure: 70 to 140 mSv

Medical exposure: 21 to 35 mSv

International organizations such as the World Health Organization, which cannot be suspected of having a nuclear bias, consider that such doses have quite insignificant medium and long-term effects. It is interesting to compare these doses with the maximum permissible dose for members of the public in the event of controllable exposure, which, in accordance with basic Euratom standards, is 5 mSv per annum.

This 5 mSv per annum value has also been recommended by the working party of radiation protection experts set up pursuant to Article 31 of the Euratom Treaty to establish the level below which it is unnecessary to take large-scale steps to withdraw contaminated foodstuffs in the first year following a nuclear accident.

It is also worth comparing the doses caused by Chernobyl with the doses caused by natural radiation. As indicated in Tables 1 and 2, the dose resulting from natural radiation is 1 to 2 mSv per annum, i.e. 70 to 140 mSv over a lifetime. The dose caused by Chernobyl is therefore, even in the country in which it is the highest, less than 1% of the dose received over a normal lifetime. The dose received during the first year following Chernobyl corresponds in that country to the dose received naturally during about four months.

(1) COM(86)607, 7.11.1986.

# Natural gas in the Community – prospects to 2000 and beyond

*With so much current uncertainty in the energy world, (for example, the difficulty of forecasting the price of oil next year, let alone the next decade) it may appear a trifle ambitious to be plotting the prospects for natural gas in the next century. And yet this is just what the planners in the natural gas business have to do, in an industry which because of its capital-intensive nature has to set its sights, not 5 or 10 years ahead, but 20 or 30 years into the future.*

*The recent Troll/Sleipner deal is evidence of the industry's long-term planning horizons. It is also a milestone in the development of natural gas supply in Europe. Some say it is potentially as important as the discovery of the Dutch Groningen field way back in the 1950s, an event which marked the birth of Europe's natural gas supply. The time is particularly ripe, therefore, for the Commission to publish a Communication to the Energy Council on natural gas. This article examines the principal questions raised in the Communication, starting with the prospects for natural gas demand, the supply outlook and the Community's security of supply.*

## Natural gas demand

**What has been the story so far?**

The story so far has been one of growth and more growth. Demand for natural gas in the Community grew year by year in the 1970s from 62 Mtoe in 1970 to a peak of 173 Mtoe in 1979. This growth found expression in the share held by natural gas in total energy demand which over the same period rose from 7% to nearly 18%.

After a fall in demand in the years 1980-82, reflecting a downturn in demand for energy in general, growth of natural gas resumed in 1983 and continued in subsequent years. In 1985 more natural gas was consumed in the Community than ever before (181 Mtoe) and the share of natural gas in the Community's energy balance (EUR 10) had risen to over 19%. In 1986, natural gas demand could edge up again in a year which has greatly favoured oil.

**Where do we go from here?**

The outlook for natural gas demand in the Community to the end of the century, based on forecasts from Member States of the Community, suggests only a limited growth in demand (see Table 1). This is particularly striking in the 1990s when a fairly flat picture is presented with demand levelling off at around 200 Mtoe per annum.

But there are a number of factors which if they were to materialize could promise a more dynamic growth outlook for natural gas in the medium to long term.

Table 1
Projected natural gas demand — EUR 12

*Mtoe*

| 1985 | 1986 (e) | 1990 | 2000 |
|---|---|---|---|
| 184 | | 199 | 195 low |
| | | | 206 high |

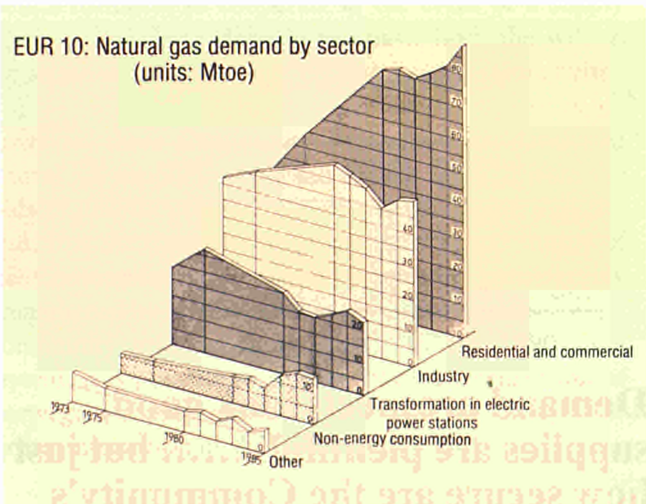
**What are these factors which could give rise to higher-than-expected growth rates?**

The Commission published a detailed study in 1985, entitled *Energy 2000* (1) in which **total energy demand** was foreseen to increase slowly, on average 0.9% a year, to the end of the century. Since then, however, the world's energy markets have been disrupted by the collapse of the oil market. If low energy prices were to continue in the short to medium term, it is reasonable to assume that demand for energy in total, including natural gas, would rise accordingly. Work carried out by Commission staff, and described in the last edition of *Energy in Europe,* (2) indicated that natural gas could indeed be one of the fuels to benefit most from any incremental demand arising from low oil prices.

Because of the relationship between gas and oil prices, a period of low oil prices should not in the longer term halt the **process of substitution** for oil products that has been such a hallmark of natural gas growth in the past. In addition, there may be opportunities to substitute for other fuels in such a situation, for example coal in the industrial sector and electricity in the residential and commercial markets. Moreover, with low prices and plentiful supplies available, natural gas use for power generation may become increasingly attractive in some countries.

The advantages enjoyed by natural gas as an **environmentally-benign fuel** are well known. In the future significant investments will be required to adhere to strict environmental regulations concerning atmospheric pollution by sulphur dioxide from the use of fossil fuels. Natural gas could gain a significant comparative advantage over oil and coal as a result.

Looking to the long term, **new technologies** already exist which could alter the way gas is used and the quantities consumed. Fuel cells and combined cycle power generation offer efficient and environmentally- attractive means of producing electricity. In the transportation sector, greater use could be made of natural gas to drive vehicles, for example in the use of compressed natural gas (CNG), or the production of gasoline directly or indirectly from natural gas. Both technologies are proven but remain expensive in relation to traditional technologies at present.




Over the next ten, twenty or thirty years, will the natural gas market in Europe remain static, the preserve of a handful of large buyers and sellers? Or will it evolve along more dynamic and flexible lines, as has happened for example in the United States where supply contracts have become shorter, natural gas is frequently transported by third parties, and a spot market now accounts for around 17% of total natural gas sales. There are already signs of change in Europe. In the United Kingdom, for example, common carriage was introduced in 1982 and has been strengthened in recent legislation. In Italy, proposals on common carriage are before Parliament. With an increasingly interconnected market, a situation where gas supply exceeds demand, and spare capacity in some pipelines, a significant spot market could emerge in Europe over and above the one-off spot deals which currently occur from time to time. **Organizational change** could therefore create the conditions for a more flexible market in the years to come, leading to increased penetration for natural gas.

Over the next 20 to 30 years, one or more of these factors could boost natural gas demand:

— Higher total energy demand
— Substitution for other fuels
— Environmental regulation
— Technological advances
— Organizational change.

# Natural gas supplies

**Do we have enough natural gas?**

Natural gas reserves in the Community stand at 2 880 Mtoe. The reserves/production ratio at 21 years is the highest it has been in recent years. What is more, the Community's three principal third-country suppliers, Norway, the Soviet Union and Algeria, between them, possess 50% of the world's proven reserves.

The Troll/Sleipner import deal from Norway announced in June will lead to the supply of an additional 400 Mtoe of natural gas, and possibly a great deal more, between 1993 and 2020. This deal will in all probability mean that Community-produced gas together with contracted imports will be sufficient to meet demand in the Community until the turn of the century.

Ample supplies of natural gas are therefore available to the Community well into the next century.

**Are there any clouds on the horizon?**

The Community's supply outlook is good but there are two long-term trends which need to be watched carefully. **First of all**, natural gas supplies will become increasingly costly as the more difficult and less accessible reserves are developed within the Community, for example in the northern North Sea. And over time, imports will have to come from sources further afield. **Secondly**, as indigenous supplies are expected to gradually decline, the Community will become increasingly dependent upon imports from third countries.

A period of low oil prices could have a significant effect in this respect, by slowing up exploration and development activity. We have already seen severe cuts, up to 30-50%, in the exploration and development budgets of some companies. Whilst this may not affect gas developments already underway, it could if continued, lead to less indigenous natural gas coming on stream in the 1990s. In this event, the Community would then find itself increasingly in the hands of external suppliers, such as the Soviet Union.

To avoid this risk to the Community's security of gas supply, Community governments will have to consider ways and means of encouraging gas producers to continue making the investments necessary to sustain adequate levels of exploration and development within the Community.

**Who will be the Community's suppliers in the years to come?**

To begin with, for the rest of the century at least, most of the Community's gas supply will continue to come from sources within the Community itself. The principal indigenous producers will remain the Netherlands and the United Kingdom. By 2000, third countries will be supplying around 40% of the Community's gas requirements compared to 33% last year.

In 1985 the main third-country suppliers to the Community were Norway, the Soviet Union and Algeria. This picture will not change substantially to the end of the century although by 1990 the Soviet Union will take over from Norway as the largest external supplier.

Among the Community's suppliers, **Norway** has substantial reserves of natural gas, estimated at 2 700 Mtoe, and the Norwegian government has said publicly that natural gas will gradually take up a higher share than oil in Norway's future hydrocarbon production. The Troll/Sleipner deal ensures Norway's position as a major supplier of natural gas to the Community well into the next century. Norway will have the potential, in terms of both reserves and infrastructure, to consolidate this position in the years to come.

Under existing contracts, **Algeria** will remain a major supplier to the Community until at least the turn of the century. It has the potential to maintain a strong position as a Community supplier due to its large natural gas reserves (2 750 Mtoe), favourable location close to the Community's southern borders, and spare export capacity.

For this potential to be realized, however, customers may press for greater flexibility of the kind recently shown by Algeria's competitors, Norway and the Soviet Union, in terms of the price and volume of gas purchases.

The **Soviet Union** has very considerable further export potential due to its huge natural gas reserves (33 500 Mtoe), spare export capacity, and need for hard currency especially at a time when its revenues from oil exports have diminished. However, increased domestic and Comecon demand for natural gas could curb Soviet export potential.

**Other third-country suppliers** from areas such as the Middle East and Africa are likely to find it difficult to find a foothold in the Community market before the year 2000. A period of sustained low oil prices would not in any case favour costly long distance gas export projects.

**Table 2**
**Projected natural gas supply — EUR 12**

*Mtoe*

| | Indigenous production | Norway | USSR | Algeria | Libya |
|---|---|---|---|---|---|
| 1985 | 125.6 | 22.1 | 21.0 | 17.3 | 1.0 |
| 1990 | 120.9 | 24.4 | 31.8 | 24.1 | — |
| 2000 | 127.5 | 19.2 | 32.6 | 21.1 | — |

## Demand prospects look good, supplies are plentiful ....... but just how secure are the Community's gas supplies?

By the end of the century, around 60% of the gas consumed will still be produced within the Community's boundaries. Beyond that time, indigenous supplies may fall off, but still substantial quantities will be produced internally.

The new Norwegian contract means that a significant share of the Community gas demand will come from

West European sources well into the next century. The level of non-OECD imports will still only be around 27% of total Community gas demand by 2000. **In short, the Community's supplies are well-diversified until the turn of the century and beyond.**

This is the long-term aspect of supply security. But attention also needs to be paid to the immediate consequences of a supply disruption. In this context, the Commission together with Member States, recently carried out a detailed analysis. This indicated that for the period 1986-90 existing and planned security measures, when applied on a Community-wide basis, should be sufficient to deal effectively with an interruption of supply from any individual import source for at least nine months. Moreover, the security situation has improved considerably over recent years.

The gas grid itself makes an important contribution to security of supply through various features of its design, including standby and back-up facilities, routing and interconnections, capacity of the system and storage. The various networks which exist in the Community are compatible with one another to a high degree and, technically, the interconnected grids may be considered as one system. Moreover, the gas companies involved express a readiness to cooperate in the event of a supply threat as they have done in the past. Both the will to cooperate and the means of cooperation therefore exist.

However, three Community countries with developed natural gas supply systems still remain isolated from the grids of neighbouring countries, the UK, Spain and Ireland. It is the Commission's view that the gas supply of the Community as a whole would be considerably strengthened by further, and finally full integration of the Community grid. Looking ahead, to the 1990s and beyond, it is possible to envisage the new generation of Norwegian supply contracts providing the catalyst for further integration of the Community's grid.

## Natural gas supply in the Community is strongly placed to meet the challenges ahead. What should be done at Community level to consolidate this situation?

Adequate levels of indigenous Community production are essential for the Community's security of gas supply.

**The Community's security of supply — the key factors**

— A diversified pattern of supplies — no over-dependence on any single source of supply

— Adequate security measures in case of major interruption
  — underground storage
  — interruptible contracts
  — spare production capacity

— An interconnected grid and a flexible system

— Cross-border cooperation between Member States' gas companies

Low oil prices, if sustained, could in the long run put these at risk. Therefore ways and means should be considered by Member States of encouraging gas producers to continue making the investments necessary to sustain levels of exploration and development.

A fully-integrated grid would make a major contribution to security of supply in the Community. The Community and Member States should encourage, and where possible, facilitate further integration. Moreover, the gas industry, should, as new supply contracts are made, continue the process of integrating the European gas grid.

Full cross-border cooperation between Member States' gas companies, in times of supply interruption, is an essential condition for an acceptable level of supply security at Community level. This has occurred in the past and should be developed and strengthened in the future in line with growing import dependence.

The Commission will continue to follow closely security and other developments related to the Community's gas supply with the help of experts from the Member States and will continue, when appropriate, to report to the Council of Energy Ministers on the natural gas situation in Europe. Natural gas now accounts for nearly 20% of all energy consumed in the Community and is providing a vital contribution to the Community's energy balance. Readers of *Energy in Europe* will be kept informed of developments in this key sector in the months and years to come.

(1) SEC(85) 324 final. See also *Energy in Europe No 1*, April 1985.
(2) *Energy in Europe No 5*, September 1986.

# Financial support (grants and loans) from the Community to the energy sector in 1985

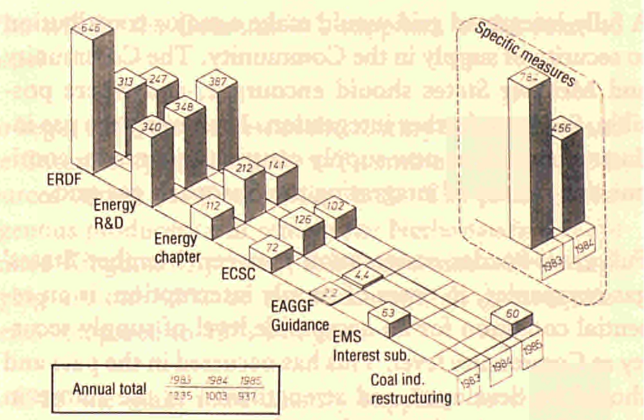
*In 1985 the Community granted the energy sector financial support (grants and loans) totalling* **3 500 MECU**, *of which* **937.2 MECU** *took the form of grants and* **2542.5 MECU** *the form of loans. This article analyses the distribution of the funds in question in 1985.*

## Grants from the General Budget and the ECSC Budget

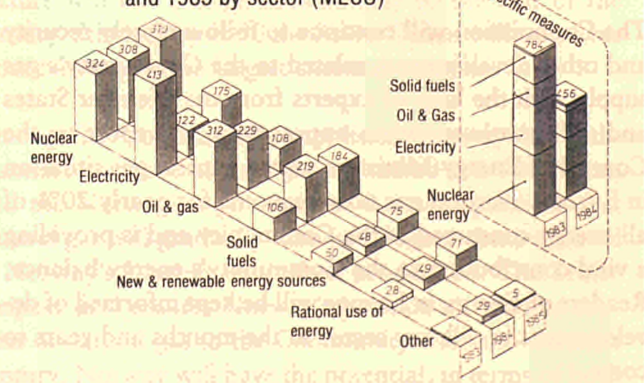
From about 1 500 MECU in 1984, Community grants to the energy sector dropped sharply in 1985, to 937 MECU.

However, if the specific measures relating to energy strategy (for the Federal Republic of Germany and the United Kingdom) are left out of account, the fall in energy grants between 1984 and 1985 is less pronounced, at only 66 MECU.

Community grants to the energy sector in 1983, 1984 and 1985 by budget heading (MECU)




Community energy grants in 1983, 1984 and 1985 by sector (MECU)




The table set out below gives a breakdown of these grants by budget heading for 1984 and 1985:

**Table 1**
**Community grants to the energy sector in 1984 and 1985 by budget heading**

| | 1984 | | 1985 | |
|---|---|---|---|---|
| | MECU | % | MECU | % |
| Chapter for energy policy | 211.7 | 21.1 | 141.3 | 15.1 |
| Restructuring of the coal industry | | | 60.0 | 6.4 |
| Chapter for energy R&D | 348.0 | 34.7 | 387.1 | 41.2 |
| European Regional Development Fund (ERDF) | 313.0 | 31.2 | 247.1 | 26.4 |
| EAGGF Guidance Section | 4.4 | 0.4 | — | — |
| European Coal and Steel Community (ECSC) Budget | 126.2 | 12.6 | 101.7 | 10.9 |
| Total | 1 003.3 | 100.0 | 937.2 | 100.0 |
| Specific measures | 456.0 | — | — | — |
| Grand total | 1 459.3 | | | |

The apparent reduction in the absolute amount and in the percentage for the energy chapter is caused almost entirely by the transfer of the appropriations for restructuring the Community coal industry to a different chapter of the General Budget (see COM(85)478 final of 5 August 1985).

Now that work has started on the third research and development programme in the field of non-nuclear energy, which was adopted by the Council on 12 March 1985, the energy R&D chapter's share of the total aid has risen sharply, to make it by far the largest budget appropriation granted to the energy sector in 1985.

ERDF grants fell once again in 1985, albeit by less than they did between 1983 and 1984. Nevertheless, the ERDF aid to finance investment in energy infrastructure remains substantial (accounting for 26.4% of the total). ECSC subsidies for coal research, interest rates on industrial loans, coking coal and redeployment aid were slightly down on 1984.

Table 2 gives a breakdown of the energy grants paid out in 1984 and 1985 by sector.

Table 2
Community energy grants in 1984 and 1985 in sector

| | 1984 | | 1985 | |
|---|---|---|---|---|
| | MECU | % | MECU | % |
| Solid fuels | 218.7 | 21.8 | 183.7 | 19.6 |
| Oil and gas | 229.2 | 22.9 | 107.8 | 11.5 |
| Nuclear energy | 307.5 | 30.7 | 319.4 | 34.1 |
| Electricity | 122.3 | 12.2 | 175.2 | 18.7 |
| New and renewable energy sources (NRES) | 47.8 | 4.8 | 74.6 | 8.0 |
| Rational use of energy (RUE) | 48.8 | 4.9 | 71.4 | 7.6 |
| Other | 29.0 | 0.3 | 5.1 | 0.5 |
| Total | 1 003.3 | 100.0 | 937.2 | 100.0 |

The shift away from **oil and gas and towards electricity** is largely due to the fact that, in contrast to 1984, three quarters of the ERDF aid went to electricity generation and grids, rather than to natural gas transmission infrastructure.

**Nuclear energy continued to predominate** in 1985, though this must, as always, be put down to the sheer scale of the thermonuclear fusion programmes (general programme, JET and direct action by the Joint Research Centre), which alone claimed commitment appropriations totalling almost 200 MECU.

The cut in the budget for **solid fuels** was smaller in percentage than in absolute terms.

The start of work on the third **non-nuclear energy** programme, combined with a 15% increase in appropriations for demonstration projects, resulted in a 6% increase in the total share of Community aid allocated to the development of new and renewable sources (which took 8.0% in 1985) and to the rational use of energy (7.6%).

Table 3 gives a more detailed breakdown for 1985.

## Loans granted to the energy sector under the Community's financial instruments

Loans to the energy sector rose slightly compared with 1984 (by a nominal 3.6%) to 2 542.5 MECU, but remained well below the 1983 record. Further evidence of this relative stagnation comes from the fact that in 1985 loans to energy projects took a smaller share of the total funding granted by all the Community's lending instruments, even though the figure remained close to one third, at 32.8% in 1985 down from 34.1% in 1984.

The total 1985 amount of 2 542.5 MECU breaks down as follows:

**By source of funding**

In 1985 the European Investment Bank (EIB) further extended its lead as the chief Community lender to energy investments. The 2 200 MECU lent by the EIB for en-

Table 3
Community grants for energy projects in 1985 by recipient sector and source of funding
*(General Budget and ECSC Budget)*

| | *MECU* | *%* |
|---|---|---|
| **1. Solid fuels** | **183.7** | **19.6** |
| General Budget | 82.0 | 8.7 |
| Demonstration projects | | |
| Liquefaction and gasification | 22.0 | 2.3 |
| Restructuring of the coal industry | | |
| Social measures | 60.0 | 6.4 |
| ECSC Budget | 101.7 | 10.9 |
| Interest subsidies | 3.6 | 0.4 |
| Coking coal | 6.0 | 0.6 |
| Research and development | 18.9 | 2.0 |
| Redeployment of workers | 73.2 | 7.8 |
| **2. Oil and gas** | **107.8** | **11.5** |
| Community technological development projects | 37.0 | 3.9 |
| ERDF | 70.8 | 7.6 |
| **3. Nuclear fission** | **121.2** | **12.9** |
| Transport and radioactive materials | 0.3 | — |
| Research and development | 120.1 | 12.8 |
| Direct action — JRC | 115.4 | 12.3 |
| Cost-sharing | 4.7 | 0.5 |
| Studies (Chapter 72) | 0.8 | 0.1 |
| **4. Nuclear fusion** | **198.2** | **21.1** |
| Research and development | 198.2 | 21.1 |
| Direct action — JRC | 13.2 | 1.4 |
| Cost-sharing | 185.0 | 19.7 |
| **5. Electricity** | **175.2** | **18.7** |
| ERDF | 175.2 | 18.7 |
| **6. New and renewable energy sources** | **74.6** | **8.0** |
| Demonstration projects | 35.0 | 3.7 |
| Research and development | 39.6 | 4.3 |
| Direct action — JRC | 6.4 | 0.7 |
| Cost-sharing | 33.2 | 3.5 |
| **7. Rational use of energy** | **71.4** | **7.6** |
| Demonstration projects | 43.0 | 4.6 |
| Energy saving | 24.0 | 2.6 |
| Substitution of hydrocarbons | 19.0 | 2.0 |
| Research and development | 28.4 | 3.0 |
| Direct action — JRC | 5.0 | 0.5 |
| Cost-sharing | 23.4 | 2.5 |
| **8. Energy programming (heading 706)** | **3.5** | **0.3** |
| **9. Others** | **1.6** | **0.2** |
| Grand total | 937.2 | 100.0 |

The New Community Instrument (NCI), however, provided virtually no funds for energy, as over 80% of the first and second tranches of NCI III had already been disbursed. In 1985 it granted only one relatively small (9.4 MECU) loan.

After the sharp fall in 1984, Euratom loans picked up slightly to reach 211 MECU, compared with 186 MECU in 1984. But over the year their contribution to nuclear investment fell once again to 18%, against 82% from the EIB.

The drop in ECSC loans for investment in mining, thermal power stations and sales of Community coal to industry from 124.4 MECU in 1984 to 90.8 MECU in 1985 affected all three sectors alike.

However, it must be stressed that for the first time the ECSC paid no loans at all to any Community coal undertaking all year.

ergy projects in 1985 accounted for almost 88% of the total loans granted to the energy sector by all the Community's lending bodies together. This represented a nominal increase of about 18% over 1984.

financing, behind nuclear power. In 1985, however, only the EIB made loans to this sector, to exploit deposits on the Italian continental shelf and in the UK sector of the North Sea and to install natural gas transport, distribution and storage infrastructure in Germany, Denmark and Italy.

The **nuclear sector** swallowed up almost half the Community funding for the energy sector. In 1985 the EIB and Euratom granted 1 166.8 MECU to one power station under construction in Belgium, two in Germany, one in France, one in Italy and two in the United Kingdom and to the project to construct a nuclear fuel reprocessing plant in the United Kingdom.

The ECSC contributed towards investment in conventional **electricity generation** with one loan to Germany and one to France. The EIB provided three loans for Greece, three for Italy, one for France and one for Ireland in the same field. Together, all these loans from the EIB and ECSC totalled 272.3 MECU. The rest of the total for non-nuclear electricity (111.1 MECU) went towards financing the connection of the French high-voltage grid to the Italian and UK grids and towards a project to extend the UK grid.

Table 4
Loans granted *(in MECU)*

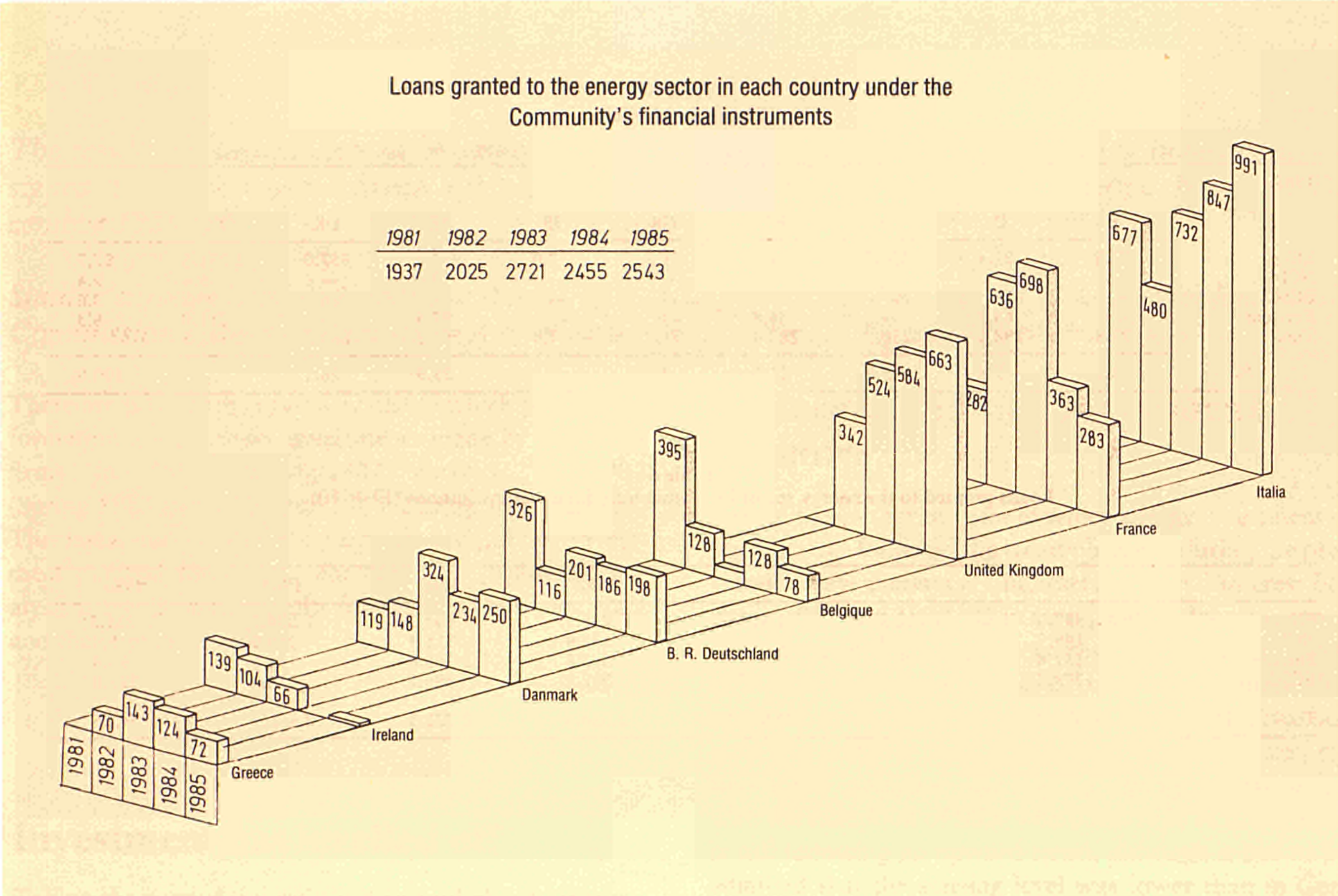
| 1985 | Solid fuels | Oil and gas | Nuclear energy | Electricity | RUE & NRES | Total | % |
|---|---|---|---|---|---|---|---|
| EIB | — | 584.1 | 955.8 | 322.6 | 368.8 | 2 231.3 | 87.7 |
| NCI | — | — | — | — | 9.4 | 9.4 | 0.4 |
| ECSC | — | — | — | 60.8 | 30.0 | 90.8 | 3.6 |
| Euratom | — | — | 211.0 | — | — | 211.0 | 8.3 |
| Total | — | 584.1 | 1 166.8 | 383.4 | 408.2 | 2 542.5 | 100.0 |
| % | — | 23.0 | 45.8 | 15.1 | 16.1 | 6.1 | 100.0 |

**By recipient sector**

Just as the ECSC paid no loans to the coal industry, in 1985 for the first time since 1978 neither the EIB nor the NCI made any loans to fund Community undertakings producing other **solid fuels** (i.e. lignite/brown coal and peat).

With loans totalling 584 MECU, the **oil and gas** sector again took the second largest share of Community energy

Over 400 MECU was lent for **rational use of energy** and the development of **new and renewable sources**, 368.8 MECU from the EIB, 30.8 MECU from the ECSC and 9.4 MECU from the NCI. A very large share (around 280 MECU) of these EIB and ECSC funds took the form of global loans, mainly to Italy, followed by France, Germany and the United Kingdom, for small-scale investment by industry or local authorities to promote more efficient use of energy, the sale of Community coal and the use of new sources of energy.




Loans totalling 112.4 MECU were granted to projects to set up or extend district heating networks in Denmark (93.0 MECU between five projects), Italy (10.9 MECU), France (6.7 MECU) and Germany (1.8 MECU).

**By recipient Member States**

As in 1983 and 1984, **Italy** remained the largest borrower of Community energy investments funds; indeed, it even increased its share to 38.9% of the total.

The **United Kingdom** again came second on 26.1%, up from 23.8% in 1984, almost exclusively by drawing on the EIB's own resources to raise the capital needed to develop its nuclear energy programme.

**France's** share in 1985 reached its lowest level since 1979. This is partly because last year, for the first time, no EIB or Euratom loans were requested for France's two major European projects - the Super-Phénix fast breeder reactor and the Eurodif uranium enrichment scheme.

**Germany** took almost the same share in 1985 as in recent years. Along with the United Kingdom and France, the Federal Republic is one of the Member States which has long been enlisting the support of the three main Community financial instruments (EIB, ECSC and Euratom) to carry through its energy projects.

**Denmark** took 9.9% of the loans, almost all of them from the EIB. Some 60% of them went towards gas infrastructure and 35% towards district heating systems.

**Belgium,** on 3.1%, used only EIB funds in 1985 to support the nuclear power station projects at Tihange (third unit) and Doel (fourth unit). Loans to Greece (2.8%) fell to their lowest level in both absolute and percentage terms since 1982. In 1985 the EIB helped fund just three hydroelectric power stations.

In 1985, **Ireland,** on 0.3%, rejoined the borrowers, by taking out an EIB loan to extend the Moneypoint coal-fired power station.

The **Netherlands** and **Luxembourg** once again took no Community loans for the energy sector.

**Table 5**
**Loans** *(in MECU)*

| 1985 | B | D | DK | FR | GR | IR | IT | UK | EC | % |
|---|---|---|---|---|---|---|---|---|---|---|
| EIB | 77.8 | 91.4 | 250.5 | 191.6 | 71.7 | 7.0 | 884.4 | 657.0 | 2 231.3 | 87.7 |
| NCI | — | — | — | — | — | — | 9.4 | — | 9.4 | 9.4 |
| ECSC | — | 38 | — | 47 | — | — | — | 6 | 90.8 | 3.6 |
| Euratom | — | 68.7 | — | 44.8 | — | — | 97.5 | — | 211.0 | 8.3 |
| Total | 77.8 | 198.1 | 250.5 | 283.4 | 71.7 | 7.0 | 991.2 | 663.0 | 2 542.5 | |
| % | 3.1 | 7.8 | 9.9 | 11.1 | 2.8 | 0.3 | 38.9 | 26.1 | | 100.0 |

**Table 6**
**Loans granted to the energy sector by Community financial institutions (EUR 10)**

*in MECU*

| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|---|---|---|
| EIB | 997.0 | 1 112.2 | 1 451.4 | 1 228.5 | 1 643.3 | 1 894.7 | 2. 231.3 |
| NCI | 149.5 | 108.0 | 93.6 | 131.4 | 315.4 | 250.0 | 9.4 |
| Euratom | 152.4 | 181.3 | 357.6 | 361.8 | 366.4 | 186.0 | 90.8 |
| ECSC | 278.7 | 323.2 | 57.2 | 302.9 | 396.2 | 124.4 | 211.0 |
| Total | 1 577.6 | 1 724.7 | 1 959.8 | 2 024.6 | 2 721.3 | 2 455.1 | 2 542.5 |

# Industrial investments to improve energy use in Europe

*The results of surveys carried out among heads of European businesses concerning investments designed to reduce expenditure on energy were published in* **Energy in Europe No 3** *in December 1985.* ([1])

*Similar surveys have been carried out in 1986 by specialized institutes* ([2]) *already involved in the Commission's more general surveys of industrial investment. The results are as follows.*

There are now three surveys available which provide information about energy investments made by industrial firms in 1981 (Spring 1982 survey), in 1984 (Spring 1985 survey) and in 1985 (Spring 1986 survey). The latest survey also supplies forecasts about investment planned for the current year. The following analysis is based on the results for France, Germany, Italy and the United Kingdom.

## Investment has levelled off

Taking the countries considered as a whole, there was a slight fall in energy investment in 1984 compared with 1981. This was not true in 1985, since there was an upturn in this category of investment in France, Italy and the United Kingdom (the respective shares increasing by 3% in France, 2.4% in Italy and 1.1% in the United Kingdom). However, there was a slight fall in Germany (0.6% reduction).

The results for 1985 are encouraging but are possibly less certain than in previous years because:

- the response rate of industrialists is lower for the 1986 survey than for the previous one. A downward adjustment of energy investment is therefore probably needed;

- the forecasts for 1986 are slightly less optimistic than the estimates for 1985.

A sector-by-sector analysis shows that the general trend in energy investment is mainly determined by the behaviour of the primary industries and metals manufacture because of the energy-intensiveness of the industries in question and the average level of their investment in better energy use.

## A more traditional investment structure

It would seem that the uses to which energy investment is put have not followed the trend observed during the previous survey: that survey indicated renewed interest between 1981 and 1984/85 in saving energy by using more efficient manufacturing processes, but it would now seem that this category of investment has stabilized. Investment in heat conservation had been declining, but now also seems to have levelled off. There has been no significant alteration concerning energy substitution, with the exception of Italy where this type of investment is still following an upward trend, although it has to be admitted that the starting level was lower than in Germany or the United Kingdom (the survey does not allow a comparison to be made with France).

## Some unanswered questions

The analysis of the trends observed in this survey differs from previous years because the energy situation in 1985/86 was not particularly propitious for investment in saving energy.

The relative share of energy investment as a proportion of total industrial investment is tending to level off, as is the trend in the structure of investment. Has there really been a slowing-down in investment in modernization or is it becoming more difficult to identify the proportion of energy savings attributable to the application of new production processes? Are then the general results concerning the significance of energy investment perhaps underestimated?

Conversely, if the generally lower response rate for the latest survey is taken into account, should not the level of energy investment be reduced?

The next survey should provide the basis for answers to these questions.

**Table 1: Share of energy-related investment in total investment (estimates/forecasts [p])**

| | Germany | | | | France | | | | Italy | | | | United Kingdom | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 81 | 84 | 85 | 86p | 81 | 84 | 85 | 86p | 81 | 84 | 85 | 86p | 81 | 84 | 85 | 86p |
| Primary industries | 12.1 | 8.2 | 7.8 | 5.9 | 14 | 10 | 11 | 12 | 13.1 | 8.4 | 12.2 | 10.0 | — | 7.0 | 8.2 | 8.4 |
| Metals manufacture | — | — | — | 8.7 | 6 | 14 | 11 | 21 | 4.1 | 5.7 | 16.8 | 12.5 | — | 6.4 | 6.5 | 6.7 |
| Engineering (incl. elec.) | 2.5 | 3.0 | 2.2 | 2.1 | 8 | 4 | 7 | 6 | 2.2 | 1.6 | 2.0 | 2.6 | — | 3.0 | 3.4 | 2.9 |
| Manu. & process. | 4.4 | 3.4 | 2.7 | 3.6 | 9 | 12 | 20 | 16 | 11.1 | 12.4 | 9.8 | 11.7 | — | 3.8 | 6.5 | 6.2 |
| Extractive inds | — | — | — | 2.2 | 8 | 12 | 15 | 9 | 3.4 | 8.7 | 3.9 | 4.8 | — | 5.7 | 11.7 | 12.6 |
| Food | 8.5 | 5.3 | 5.2 | 3.8 | 20 | 11 | 9 | 9 | 3.6 | 9.8 | 7.6 | 4.1 | — | 6.7 | 9.1 | 7.6 |
| Weighted average | 5.4 | 4.3 | 3.7 | 3.2 | 11 | 8 | 11 | 11 | 6.5 | 4.4 | 6.8 | 5.9 | 5.7 | 4.8 | 5.9 | 5.7 |

p = provisional.

**Table 2: Purposes of energy-related investment (estimates/forecasts)**

| | Germany | | | | Italy | | | | United Kingdom | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 81 | 84 | 85 | 86 | 81 | 84 | 85 | 86 | 81 | 84 | 85 | 86 |
| More efficient production processes | 50.5 | 59.1 | 59.8 | 70.4 | 51.1 | 70.1 | 84.5 | 80.5 | (56+22)[1] | (40+18) | (38+16) | (48+30) |
| Heat conservation | 77.2 | 76.9 | 72.0 | 75.6 | 60.8 | 61.2 | 85.3 | 82.5 | 55 | 43 | 41 | 44 |
| Energy substitution | 31.4 | 35.5 | 37.5 | 27.2 | 11.2 | 16.3 | 21.1 | 27.0 | (nd) | 33 | 34 | 29 |

[1] The first figure is for the improvement of existing processes, the second for the introduction of new processes.

| | France | | | |
|---|---|---|---|---|
| | 81 | 84 | 85 | 86 |
| Automation, introduction of new methods | 70 | 69 | 69 | 67 |
| Energy saving | 13 | 13 | 12 | 12 |
| Energy substitution | 2 | 3 | 3 | 2 |

(1) The forms of investment in question relate to action to save energy, to reduce the cost of energy, to replace one energy source with another, or to increase security of supply.

(2) The bodies concerned are as follows: Banque Nationale de Belgique (B), IFO-Institut für Wirtschaftsforschung (D), INSEE — Institut national de la statistique et des études économiques (F), ESRI — Economic and Social Research Institute (IRL), ISCO — Istituto nazionale per lo studio della congiuntura (I), Statec — Service central de la statistique et des études économiques (L), CBI — Confederation of British Industry (UK).

# Short-term energy outlook 1986-87 – European Community

*The Community's energy situation is dominated in the short term by low energy prices. Having fallen to below $9/barrel in July 1986 the fob cost of the Community's crude oil imports has since increased to around $15/barrel, following OPEC's short-term production sharing agreement in August. But since the beginning of 1986 the average cost of the Community's crude oil imports has fallen by around 50% in real dollar terms, and by over 60% in real ECU terms as the ECU has revalued strongly against the dollar. Falling oil prices have also dragged down the price of other fuels — coal, natural gas and electricity. The Community is therefore now facing a much lower energy price environment than at any time during the past 10 years. On top of this, economic growth is continuing to improve. The improvement is not spectacular — Community GDP has failed to exceed 3% since 1979 — but at 2.5% in 1986 and a forecast 2.8% in 1987 the outlook is still the most optimistic of this decade.*

*Energy forecasting is particularly difficult when energy prices have changed so radically and the future price outlook so uncertain.* **Firstly,** *the assumed short-term crude oil price itself could turn out to be far from reality.* **Secondly,** *the relative prices between fuels are changing rapidly. In some Member States energy suppliers are reacting more quickly than in others to preserve market share.* **Thirdly,** *it is too early to be sure of consumer and Government reactions to falling energy prices and of the effects on energy saving.*

*For the purposes of analysis the current forecast assumes that the Community's average oil price will be $15 in 1987. This implies the maintenance of a limited OPEC production agreement such as to avoid a sustained downward fall in prices. But there are other possibilities. Prices could, for instance, fall again in the spring, in the event of a combination of factors such as oversupply, a mild winter, drawdown of the high levels of oil stocks overhanging the world oil market and slower than expected increases in world oil demand. Equally, prices could increase to the $18/barrel sought by many oil producers if OPEC were to implement successfully a tight production sharing agreement.*

*Falling energy prices and rising economic activity should, ceteris paribus, give rise to increasing energy consumption. In 1985,* **Community primary energy demand** *expanded by 3.8%, and in 1986 a further increase in the 2-3% range is the likely outcome. Offsetting this, however, are progressive improvements in energy efficiency — the pace of which is slowing down, but nevertheless still continuing. (A special section in this article looks at some broad structural changes in the Community's energy economy in the 1980s).*

*In 1986, Community* **oil demand** *could increase by about 3% — the first time this has happened (discounting the effects of the UK miners' strike) since 1979. The rate of growth of oil demand in the Community has, however, considerably slowed in the second half of 1986. The increase in oil demand is mainly attributable to the transport fuels, cold weather, an increase in consumer stocks and some switching to fuel oil in industry. As for* **natural gas,** *demand is not expected to have increased in 1986 with natural gas sales in the first three-quarters of 1986 having been constrained by an unfavourable relative price compared to oil.*

**Coal demand** *in 1986 will be close to the 1985 level. This could represent a slight decrease after netting out the effects of the UK miners' strike. Coal has lost some demand in the industrial market where fuel oil prices were particularly attractive in 1986. As for* **electricity,** *Community demand is expected to have edged up by about 3% — a slower rate of growth than in 1984 or 1985.* **Nuclear**

**electricity production** *has again expanded significantly (+8%), although by less than previously forecast.*

*On the* **supply side,** *there have as yet been few signs of a changed trend in Community* **oil production,** *although exploration and development expenditure has been sharply cut back. Oil production is expected to be slightly higher than in 1985 — at around 3 Mb/d — and is expected to remain at about this level in 1987.* **Nuclear output** *has, however, been lower than previously forecast — due to delays in the commercial start-up of some scheduled new nuclear plants in the Federal Republic of Germany, France and the United Kingdom. Nevetherless, overall Community energy production is expected to increase by 3% over 1985 (+2% netting out the effects of the United Kingdom's mining dispute).*

*Another significant feature in the supply/demand balance has been the evolution of primary and secondary oil stocks. Company-owned primary oil stocks and consumer oil stocks in the Community have increased for the first time for many years — with strong increases noted in the second and third quarters of the year. Low prices have obviously been the case.*

*Net imports of oil and gas have increased in 1986, but net imports of coal have decreased.*

**What are the prospects in 1987?**

*Assuming $15/barrel imported oil, 2.8% Community GDP growth, average weather, and further dollar devaluation — energy consumption could increase again in 1987 — but the rate of increase may be rather small. This assumes of continued energy efficiency improvements — although at a slightly slower rate than in previous years (see box on structural analysis). Conceivably energy demand growth could be close to zero if the winter turns out to be very mild.*

*As for the fuels,* **oil demand** *which was affected by increased consumer stocks in 1986, is unlikely to grow by very much. Why is this?* **Firstly,** *assuming $15 oil, natural gas prices will be relatively more attractive as the lagged import price mechanisms work through.* **Secondly,** *the continuing unlikelihood of any substantial revival in industrial energy demand.* **Thirdly,** *the assumption of average weather (compared to particularly cold winters in 1985 and 1986) which will limit domestic oil consumption, and* **fourthly,** *ongoing energy efficiency improvements. Only the transport fuels could show some growth (in line with GDP). But there is considerable uncertainty on whether companies or individuals will maintain their high stock levels if prices remain in the $15 range. Will they gradually reduce their stocks to more normal levels or will they maintain higher levels in the belief that prices will soon rise again?*

*As for* **natural gas** *— demand should edge up by around 2% if lost sales in the interruptible market are recaptured, whilst the electricity sector will be dominated by a further large tranche of nuclear capacity coming on stream. Average nuclear capacity in the Community in 1987 could be 10 GWe more than in 1986 (+16%).* **Electricity demand** *should grow in the 3% range.* **Coal consumption** *could slightly improve in 1987, but any increase will be no more than marginal.*

*The Community's net imports of energy in 1987 should be about 42% of consumption, little changed on 1986 levels.*

The remainder of this article presents in more detail the Commission's Directorate-General for Energy's (DG X-VII) latest short-term forecast for the Community. Whilst use has been made of the short-term forecasting model (**Stem**) developed with the Directorate-General for Science, Research and Development, there has been more reliance than usual on market information in the present uncertain situation.

# Forecasting assumptions

The key assumptions underlying this forecast are shown in the box below:

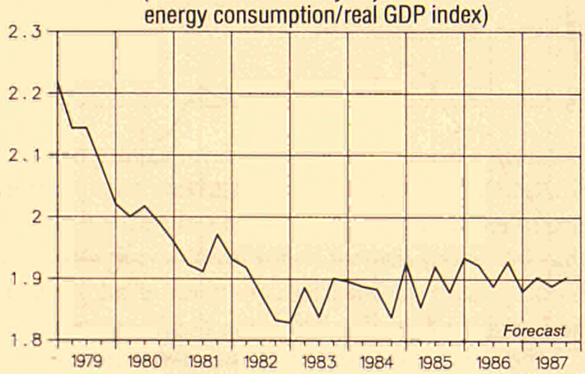
Forecasting assumptions
EUR 12
% growth over previous year

| Macroeconomic | 1985 | 1986 | 1987 |
|---|---|---|---|
| GDP | 2.4 | 2.5 | 2.8 |
| Consumers expenditure | 2.2 | 3.7 | 3.5 |
| Industrial production | 3.3 | 2.5 | 3.0 |
| Inflation | 5.8 | 3.7 | 3.0 |
| 1 ECU = $.... | 76.2 US cents | 98.3 US cents | 103.8 US cents |

*Source: Directorate-General for Economic and Financial Affairs: Economic forecasts 1986-87 (Sept/Oct)*

| | 1985 | 1986 | 1987 |
|---|---|---|---|
| **Community oil production** | | | |
| in Mtoe | 149.0 | 150.5 | 145.6 |
| in Mb/d | 2.98 | 3.01 | 2.91 |
| **Average net nuclear capacity** in GWe | 60.5 | 70.5 | 81.8 |
| **Degree days** (average : 232) | 239 | 232 | 232 |
| **Average Community crude oil import price (fob)** | | | |
| $ | 27.09 | 14.0 | 15 |
| ECU | 35.8 | 14.4 | 14.4 |

Graph 1 – EUR 10: Quarterly energy ratio trend (volume of seasonally adjusted inland energy consumption/real GDP index)




# Energy prices

## (a) Crude oil prices

Crude oil and oil product prices have collapsed in 1986 — largely due to OPEC's December 1985 decision to increase its share of the world oil market. The Community's average import price of crude oil (fob) fell to below $9 in July 1986 but has since increased to around $13 in the last quarter of 1986 resulting from OPEC's limited sharing agreement in August 1986. The recent trends can be seen in the table below:

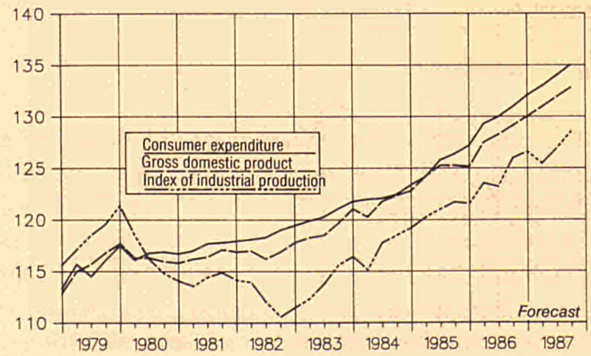
European Community average crude oil import price (fob)

| | $ | ECU | % change on previous quarter (in ECU) |
|---|---|---|---|
| 1985 Q1 | 27.31 | 39.9 | + 5.2 |
| Q2 | 27.27 | 37.6 | – 5.8 |
| Q3 | 26.37 | 33.6 | – 10.6 |
| Q4 | 27.27 | 32.1 | – 4.5 |
| Average 1985 | 27.09 | 35.8 | |
| 1986 Q1 | 20.2 | 21.8 | – 32.1 |
| Q2 | 12.2 | 12.7 | – 41.7 |
| Q3 | 10.4 | 10.3 | – 18.9 |
| Q4* | 13.3 | 12.9 | + 25.2 |
| Average 1986 | 14.0 | 14.4 | |

* Estimate. Source DG XVII

As can be seen in the following table — the price the Community had to pay for its imported oil fell by about 60% in 1986. The assumption used for this forecast assumes that the Community's crude oil import price will hold at around $15/barrel throughout 1986. The table below shows the Community's annual oil import prices for 1985-87.

Graph 2 – EUR 10: Quarterly macroeconomic indicators (1975 = 100)



European Community
Average crude oil import price (fob)

| | $ | ECU | % change in ECU on previous year |
|---|---|---|---|
| 1985 | 27.09 | 35.8 | – 0.0% |
| 1986 | 14.0 | 14.4 | – 60% |
| Base case 1987 | 15.0 | 14.4 | – 0.0% |

As can be seen, the base case assumption implies the continuation of low oil prices — on average excluding inflation, the same as in 1986.

### (b) Oil products prices

Rotterdam spot market quotations have partially revived in the last four months of 1986 since the lows recorded in July. The 1986 average monthly movements can be seen in the table below:

Approximate average monthly spot market quotations ($/tonne)
Barges (fob) Rotterdam

| | Motor gasoline (premium) | EEC Gasoil | RFO (3.5%s) |
|---|---|---|---|
| December 1985 | 264 | 249 | 137 |
| January 1986 | 222 | 212 | 120 |
| February 1986 | 165 | 200 | 101 |
| March 1986 | 151 | 181 | 94 |
| April 1986 | 151 | 164 | 66 |
| May 1986 | 187 | 144 | 54 |
| June 1986 | 158 | 116 | 54 |
| July 1986 | 126 | 94 | 42 |
| August 1986 | 145 | 122 | 64 |
| September 1986 | 157 | 122 | 72 |
| October 1986 | 145 | 117 | 66 |
| November 1986 | 136 | 123 | 72 |
| December 1986 | 141 | 129 | 79 |

Source: Platts oilgram

A feature of 1986 has been a significant increase in the volatility of spot oil price quotations, resulting not only from the new importance of these prices in determining crude oil prices through netback pricing arrangements but through changed trading arrangements and new market participants.

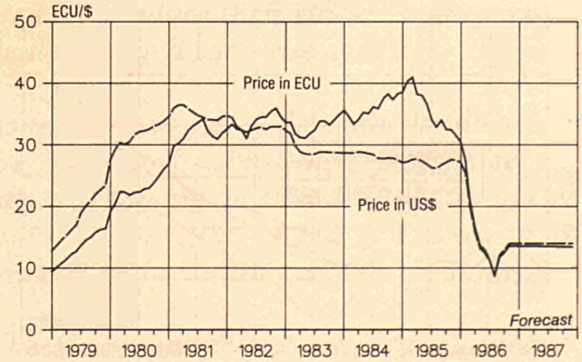
In the European Community, the dramatic fall in oil prices has been partially offset by increased Government taxation on oil products. The accompanying table compares the oil product excise taxes and VAT rates in December 1986 with the same period in 1985.

As the table shows, only three countries — FR Germany, Luxembourg and Belgium have left their oil taxation completely unchanged.

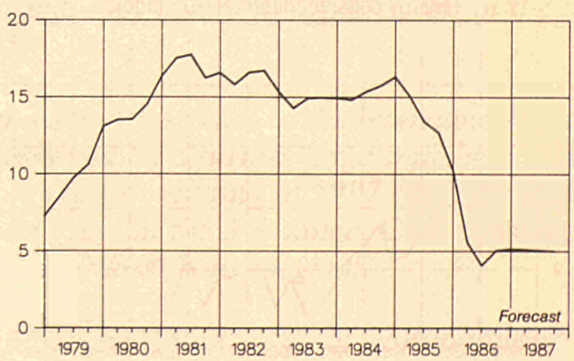
% changes in excise and other duties
December 1986 compared to December 1985

| | Premium gasoline/1000l | Diesel oil/1000l | Heating gasoils/1000l | Residual fuel oil/t |
|---|---|---|---|---|
| FR Germany | — | — | — | — |
| France | + 7.6 | + 9.6 | + 5.9 | + 80 |
| Italy | + 15.0 | + 94.7 | + 94.7 | — |
| Netherlands | + 13.7 | + 35.5 | + 204 | + 223 |
| Belgium | — | — | — | — |
| Luxembourg | — | — | — | — |
| United Kingdom | + 8.0 | + 8.2 | + 42.9 | — |
| Ireland | + 7.2 | + 11.1 | — | – 23 |
| Denmark | + 63.3 | + 285 | + 285 | + 285 |
| Greece | + 113 | + 148 | + 148 | + 300 |
| Spain | Renta 46124 PES in Nov.'86 | Renta 28895 PES Nov. '86 | Renta 11767 PES Nov. '86 | Renta 108 PES Nov.'86 |
| Portugal | 73092 ESC in Dec. '86 | 34163 ESC Dec. '86 | — | 4383 ESC Dec. '86 |

Graph 3 – EUR 10: Average crude oil import price/barrel (FOB)




Graph 4 – EUR 10: Real price of imported crude oil/barrel (FOB) in ECU 1975



**Changes in VAT**
**December 1986 compared to December 1985**

| | |
|---|---|
| Netherlands | — 19% in December 1985 increased to 20% in October 1986. |
| Ireland | — 23% in December 1985 increased to 25% in March 1986. |
| Spain | — no VAT in 1985. VAT now levied at 12% from 1 Jan. 1986. |
| Portugal | — no VAT in 1985. VAT now levied at 8% from 1 Jan. 1986. |

## What has this meant for average Community prices?

Average consumer oil prices for the Community are estimated to have fallen on average by the following amounts in 1986 compared to 1985.

**% change in real average consumer oil prices in the EEC 1986/5**

| | |
|---|---|
| Motor gasoline | —19% |
| Diesel Oil | —23% |
| Heating gas oil | —36% |
| RFO (3.5%S) ex VAT | —52% |

In 1987 consumer oil prices in the EEC, assuming $15 imported oil, and no new taxation changes, should be close to the average 1986 levels.

### (c) Natural gas prices

Falling oil prices, and in particular gas oil and residual fuel oil prices have driven down the price of imported natural gas into the Community. The latest trends can be seen below:

**Index of average price of imported natural gas into the Community (1985 Q4 = 100)**

| | | | |
|---|---|---|---|
| 1985 Q1 | 108.4 | 1986 Q1 | 93.7 |
| Q2 | 107.4 | Q2 | 84.6 |
| Q3 | 106.2 | Q3* | 75 |
| Q4 | 100 | Q4* | 60 |

* Estimate

The lagged pricing mechanisms used in most Community gas import contracts have concentrated the fall in natural gas prices into the last half of 1986 — although in order to protect sales volume some natural gas distribution companies have prematurely lowered their prices to maintain competition with fuel oil in the under boiler market. Domestic gas prices, however, have fallen by much less than for industry.

The average Community relative gas price against fuel oil has shifted as follows in the last two years:

**European Community**
**Average relative price index of residual fuel oil to imported natural gas (Q4 1985 = 100)**

| | | | |
|---|---|---|---|
| 1985 Q1 | 133.5 | 1986 Q1 | 83.3 |
| Q2 | 117.8 | Q2 | 66.0 |
| Q3 | 125.1 | Q3* | 70 |
| Q4 | 100 | Q4* | 103 |

* Estimate: Source DG XVII

This shows that the relative position of natural gas could improve by around 50% in the last quarter of 1986. This improved situation for natural gas will hold for at least the first two quarters of 1987 but from then on will be determined by the evolution of gas oil and residual fuel oil prices in the first half of 1987.

### (d) Coal prices

Imported coal prices have fallen in 1986. In ECU terms, average Community import prices of both steam and coking coal have fallen steadily and substantially throughout the year which can be seen in the following table:

**European Community**
**Average cif imported steam and coking coal prices (price per tonne of coal equivalent)**

| | steam coal | | coking coal | |
|---|---|---|---|---|
| | $ | ECU | $ | ECU |
| 1985 Q1 | 51.1 | 74.7 | 59.7 | 86.4 |
| Q2 | 52.4 | 72.1 | 59.0 | 81.3 |
| Q3 | 50.7 | 64.6 | 58.5 | 74.5 |
| Q4 | 52.5 | 61.5 | 58.3 | 68.3 |
| 1986 Q1 | 50.1 | 54.2 | 58.3 | 63.7 |
| Q2 | 48.75 | 50.8 | 54.8 | 57.1 |
| Q3 | 48.75 | 48.4 | 53.8 | 53.1 |

The international coal market is still oversupplied. Substantial excess export capacity exists in the United States, Colombia, South Africa and Australia. Steel demand, worldwide, is sluggish — and in the Community steel production levels will be lower than in 1985. But the outlook for steam coal prices could firm in the medium-term in the OECD area if new planned coal-fired electricity generating capacity comes on stream as forecast, and crude oil prices harden. In 1986 the Community has generated more electricity from coal than in the previous year.

As far as Community coal producers are concerned, high average production costs mean that Community production costs are already significantly above world coal prices. Lower international prices, and a weaker dollar will substantially increase the payments for current production to Community coal producers in 1986 and in 1987.

The $15 oil price assumption gives no grounds for believing delivered coal prices will increase in the Community in 1987. At best the rate of decrease of coal prices in 1986 may slow down.

## What has been happening to Community energy supply and demand in the 1980s?

The table below looks at the changes in Community energy supply and demand between 1980 and 1985. As can be seen, three features stand out, namely the decline in the Community's oil consumption (- 1.8 Mb/d in five years), and the strong increases in Community oil production (+ 1.2 Mb/d) and nuclear power (+ 1.6 Mb/d). These changes have radically altered the Community's energy balance, such that in 1985 the 12 Member States were importing on a net basis 3.25 Mb/d less oil. The movements in the other fuels has been much less marked (the comparison is slightly biased against solid fuels because 1985 was a coal-strike affected year. Even final electricity demand increased by only 0.2 Mb/d in the same period. Overall energy demand, in 1985, had shown no increase over the 1980 level.

EUR 12
Changes in energy supply and demand in the 1980s
(1985 -1980)

| | Mtoe | Mb/d |
|---|---|---|
| **Energy production** | +109.8 | +2.2 |
| Oil | + 58.0 | +1.16 |
| Natural gas | − 2.1 | −0.04 |
| Solid fuels | − 25.1 | −0.5 |
| Nuclear | + 79.8 | +1.6 |
| Other | − 0.8 | −0.02 |
| **Net energy imports** | −134.7 | −2.7 |
| Oil | −162.7 | −3.25 |
| Natural gas | + 17.2 | +0.34 |
| Solid fuels | + 10.9 | 0.22 |
| Electricity | − 0.1 | −0.002 |
| **Bunkers** | − 1.5 | −0.03 |
| **Primary energy demand** | + 4.2 | +0.084 |
| Oil | − 89.2 | −1.78 |
| Natural gas | + 13.7 | +0.27 |
| Solid fuels | + 0.9 | +0.02 |
| Nuclear | + 79.8 | +1.6 |
| Other | − 1.0 | −0.2 |
| (Final electricity demand | + 11.2 | +0.22) |

*Note:* The difference between energy production plus net imports plus bunkers minus primary energy demand is stock changes.

## How has the pattern of energy consumption changed? What are the trends in the relationship between the Community's economic indicators and energy use?

Tables 1a to 5a show the broad sectoral energy trends for the period 1979-85 alongside some indicators of energy demand and a rough 'energy intensity' measurement. What has happened?

**In the industrial sector** (Table 1a) demand for energy (including non-energy use) has been considerably reduced. From 1979 to 1983 demand was reduced by over 1.2 Mb/d, mostly oil. The two effects causing reduced energy use were, **firstly**, the industrial recession causing a substantial shake-out in the energy intensive industries (see weighted Community energy industrial production index in column 2) and **secondly**, high oil and energy prices, themselves a partial cause of the recession. Since 1983, industrial energy consumption has increased by about 10 Mtoe. But the most interesting fact is that industrial energy intensity, which improved markedly from 1979 to 1983, is nevertheless continuing to decline (at about 1.5% per year). Since 1979, industrial energy intensity seems to have been improved by around 15%.

**In the transport sector**, (Table 2a) (excluding marine bunkers), energy consumption has increased by 7% since 1979, and particularly strongly in the last two years. The ratio of transport demand for energy to the Community's GDP index has hardly shifted in the past six years.

The data on the **household energy consumption** (Table 3a) are fragile. Bearing this in mind, the trends show that energy consumption has decreased since the year of peak consumption in 1979. Five main variables are acting on household consumption. These are:

- energy prices
- household income (consumers' expenditure)
- the number of households and age structure of the population
- the weather
- energy-saving improvements

The effects of cold weather between 1984 and 1985 can be seen as by far the most important factor influencing short-term energy demand.

Table 1a
Industry

| | EUR 12 Energy & non-energy consumption (Mtoe) | Weighted index[1] of industrial production (1980 = 100) | Ratio of energy consumption/Weighted index of industrial production (1980 = 100) |
|---|---|---|---|
| 1979 | 334 | 101.7 | 104.5 |
| 1980 | 314.2 | 100 | 100 |
| 1981 | 292.1 | 97.3 | 95.5 |
| 1982 | 274.4 | 95.0 | 91.9 |
| 1983 | 271.6 | 96.9 | 89.2 |
| 1984 | 281.0 | 102.1 | 87.6 |
| 1985 | 281.8 | 103.9 | 86.3 |
| 1986* | 286 | 106.5 | 85.4[2] |
| 1987* | 291 | 109.5 | 84.6[2] |

Table 2a
Transport[3]

| | EUR 12 Energy consumption (Mtoe) | GDP index (1980 = 100) | Ratio energy consumption/GDP (1980 = 100) |
|---|---|---|---|
| 1979 | 169.5 | 98.9 | 100.6 |
| 1980 | 170.4 | 100 | 100 |
| 1981 | 168.8 | 99.9 | 99.2 |
| 1982 | 173.4 | 100.4 | 101.4 |
| 1983 | 173 | 101.6 | 99.9 |
| 1984 | 178.2 | 103.6 | 100.9 |
| 1985 | 181.5 | 106.1 | 100.4 |
| 1986* | 190 | 108.7 | 102.5[4] |
| 1987* | 195 | 111.8 | 102.5[4] |

The **other sectors** (Table 4a) of final energy demand (public administration, commercial, agriculture, etc.) has also reduced its energy consumption since 1979, and apart from the cold winter of 1985, which possibly increased consumption by up to 5 Mtoe, energy intensity has improved steadily, using GDP as the output indicator.

Table 3a
Households

| | EUR 12 Energy consumption (Mtoe) | Degree days (Average = 100) | Consumers' expenditure (1980 = 100) | Population (million) |
|---|---|---|---|---|
| 1979 | 191 | 103 | 98.5 | 316.7 |
| 1980 | 182 | 100 | 100 | 318.0 |
| 1981 | 176 | 93 | 100.2 | 319.1 |
| 1982 | 171 | 93.5 | 100.8 | 319.9 |
| 1983 | 174 | 95 | 101.8 | 319.6 |
| 1984 | 178 | 97 | 102.7 | 321.3 |
| 1985 | 187 | 103 | 104.9 | : |
| 1986* | 190 | 100 | 108.8 | : |
| 1987* | 180-185 | 100 | 112.7 | : |

Table 4a
Other sectors[5]

| | EUR 12 Energy consumption (Mtoe) | GDP index (1980 = 100) | Ratio energy consumption/GDP (1980 = 100) |
|---|---|---|---|
| 1979 | 107 | 98.9 | 112.7 |
| 1980 | 96 | 100 | 100 |
| 1981 | 93 | 99.9 | 97.0 |
| 1982 | 89 | 100.4 | 92.3 |
| 1983 | 90 | 101.6 | 92.4 |
| 1984 | 88 | 103.6 | 88.5 |
| 1985 | 95 | 106.1 | 93.3 |
| 1986* | 93 | 108.7 | 89.1 |
| 1987* | 94 | 111.8 | 87.6 |

* Forecast
[1] Synthetic index calculated by weighting the industrial production index of each energy-consuming branch by its share of energy consumption. This simple approach broadly eliminates structural effects.
[2] Assuming only 1% improvement in energy use.
[3] Excluding marine bunkers.
[4] Assumed slightly higher than in previous years due to forecast increase in consumers' expenditure being greater than GDP coupled with low fuel prices.
[5] Commercial, public administration, agriculture and other sectors.

Table 5a shows **final energy and non-energy consumption** for the Community since 1979 against a weighted output index. This suggests that the Community is now using approximately 13% less energy per unit of output than in 1979. The increase in this measurement of energy intensity in 1985 was due to the cold winter which could have added at least 10-15 Mtoe to final demand. Discounting this, energy intensity would have improved in 1985.

Table 5a
Final energy and non-energy consumption

| | EUR 12 Energy and non-energy consumption (Mtoe) | Synthetic output index[1] | Energy consumption/ output ratio (1980 = 100) |
|---|---|---|---|
| 1979 | 801.5 | 99.76 | 105.3 |
| 1980 | 762.6 | 100 | 100 |
| 1981 | 729.9 | 99.0 | 96.7 |
| 1982 | 707.8 | 98.45 | 94.3 |
| 1983 | 708.6 | 99.86 | 93.0 |
| 1984 | 725.2 | 102.69 | 92.6 |
| 1985 | 745.3 | 104.8 | 93.2 |
| 1986 | 759 [5] | 107.8 | 92.3 |
| 1987 | 760-765[5] | 111.23 | 89.3-89.9 |

[1] Calculated by weighting the synthetic industrial production index for industry used above, the GDP index for transport and consumers' expenditure index for househoulds by each sector's share of energy consumption.

## 1986 energy trends

With approximately nine months' data in hand, energy consumption seems certain to rise again in the Community in 1986. The table below summarizes estimated changes in primary energy demand in the first nine months of 1986.

| | Community energy consumption trends 1st 9 mths 1986/ 1st 9 mths 1985 |
|---|---|
| Oil | +3.4% |
| Natural gas | +1.7% |
| Solid fuels | +2.0% |
| Nuclear | +8.2% |
| Total energy | +3.0% |

**How can this be explained in terms of the structural intensity coefficients listed above and what are the prospects for 1987?**

**Industrial energy demand** could have slightly increased in the Community in 1986 but, assuming a 1% efficiency gain, the increase is likely to be very small. A similar picture could emerge in 1987 — i.e. a small increase in deliveries at the most.

**Transport energy demand** increased in 1986 — with both mogas and diesel oil showing reasonably strong growth. The increase in transport demand is almost certainly above GDP in 1986 — hence the assumption of a high energy consumption/GDP transport ratio. Assuming the same ratio holds in 1987, transport energy demand could increase by 2.7% in 1987. As for the **household sector** estimates are more difficult. Measurement of 1986 consumption was probably swollen by increased household stocking of oil which could, if the weather is normal/mild, act to depress the 1987 measurement of deliveries. A range of 180-185 Mtoe for 1987 is a best estimate.

Summing across the sectors yields the following forecast for EUR 12 final energy consumption for 1987.

| | EUR 12 Projected total final energy demand | EUR 12 Projected total primary energy demand | Possible rate of increase of primary energy demand over previous year |
|---|---|---|---|
| 1985 | 745.5 | 1 028.7 | |
| 1986 | 759 | 1 054 | +2.5% |
| 1987 | 760-765 | 1 055-1 062 | +0.0 to +1.0% |

## Conclusions

This simple analysis, which takes no account of falling energy prices on consumer behaviour, suggests that energy consumption will rise in 1987, assuming GDP grows at around 2.8%. However, if the weather is mild and if consumer stocks are drawn down and not rebuilt to former levels, the increase in deliveries could be very small. The Commission is working on a more detailed analysis of energy efficiency indicators, and the results of this work will be reported in a future issue of *Energy in Europe*.

# Overall energy

The special section of this article looks at the broad structural changes that have been taking place in the Community's energy economy in the 1980s. As Graph 5 shows, since the end of 1982 Community energy consumption has been on an upward trend.

Recent quarterly movements have been as follows:

EUR 10: Primary energy consumption
% change on same quarter of previous year

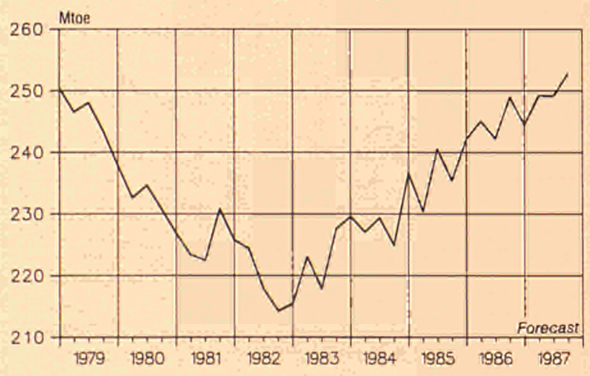
| | | | |
|---|---|---|---|
| 1985 Q1 | +3.1 | 1986 Q1 | +2.5 |
| Q2 | +1.3 | Q2 | +6.5 |
| Q3 | +4.8 | Q3* | −0.2 |
| Q4 | +5.6 | Q4* | +0.9 |
| 1985 annual change | +3.5 | 1986 annual change | +2.5 |

* Forecast.
Sources DG XVII Eurostat.

This shows that there was apparently a significant increase in primary energy consumption in the second quarter of 1986. However an important portion of this was early consumer oil stocking — particularly in the Federal Republic of Germany — which will diminish deliveries in the last quarter of 1986 when seasonal stocking normally takes place. Q4 1986 will also be depressed by the mild weather conditions. Short-term underlying trends are therefore rather difficult to disentangle from the data. The structural analysis suggests that final energy demand could have increased around 10-15 Mtoe in 1986 — of which perhaps up to half was attributable to the weather — suggesting the underlying growth of Community energy demand to be in the 1.0-2.0% range rather than the higher rates coming straight from the statistics.

As far as supply is concerned, the Community's net energy imports have increased in 1986 — with net oil imports up by the most. Community energy production also increased by 2.0% (ex. UK miners' strike) with nuclear and coal each contributing an extra 10 Mtoe to Community energy supply. The Community's oil production appears to be at its plateau. Stock changes have also been significant in 1986 (see oil).

Graph 5 – EUR 10: Seasonally adjusted quarterly energy consumption




As for 1987, nearly 3% forecast GDP growth — and the continuation of low energy prices argue strongly for a continuation of energy demand growth. However, taking into account the structural analysis above, the rate of increase of energy demand could well turn out to be low, assuming normal weather patterns and continuing small improvements in energy efficiency. A 1-2% range seems possible — with the probability towards the lower end of the range.

# Oil

As forecast in *Energy in Europe No 4* (April 1986), **Community oil demand** is forecast to increase in 1986 — the first underlying increase in demand since 1979. However the underlying rate of increase seen in deliveries of oil in the first half of 1986 over the same period of 1985 (+7%), slowed in the third and fourth quarters of 1986.

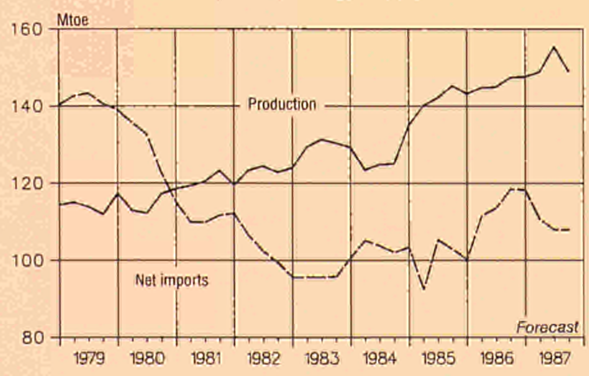
EUR 10
% increase in inland deliveries of oil products
over same quarter of preceding year

| | Q1 | | Q2 | Q3 |
|---|---|---|---|---|
| Motor gasoline | + 2.6 | | + 5.1 | + 4.0 |
| Gas oils | + 5.6 | | +24.0 | + 0.0 |
| Residual fuel oil | —26.8[1] | (−3.7)[2] | +20.5 | +15.6 |
| Other products | + 0.5 | | + 0.0 | + 5.7 |
| Total oil deliveries | — 3.2[1] | (+2.5)[2] | +12.8 | + 4.7 |

[1] UK miners' strike affected
[2] Estimate ex-UK miners' strike

The principal reason for the very strong increase in demand recorded in the second quarter was due to unseasonal stocking of domestic heating oil — particularly in the Federal Republic of Germany. Some analysts have suggested that the difference between the stockbuild in Q2 1986 and Q2 1985 was as much as 9 Mtoe (a rate of

Graph 6 – EUR 10: Seasonally adjusted quarterly primary energy supply



0.7 Mb/d for the quarter). There is also some Q3 and Q4 evidence of increased RFO stocking by industry. But even netting this and the effects of the UK miners' strike out of the data — Community oil demand has still grown by around 3-3.5% in the first nine months of 1986 — higher than previous expectations and a substantial increase.

## Motor gasoline

Apart from Italy, motor gasoline demand has increased in every Community country with discretionary driving being marginally stimulated by an average fall of 20% in pump prices. 1986 has been a good year for car sales (particularly in the Federal Republic of Germany due to special tax incentives) so the stock of cars in the Community will have also increased. Overall mogas demand could be at least 3% higher than in 1985.

## Gasoils

**(i) For transport**

There has been a surge in gasoil use for transportation in the Community in 1986. Average prices have fallen by about a quarter and as the economic climate has improved so goods traffic has increased and switching to diesel vehicles continues apace in some Community markets. First estimates suggest that diesel use could have increased by about 8% in 1986.

**(ii) For heating**

Consumer stocks of heating oil are probably higher in most Community markets than for many years. Some critical questions then emerge. When will consumers return to more normal oil stock levels? The outcome may well depend on consumers perceptions of future prices. In 1986, deliveries of gas oil for heating could be 3 to 5% more than in 1985.

## Residual fuel oil (RFO)

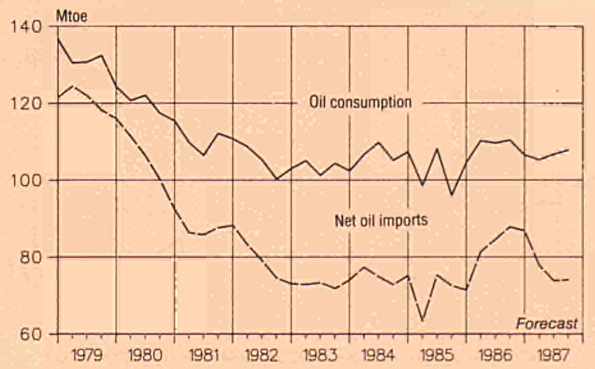
The underlying trend in RFO use in the Community was upwards in 1986 — for the first time since the second oil crisis. With limited data in hand, it is difficult to fully disentangle the trends. It seems that some extra fuel oil has been used in industry, some has been used to build up consumer stocks — and in September, at least an extra 0.5 Mtoe was burnt in Community power stations. This extra RFO use reflects parallel losses to coal and interruptible gas. Overall, RFO use in 1986 in the Community could be close to the 1985 level of demand, itself inflated by the UK miners' dispute.

## 1987 oil demand prospects

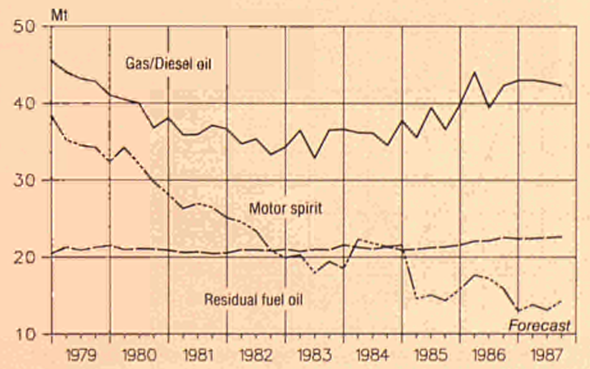
It is unlikely that Community oil demand in 1987 will grow by as much as in 1986. Why is this?

(i) price effects will be small, assuming no changes in oil taxation;

Graph 7 – EUR 10: Seasonally adjusted quarterly oil consumption and net oil imports




Graph 8 – EUR 10: Seasonally adjusted oil products consumption



(ii) consumer stocks of heating oil are very high — and in the first part of the winter (October to December 1986) the weather has been very mild;

(iii) natural gas should regain its lost share of interruptible business from fuel oil, certainly in the first half of 1987;

(iv) continuing energy efficiencies in oil use.

Although there could be some GDP-related growth in the transport fuels, this should be offset by reduced heating oil and RFO demand.

Overall Community oil demand may be rather flat in 1987 — with a chance of even having negative rather than positive growth.

## Natural gas

The European Community's natural gas demand increased by 1.5% in the first half of 1986 — with the growth concentrated in the second quarter of 1986. To date there has been no increase in gas consumption in power stations and given the certainty of some lost gas business to fuel oil, the slight increase in demand probably derives from the domestic sector in part due to the cold weather and in part to the expanding gas network in some Community gas markets.

Overall, natural gas demand in 1986 is unlikely to have grown, and this represents a significant slowdown compared to the previous three years. This is mainly because demand in the last quarter will have fallen due to the mild weather. On the supply side, net imports of natural gas have increased quite strongly (in particular from the Soviet Union) whilst domestic production has declined.

The prospects in 1987 should be brighter for natural gas. Four indicators point in this direction:

— the forecast 2.8% growth in GDP with the industrial output of the chemical industry (24% of gas demand) being particularly important;

— the improving competitive position of gas *vis-à-vis* fuel oil

— the expanding gas network

— low gas prices.

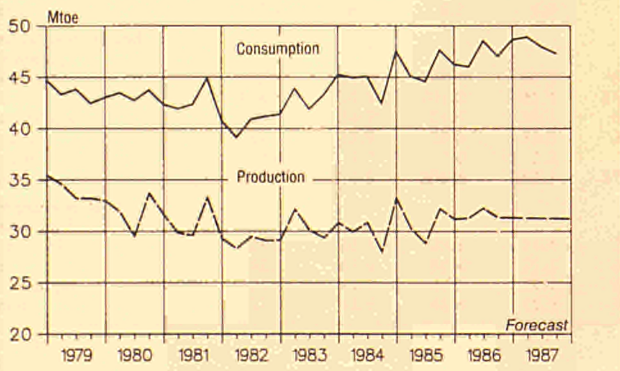
However, continuing energy efficiencies and assumed average weather should slow down the increase in demand (household and tertiary consumption represents nearly 50% of natural gas consumption).

Overall, a small increase in natural gas demand is possible for 1987.

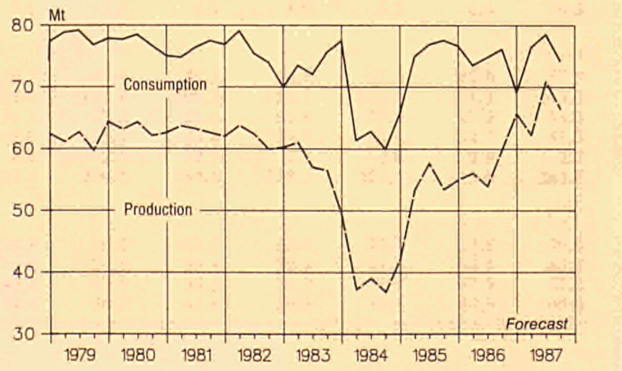
## Coal

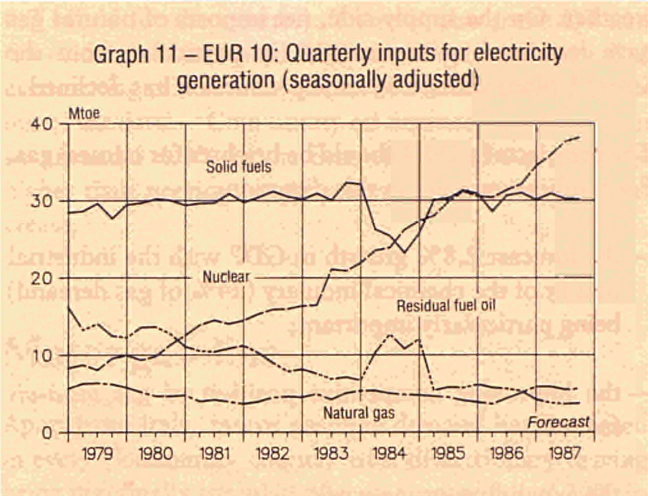
Solid fuel demand increased by about 2% in the first half of 1986, however, discounting the effects of the UK miners' dispute which affected data in the first quarter of 1985, the growth would have been slightly negative. Sales have been lost in the industrial sector to fuel oil, and deliveries to the iron and steel industry are 6% below

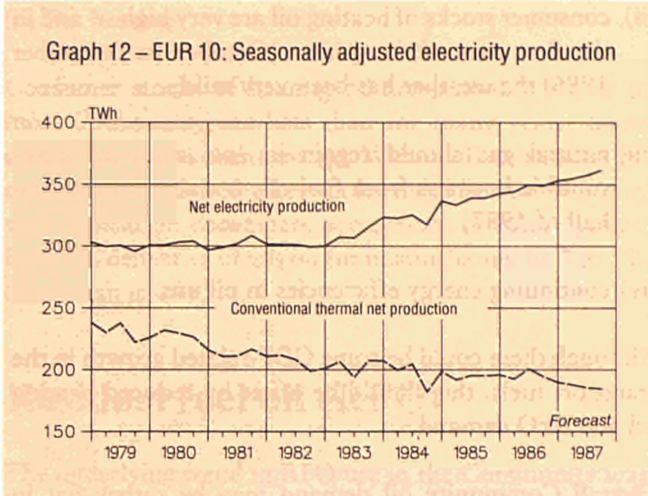
Graph 9 – EUR 10: Seasonally adjusted natural gas supply and demand




Graph 10 – EUR 10: Seasonally adjusted hardcoal consumption and production






the same period in 1986. Lignite consumption in power stations has also fallen, but hard coal consumption in this sector has increased.

In 1986, solid fuel consumption is expected to remain at around the 1985 level — actually a slightly downward trend overall.

The most optimistic sector of demand in 1987 would appear to be the power generation market. Deliveries here could increase since a further net 2.2 Gw of coal-burning electricity capacity is due to come on stream in 1987. But the outlook in the steel and other industrial sector is rather pessimistic. EUR 10 solid fuel demand could do well to reach 220 Mtoe which would represent a 1-2% increase over 1986.

**Electricity**

The Community's consumption of electricity, having increased by 2% in 1983, 4% in 1984, 4.4% in 1985 should grow by around 2.5-3.0% in 1986. Although data is incomplete, it seems that the increase in demand has been more broadly spread across the main consuming sectors than for the other fuels. On the supply side, forecast nuclear output has been continually revised downwards in 1986 as more nuclear power plants due on stream in 1986 have delayed their commercial start-up dates. As a result, nuclear output is currently forecast to increase by no more than about 8% in 1986, much the slowest rate in recent years.

**In 1987**, demand could expand by around 3-3.5% and nuclear production, provided scheduled plant comes on stream as forecast, could be producing over 36% of the Community's electricity production by year end.

**TABLE 1 — Primary energy balance for the European Community**

*(Mtoe)*

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986[1] | 1987[2] |
|---|---|---|---|---|---|---|---|---|
| **Primary production** | | | | | | | | |
| Solid fuels | 186.5 | 186.8 | 183.8 | 175.7 | 131.8 | 157.9 | 167.2 | 167 |
| Oil | 91.5 | 101.7 | 115.1 | 131.4 | 144.2 | 149.0 | 150.5 | 145 |
| Natural gas | 129.4 | 125.5 | 116.1 | 119.9 | 119.2 | 126.5 | 122.4 | 120 |
| Nuclear | 40.5 | 54.7 | 61.5 | 74.5 | 95.6 | 116.4 | 125.6 | 140-145 |
| Hydro | 12.6 | 12.8 | 12.6 | 12.5 | 12.2 | 11.8 | 12.4 | 12 |
| Total | 460.6 | 481.5 | 489.1 | 514.0 | 503.0 | 561.6 | 578.1 | 584-589 |
| **Net imports** | | | | | | | | |
| Hard coal | 48.9 | 44.2 | 46.1 | 38.4 | 51.9 | 56.0 | 54.8 | 50-55 |
| Oil | 435.3 | 354.6 | 325.1 | 289.6 | 300.3 | 286.4 | 313.9 | 307 |
| Natural gas | 43.5 | 46.2 | 45.8 | 50.1 | 57.9 | 59.3 | 61.2 | 67 |
| Electricity | 1.2 | 1.9 | 1.7 | 1.9 | 1.3 | 1.1 | 1.5 | 1.0 |
| Total | 528.9 | 446.8 | 418.7 | 379.9 | 411.3 | 402.8 | 431.4 | 425-430 |
| **Change in stocks** | | | | | | | | |
| Hard coal/coke | 11.0 | 8.9 | 10.6 | 1.8 | - 16.5 | - 4.0 | 4.2 | 2.0 |
| Oil | 15.2 | - 17.3 | - 11.7 | - 18.0 | - 3.3 | - 0.8 | 11.9 | - 1.0 |
| Natural gas | 3.9 | 6.7 | 3.4 | 4.9 | 2.9 | 3.6 | 1.9 | 2.0 |
| **Bunkers** | 23.8 | 25.9 | 24.2 | 22.3 | 21.2 | 23.3 | 26.7 | 25 |
| **Estimated gross inland consumption** | | | | | | | | |
| Solid fuels | 224.4 | 222.0 | 219.4 | 212.3 | 200.2 | 218.0 | 217.8 | 215-220 |
| Oil | 487.8 | 447.6 | 427.7 | 416.6 | 426.5 | 412.9 | 425.8 | 428 |
| Natural gas | 169.0 | 164.9 | 158.5 | 165.1 | 174.3 | 182.1 | 181.7 | 185 |
| Nuclear | 40.5 | 54.7 | 61.5 | 74.5 | 95.6 | 116.4 | 125.6 | 140-145 |
| Hydro | 12.6 | 12.8 | 12.6 | 12.5 | 12.2 | 11.8 | 12.4 | 12 |
| Total | 935.6 | 904.0 | 881.3 | 882.9 | 910.0 | 942.3 | 964.8 | 981-991 |
| **Net imports as % of consumption[3]** | | | | | | | | |
| Hard coal | 21.8 | 19.9 | 21.0 | 18.1 | 25.9 | 25.7 | 25.2 | 23.2-25.0 |
| Oil | 85.1 | 74.9 | 72.0 | 66.0 | 67.1 | 65.7 | 69.4 | 67.8 |
| Natural gas | 25.7 | 28.0 | 28.9 | 30.3 | 33.2 | 32.6 | 33.7 | 36.2 |
| Total | 55.1 | 48.1 | 46.2 | 42.0 | 44.2 | 41.7 | 43.5 | 42.2-42.3 |

[1] Provisional.
[2] Forecast.
[3] Net imports/(gross inland consumption + bunkers).

**TABLE 2 — Primary energy balance for the European Community**

*(Mtoe)*

| | 1985 | | | | 1986[1] | | | | 1987[2] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | I | II | III | IV | I | II | III | IV |
| **Primary production** | | | | | | | | | | | | |
| Solid fuels | 35.4 | 38.9 | 40.4 | 43.3 | 43.3 | 40.5 | 38.1 | 45.4 | 42.0 | 39.4 | 41.1 | 44.6 |
| Oil | 38.2 | 36.5 | 35.9 | 38.5 | 39.3 | 36.0 | 37.4 | 37.8 | 38.0 | 35.6 | 35.5 | 36.5 |
| Natural gas | 46.1 | 25.0 | 17.9 | 37.4 | 43.4 | 25.8 | 19.7 | 33.6 | 43.9 | 25.9 | 18.7 | 31.9 |
| Nuclear | 31.1 | 25.9 | 26.0 | 33.3 | 34.7 | 28.0 | 27.1 | 35.8 | 39.7 | 33.1 | 32.7 | 41.3 |
| Hydro | 3.0 | 3.7 | 3.0 | 2.2 | 2.7 | 4.0 | 2.9 | 2.7 | 2.8 | 3.6 | 2.9 | 2.7 |
| Total | 153.7 | 130.1 | 123.2 | 154.6 | 163.4 | 134.3 | 125.2 | 155.3 | 166.4 | 137.5 | 130.9 | 157.1 |
| **Net imports** | | | | | | | | | | | | |
| Hard coal | 13.5 | 13.9 | 13.8 | 14.8 | 12.9 | 14.9 | 14.0 | 12.9 | 9.6 | 13.1 | 14.2 | 11.6 |
| Oil | 74.6 | 62.8 | 72.1 | 76.9 | 71.7 | 82.5 | 81.2 | 78.6 | 83.2 | 74.2 | 70.7 | 78.6 |
| Natural gas | 16.1 | 14.6 | 12.5 | 16.2 | 17.4 | 14.5 | 12.5 | 16.8 | 17.9 | 15.6 | 13.2 | 19.9 |
| Electricity | 0.2 | 0.4 | 0.5 | 0.1 | 0.2 | 0.6 | 0.5 | 0.2 | 0.3 | 0.4 | 0.5 | - 0.2 |
| Total | 104.2 | 91.7 | 98.8 | 108.0 | 102.2 | 112.5 | 108.2 | 108.4 | 111.0 | 103.4 | 98.6 | 109.9 |
| **Change in stocks** | | | | | | | | | | | | |
| Hard coal/coke | - 6.8 | 0.3 | 5.0 | - 2.6 | - 6.0 | 4.6 | 4.7 | 0.8 | - 5.2 | 1.5 | 7.4 | - 1.7 |
| Oil | - 7.3 | - 1.4 | 0.1 | 7.9 | - 7.1 | 5.6 | 10.2 | 3.2 | 3.3 | 2.0 | - 1.6 | - 4.6 |
| Natural gas | - 4.5 | 4.8 | 3.9 | - 0.7 | - 5.8 | 4.0 | 4.9 | - 1.2 | - 4.8 | 4.0 | 4.3 | - 1.6 |
| **Bunkers** | 5.1 | 6.2 | 6.2 | 5.8 | 6.4 | 7.1 | 7.0 | 6.3 | 5.9 | 6.2 | 6.4 | 6.2 |
| **Estimated gross inland consumption** | | | | | | | | | | | | |
| Solid fuels | 55.6 | 52.5 | 49.1 | 60.7 | 62.2 | 50.7 | 47.4 | 57.5 | 56.7 | 51.1 | 48.0 | 57.9 |
| Oil | 114.9 | 94.5 | 101.8 | 101.8 | 111.8 | 105.8 | 101.4 | 106.8 | 112.1 | 101.5 | 101.3 | 113.5 |
| Natural gas | 66.7 | 34.7 | 26.5 | 54.3 | 66.6 | 36.3 | 27.2 | 51.6 | 66.6 | 37.5 | 27.6 | 53.3 |
| Nuclear | 31.1 | 25.9 | 26.0 | 33.3 | 34.7 | 28.0 | 27.1 | 35.8 | 39.7 | 33.1 | 32.7 | 41.3 |
| Hydro | 3.0 | 3.7 | 3.0 | 2.2 | 2.7 | 4.0 | 2.9 | 2.7 | 2.8 | 3.6 | 2.9 | 2.7 |
| Total | 271.4 | 211.8 | 206.9 | 252.3 | 278.1 | 225.6 | 206.5 | 254.6 | 278.2 | 227.1 | 213.0 | 268.6 |
| **Net imports as % of consumption[3]** | | | | | | | | | | | | |
| Hard coal | 24.2 | 26.5 | 28.1 | 24.4 | 20.8 | 29.3 | 29.6 | 22.5 | 16.9 | 25.7 | 29.6 | 20.0 |
| Oil | 62.1 | 62.4 | 66.8 | 71.5 | 60.7 | 73.0 | 74.9 | 69.4 | 70.6 | 68.8 | 65.6 | 65.6 |
| Natural gas | 24.1 | 41.9 | 47.1 | 29.9 | 26.1 | 40.0 | 45.9 | 32.5 | 26.8 | 41.7 | 47.9 | 37.3 |
| Total | 37.7 | 42.1 | 46.4 | 41.9 | 35.9 | 48.4 | 50.7 | 41.6 | 39.1 | 44.3 | 44.9 | 40.0 |

[1] Provisional.
[2] Forecast.
[3] Net imports/(gross inland consumption + bunkers).

TABLE 3 — Hydrocarbons: supply and disposal in the European Community

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986[1] | 1987[2] |
|---|---|---|---|---|---|---|---|---|
| 1. Oil (Mt) | | | | | | | | |
| Primary production | 90.6 | 100.7 | 113.9 | 130.1 | 142.7 | 147.6 | 149.0 | 144.2 |
| Change in stocks [3] | 15.1 | - 17.2 | - 11.6 | - 17.9 | - 3.3 | - 0.8 | 11.9 | - 0.9 |
| Net imports [3] | 433.0 | 353.0 | 323.7 | 288.4 | 299.0 | 285.4 | 312.8 | 305.5 |
| Bunkers | 24.5 | 26.8 | 25.0 | 23.0 | 21.9 | 24.1 | 27.6 | 25.6 |
| **Apparent consumption** | 484.0 | 444.1 | 424.3 | 413.3 | 423.2 | 409.6 | 422.4 | 425.0 |
| Inland deliveries: | | | | | | | | |
| Motor spirit | 84.5 | 82.6 | 83.3 | 83.7 | 85.2 | 84.5 | 88.3 | 90.8 |
| Gas/diesel oil | 158.6 | 147.5 | 140.3 | 140.4 | 143.3 | 149.1 | 157.3 | 159.3 |
| Heavy fuel oil | 128.0 | 108.1 | 93.6 | 77.8 | 83.3 | 66.6 | 66.4 | 61.8 |
| Other products | 85.0 | 80.4 | 80.5 | 85.4 | 86.5 | 87.1 | 89.9 | 89.1 |
| Total | 456.2 | 418.6 | 397.8 | 387.3 | 398.2 | 387.3 | 401.9 | 401.1 |
| Power stations: | | | | | | | | |
| Consumption | 53.9 | 44.7 | 40.0 | 31.2 | 41.2 | 31.6 | 25.7 | 22.1 |
| Change in stocks | - 0.4 | 0.6 | - 1.4 | - 2.7 | - 0.1 | - 1.2 | 2.2 | - 1.3 |
| 2. Natural gas (Mtoe) | | | | | | | | |
| Primary production | 129.4 | 125.5 | 116.1 | 119.9 | 119.2 | 126.5 | 122.4 | 120.3 |
| Imports[4] | 43.5 | 46.2 | 45.8 | 50.1 | 57.9 | 59.3 | 61.2 | 66.6 |
| Apparent consumption | 169.0 | 164.9 | 158.5 | 165.1 | 174.3 | 182.1 | 181.7 | 184.9 |
| of which: | | | | | | | | |
| in power stations | 20.3 | 16.9 | 16.6 | 18.8 | 20.6 | 18.0 | 15.5 | 17.4 |

[1] Provisional.
[2] Forecast.
[3] Crude oil and petroleum products.
[4] Imports from third-party countries.

TABLE 4 — Solid fuels: supply and disposal in the European Community

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986[1] | 1987[2] |
|---|---|---|---|---|---|---|---|---|
| 1. Hard coal (Mt) | | | | | | | | |
| Primary production | 253.6 | 252.2 | 248.4 | 235.2 | 161.9 | 205.9 | 222.2 | 223.6 |
| Change in stocks | | | | | | | | |
| Collieries | 10.7 | 8.9 | 4.2 | 0.5 | - 8.3 | - 10.4 | - 1.7 | - 1.5 |
| Power plants | 6.7 | 6.2 | 9.5 | 0.9 | - 13.6 | 8.8 | 6.6 | 3.9 |
| Net imports | 74.2 | 66.5 | 70.0 | 57.0 | 78.9 | 86.5 | 84.2 | 73.8 |
| Apparent consumption | 310.3 | 303.6 | 304.6 | 290.8 | 262.7 | 294.0 | 301.6 | 295.0 |
| Deliveries to: | | | | | | | | |
| Power plants | 179.2 | 176.5 | 184.0 | 175.8 | 131.9 | 172.9 | 183.4 | 177.8 |
| Coking plants | 88.4 | 85.2 | 80.1 | 69.7 | 69.8 | 76.3 | 76.1 | 72.2 |
| All industries | 22.7 | 24.0 | 24.5 | 25.4 | 26.1 | 29.0 | 27.3 | 23.0 |
| Households | 18.0 | 16.0 | 16.5 | 15.9 | 14.5 | 17.3 | 17.0 | 18.2 |
| Total | 308.4 | 301.7 | 305.2 | 286.8 | 242.2 | 295.5 | 303.8 | 291.2 |
| 2. Hard coke (Mt) | | | | | | | | |
| Coking plants | | | | | | | | |
| Production | 66.6 | 64.2 | 60.2 | 53.5 | 52.8 | 57.1 | 54.8 | 55.0 |
| Change in stocks | 0.8 | - 0.1 | 3.8 | 1.4 | - 5.3 | - 3.9 | 2.2 | 0.9 |
| Deliveries to the iron and steel industry | 54.3 | 52.6 | 46.3 | 41.8 | 48.5 | 49.8 | 45.6 | 49.8 |
| 3. Lignite | | | | | | | | |
| Production (Mt) | 157.0 | 162.4 | 159.3 | 158.7 | 162.0 | 159.2 | 155.8 | 151.2 |
| Consumption in power stations (Mtoe) | 26.2 | 27.6 | 26.6 | 27.3 | 27.0 | 25.7 | 24.5 | 25.2 |

[1] Provisional.
[2] Forecast.

TABLE 5 — Electricity: Supply, disposal and generating structure in the European Community

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986[1] | 1987[2] |
|---|---|---|---|---|---|---|---|---|
| **Electrical power (TWh)** | | | | | | | | |
| Total generation | 1 277.6 | 1 274.6 | 1 271.4 | 1 299.8 | 1 360.7 | 1 425.7 | 1 463.0 | 1 512.2 |
| Total net production | 1 208.7 | 1 206.1 | 1 202.9 | 1 229.1 | 1 286.7 | 1 347.3 | 1 382.4 | 1 428.0 |
| of which: | | | | | | | | |
| Hydroelectrical | 146.1 | 149.1 | 146.1 | 144.8 | 141.5 | 137.7 | 144.6 | 140.5 |
| Nuclear | 149.4 | 201.7 | 226.9 | 275.0 | 352.8 | 429.4 | 463.5 | 541.7 |
| Conventional thermal | 913.1 | 855.2 | 830.0 | 809.3 | 792.4 | 780.2 | 774.3 | 745.8 |
| Gross inland consumption | 1 291.7 | 1 296.8 | 1 290.8 | 1 321.6 | 1 375.3 | 1 438.5 | 1 480.1 | 1 523.4 |
| Available for internal market | 1 213.9 | 1 217.4 | 1 212.0 | 1 237.9 | 1 287.5 | 1 343.7 | 1 385.7 | 1 427.9 |
| **Input to thermal power stations[3] (Mtoe)** | | | | | | | | |
| Hard coal | 92.9 | 91.9 | 94.7 | 96.1 | 80.8 | 90.9 | 97.1 | 95.6 |
| Lignite | 26.2 | 27.6 | 26.6 | 27.3 | 27.0 | 25.7 | 24.5 | 25.2 |
| Petroleum products | 51.7 | 43.0 | 38.4 | 29.9 | 39.6 | 30.3 | 24.7 | 21.2 |
| Natural gas | 20.3 | 16.9 | 16.6 | 18.8 | 20.6 | 18.0 | 15.5 | 17.4 |
| Derived gas | 1.7 | 1.8 | 1.5 | 1.3 | 1.5 | 1.5 | 1.4 | 1.4 |
| Total | 193.7 | 182.2 | 178.2 | 174.0 | 171.7 | 167.7 | 165.2 | 161.7 |
| **Net nuclear capacity (GW)** | 26.7 | 34.4 | 40.2 | 43.8 | 50.7 | 60.5 | 70.5 | 81.8 |

[1] Provisional.
[2] Forecast.
[3] Conventional thermal plants in the public supply system.

# Community News

## The Council of Energy Ministers

The Council of Energy Ministers met on 26 November under the chairmanship of Mr Peter Walker (UK). There was a large number of items on the agenda.

The first point discussed concerned energy efficiency. This issue contains the text that the Ministers adopted.

Also in the area of energy efficiency, the Council discussed the long-standing dossier on **labelling of electrical appliances** and is now very close to reaching agreement on a framework directive in this field.

The Council had its first discussion on the Communication produced by the Commission services on the outlook for improved energy efficiency in the transport area. This edition contains an abridged version of the paper. The purpose of the Commission Communication was to provide a basis for the Council discussion so that the priority areas could be identified for detailed study. The Council were able to agree on the further work that should be done and on the areas for detailed consideration. The Commission will, in the light of its analysis of these areas present further Communications to the Council. The Commission proposes to hold a technical seminar on the Rational Use of Energy in Transport during 1987 and this will provide a valuable input into the further consideration of this complex topic.

Following earlier consideration of a Commission Communication a resolution on **New and Renewable Energies** was adopted by the Council. This resolution should begin the process of putting greater emphasis on these energy sources. To ensure that sight is not lost of this resolution, it has been agreed to convene early in 1987 a meeting of high level scientific advisers under the chairmanship of the Commission. The work of this group will be to identify the complementary aspects of Member States' programmes and to indicate at Member State level the potential for new and renewable energies to make a long-term contribution to our energy needs.

Commissioner Mosar presented a factual report to Ministers on the work underway within the Commission in the **post-Chernobyl follow-up.**

Commissioner Mosar's report was welcomed by delegations and in the discussions that followed Member States outlined where they saw the priorities for further action. It is now up to the Commission and the Member States to ensure that the necessary decisions are taken quickly and implemented to ensure that the right conditions are established for the safe use of nuclear energy in the Community.

The Commission services have been looking at the possible effects on our long-term energy situation of a sustained fall in oil prices. Based on the latest analysis undertaken, Commissioner Mosar drew his colleagues' attention to a number of key areas which need to be looked at closely in the context of **attaining the 1995 Energy Objectives**. Basically he focused on the possible negative effects lower oil prices could have on energy efficiency improvements, oil import levels, indigenous energy production in the Community and the role of coal and nuclear energy. It was agreed that the Commission should deepen its analysis of the effects of the changed energy situation on the attainment of the 1995 energy objectives and, if necessary, make recommendations to the Council as to how energy policies should be strengthened so as to ensure the achievement of the objectives. In this regard, it was announced that the Commission intends to conduct a review of Member States' energy programmes towards the end of 1987.

The **oil market situation** was discussed between Ministers over lunch, where there was a general exchange of views on the present situation.

The Commission made its regular report on **refining and oil products trade** to the Council (also contained in this issue). The Commission will continue to follow developments in the refining industry as well as keeping close contact with our main trading partners, i.e. the United States and Japan so that a liberal approach to trade in oil products can be maintained.

The final point discussed at the Council concerned **lignite and peat.** Commissioner Mosar outlined the work underway within the Commission following the Council's request to examine the Community's financial instruments available to assist lignite and peat. This report is expected to be discussed at the next Energy Council.

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## Environment Council update

Ministers responsible for environmental questions met on 24 and 25 November to discuss the following energy-related subjects:

- disposal of waste oils;
- sulphur content of gasoil;
- limitation of emissions from large combustion plants;
- vehicle emissions;
- nuclear safety.

The Council reached agreement to amend Directive 75/439/EEC concerning the **disposal of waste oils.** The purpose of this amendment is to strengthen existing provisions and to give priority to the processing of waste oils by regeneration. Any combustion of waste oils has to be carried out under environmentally acceptable conditions. The major new features introduced are the following:

— plants above 3 MW will be subject to specific Community emission limits;

— plants below 3 MW will be subject to national controls to be reviewed by the Council after five years;

— Member States may introduce a system for the prior control of pollutants contained in waste oils;

— the levels of PCB/PCTs permitted in waste oils shall be significantly reduced.

The amended Directive will be a so-called 'minimum Directive' so that Member States are free to implement more severe measures than those provided for in the Directive as long as the provisions of the Treaty are not violated. Consequently interested Member States are free to impose a national ban on combustion of waste oils in small installations.

No agreement was reached with regard to the draft Directive amending Directive 75/716/EEC on the approximation of the laws of the Member States relating to the **sulphur content** of certain liquid fuels (**gas oil**) and the proposal for a Directive on the limitation of emissions of pollutants into the air from **large combustion plants.** Whereas some progress was made concerning the limitation of sulphur in gasoils, discussions on the draft Directive on large combustion plants seem to be in deadlock. Even compromise proposals presented by the Presidency which have to be considered to form the smallest common denominator could not be agreed upon by all Member States. The Counil without having reached any conclusions on this dossier instructed Coreper to continue its examination.

The Council had a wide-ranging debate on compromise proposals from the Presidency concerning **particulate emissions from private diesel cars** and **gaseous emissions from heavy commercial vehicles.** Some technical aspects need continued examination by Coreper to prepare final decisions, if possible, to be taken under the Belgian Presidency.

Spain and Portugal joined those Member States having accepted the **compromise** solution in **Luxembourg** in June 1985 on the draft Directive on gaseous emissions from private cars. However, Denmark and Greece have not been in a position to withdraw their reservations on this subject.

Furthermore, the Council endorsed a German memorandum concerning the ban of **leaded normal petrol** from national markets. The Commission has been invited to submit a proposal to amend the Directive on the lead content of petrol so as to establish the appropriate basis for the speedy prohibition of leaded regular petrol.

Finally, the Council had an exchange of views on the environmental aspects of **nuclear safety** and agreed on the primordial importance of protecting the public and the environment from harm through nuclear radiation both as a result of normal operations and in the circumstances of an accident.

The Council agreed that, in addition to work in the IAEA, the Community, which is already bound by the Euratom Treaty and which will shortly be bound by new EEC Treaty commitments on the subject of environmental protection, and which has acted as a pacemaker on international cooperation on transboundary environmental issues, has an important and complementary role to play, whilst avoiding unnecessary duplication of effort.

The Council noted that in the light of today's discussion, the Commission will come forward soon with precise proposals for the protection of the public and the environment from the harmful effects of nuclear radiation. It agreed that such proposals should be considered as a matter of urgency. The next Environment Council is scheduled for 19 March, 1987.

## European Parliament

The Committee on Energy, Research and Technology is preparing work on a series of reports on the future of nuclear energy in the light of the Chernobyl accident.

**Madron Seligman** (ED-UK) will be presenting a report on the future of nuclear energy;

**Gordon Adam** (SOC-UK) will be suggesting a follow-up to the Community's 1995 energy objectives; and

**Leopold Späth** (PPE-FRG) will be examining the Commission communications on the aftermath of Chernobyl.

These reports will hopefully be adopted in time for the April 1987 part session of the European Parliament which will also be considering three reports prepared by Parliament's Committee on Environment. The future of nuclear energy will be the major theme of that session.

In the meantime, the Committee visited Madrid and met the Minister of Industry and Energy, Mr Croissier; the Secretary General for Energy and Mineral Resources, Mr Maravall-Herrero; and policy directors for oil and gas, nuclear energy, coal and alternative energy sources.

During the course of the visit, much attention was paid to the evolution of Spanish policies as regards nuclear energy, and Spain's needs concerning the validation of its coal resources.

Spain has abundant coal reserves, but of varying qualities. Major involvement in new technology is required for safe and economic exploitation of some of them.

The Chairman and the three Vice-Chairmen of the Committee attended the World Energy Conference in Cannes. In his speech to one of the main sessions of the Conference, **Mr Poniatowski** underlined the importance of not slackening efforts to promote alternative energy resources. Since 1980, world research in the energy sector had declined by almost 33% partly as a result of the energy glut: this decline was particularly noticeable in the alternative energy area, where expenditure on solar and photovoltaic research has almost halved since the beginning of the decade. The view of the Chairman of the Committee on Energy, Research and Technology is that it is necessary to set targets for the industrialized countries because at present the research burden for EEC countries is very unevenly distributed with some of the better-off countries spending far less as a proportion of the GDP than others.

The Committee is also drafting a motion for the European Parliament's Committee on Economic and Monetary Affairs on the consequences for the Community and the Member States of the fall in the oil prices. One of the members of the Committee (**Mr Bonaccini**) will be drafting the final resolution to be adopted by the abovementioned Economic and Monetary Affairs Committee. The Energy Committee has also had a first exchange of views on the draft report prepared by Mr Staes on the rational use of energy in the building and industrial sectors.

## ECSC Consultative Committee: main activities in the energy field

At its 258th session, held in Swansea on 17 to 19 September 1986, the Consultative Committee included on its agenda a consultation on the Commission's revised forecasts for the Community solid fuels market for 1986. As the data for the revision were gathered in June, and further developments affecting the market have since occurred, the Commission's report on 1986-87 will contain the necessary updating.

At the same session, a representative of the Commission read a statement on Community energy policy focusing on the new energy objectives for 1995, including the improvement of the competitivity of production capacities for coal and other solid fuels and the need for them to take a larger share of energy consumption generally. *(See the article on 1995 energy objectives in this issue).*

At the 260th session, held in Luxembourg on December 19th, Mr Maniatopoulos addressed the Committee on recent energy developments and their relation to the new 1995 energy objectives. The Committee welcomed this discussion and agreed to take these issues up at a future date.

# Participation by the Community in the work of the International Atomic Energy Agency (IAEA)

Following the Chernobyl accident, it was decided at a meeting of the IAEA's Board of Governors on 21 May to set up a working party of experts to prepare two international Conventions on the subject, one on early notification and the other on assistance in the event of a nuclear accident.

The experts met in Vienna from 21 July to 15 August. The Commission took part in their deliberations. The texts of the two Conventions allow international organizations and regional integration organizations to accede to them.

The IAEA's General Conference adopted the two conventions on 26 September at a special ministerial meeting.

The Convention on early notification entered into force on 27 October and has so far been signed by 58 States, including the 12 Community Member States.

The Convention on assistance has not yet entered into force but has so far been signed by 57 States, including 11 Community Member States.

In its outline communication to the Council on the consequences of the Chernobyl accident [1] the Commission recommended that Euratom should participate in the international Conventions where its sphere of responsibility is directly or indirectly involved. The Commission will shortly be submitting proposals on this to the Council.

Mr Mosar, the Energy Commissioner, gave a statement at the special ministerial meeting of the IAEA's General Conference.

He emphasized that the work carried out at the special meeting, which was devoted entirely to nuclear safety, was of very great importance to the European Community in view of its major responsibilities in the nuclear sphere. This was all the more understandable when one considered the large number of nuclear installations in the Community, the importance of nuclear energy in the energy balance sheet and the fact that the public is extremely sensitive about the nuclear issue.

Mr Mosar reminded his audience that Euratom research programmes and the provisions of the Euratom Treaty were based on two principles:

— firstly, the exploitation of atomic energy is acceptable only in optimum conditions of safety and health and environmental protection;

— secondly, the European Community would run extremely serious economic and political risks if this energy source were called into question.

Thanks to the experience it has acquired through its own research programmes on nuclear safety and radiation protection, the European Community will be able to make a substantial contribution to the implementation of most of the projects proposed in the IAEA framework.

The special meeting of the IAEA's General Conference in September adopted a Resolution which:

— recognizes that nuclear energy will continue to be an energy source of importance to economic and social development;

— emphasizes that the highest standards of nuclear safety will continue to be essential prerequisites for the use of this energy source;

— calls for the strengthening of bilateral and multilateral international cooperation on nuclear safety, radiation protection, physical safety and environmental protection.

The Conference also decided that all the statements, declarations and proposals made during the Conference would be submitted to the IAEA's Board of Governors for discussion.

# The non-nuclear research and development programmes

### The cost-sharing programme

The third non-nuclear energy research and development programme adopted on 12 March 1985 for the period 1 January 1986 — 31 December 1988, which had been extended to include new areas (solid fuels, synthetic fuels, hydrocarbons, etc.), takes account of the most recent energy trends. Special emphasis is placed on environmental problems, advanced technologies (combustion, deep drilling, etc.) and the improvement of industrial competitiveness. Following a first call for proposals in March 1985, 359 contracts corresponding to cost-sharing research work totalling 83 MECU with a Community contribution of 51 MECU had been concluded or negotiations were in their final stages as at 1 October 1986. The activities in question cover all nine subprogrammes and affect all the sectors concerned by the research work: universities, public and private research centres, large industry, small business, and the experts called upon by the Commission departments. A second call for proposals limited to four subprogrammes, the time limit for which was 15 September 1986, attracted 160 proposals. The examination and selection procedure is now in progress.

The initial contractors' meetings organized by topic or specific research area have already taken place. These meetings are not only a way of disseminating in good time the results obtained and appropriate information about the state of the art in question but also, and perhaps especially, represent a unique opportunity for scientists from all Member States to meet and for there to be productive collaboration between leading experts in the areas concerned. They generate genuine sectoral scientific communities in Europe.

In the same sphere of activities, the Commission organized the seventh European Conference on photovoltaic solar energy in Seville in Spain (27 to 31 October). This type of event is open to contributors from outside the Community (USA, Japan, USSR, China, Canada, Australia, Sweden, Brazil, India, Israel, Saudi Arabia, Mexico, Egypt, Morocco, Algeria, Colombia, Cuba, Syria, Senegal etc.) and attracts a large number of participants (over 450), making it possible to establish the state of progress of Community research but also to collect essential information about progress made elsewhere in the world. The Commission also played an active part in the Conference on wind energy held in Rome from 7 to 9 October.

More generally, in order to provide information about the content and implementation of the programme, Commission representatives have given talks in most Member States, including Spain and Portugal, both to those responsible for research policy and to scientific circles.

A briefing session was also held in Brussels on 30 September specifically for members of the European Parliament and scientific journalists.

In addition, a survey has been carried out by an external body among the contractors concerned, in order to assess the impact of the second programme on the industrial sector and to quantify the use made of the research.

From replies it emerges that 116 patents have been applied for by European firms and 254 permanent jobs have been created. It also emerges that industrial contractors have established productive collaboration with other firms, universities or research centres (85%), introduced new products or processes (25%), developed new markets (21%) and improved their competitiveness (49%). These figures are undoubtedly underestimated because not all the contractors consulted did in fact reply.

Turning to the dissemination of the results, apart from the publication of all the final reports, the articles published in the specialist press and the talks given at public events, over 50 works have been published, and several thousand copies have been sold through commercial channels in addition to the normal distribution channels.

The Joint Research Centre's (direct action) programme

The JRC is proceeding with its 1984-87 programme which, as far as non-nuclear energy is concerned, aims to establish standards for the photovoltaic conversion of solar energy and the use of low-temperature heat in housing. The activities relating to methods of testing solar energy systems and energy management in housing have resulted in the setting-up of specialized working parties, the installation of test equipment, the organization of meetings, the publication of reports and works, and international cooperation with the International Energy Agency (IEA) and international standards organizations.

A special effort has been made to include the two new Member States in the research activities conducted by the JRC and under the cost-sharing projects.

## European PV – plant monitoring newsletter

The first edition of a new newsletter entitled 'European PV Plant Monitoring Newsletter' has been published by the Joint Research Centre, Ispra, Italy.

This newsletter is intended for all the contractors, research institutions and other organizations involved or interested in the European photovoltaic research, development and demonstration programme, to keep them informed of progress with the monitoring of the pilot and demonstration plants. It will provide information on such matters as the methods and systems being used to collect, store and analyse data, the presentation of results and the conclusions that can be drawn.

The newsletter will be issued twice a year. Requests for copies should be adressed to the CEC Joint Research Centre, Sector ESTI, I — 21020 Ispra (Varese) Italy.

# The Council approves the Valoren Programme

The proposal for a Regulation establishing a Community programme for the development of less-favoured regions in the Community by exploiting indigenous energy potential (*Valoren Programme*) was presented in *Energy in Europe No 4*.

The Council of Ministers adopted the Regulation in question on 27 October and it was published in Official Journal, L 305 of 31 October 1986 (Council Regulation EEC No 3301/86).

**The Valoren Programme will run for five years and will concern the least-favoured regions in the Community, namely regions of Greece and Portugal, Ireland, the Mezzogiorno, Northern Ireland, Corsica and the French Overseas Departments, and a large number of Spanish regions.**

The Regional Fund's contribution towards this programme is estimated at 400 MECU. The indicative breakdown is as follows:

**By type of operation**

| | *MECU* |
|---|---|
| — exploitation of local energy resources | 248 |
| — efficient use of energy | 107 |
| — promotion of improved use of energy potential | 45 |
| | 400 |

**by country:**

| | |
|---|---|
| Spain | 105 |
| France | 15 |
| Greece | 50 |
| Ireland | 25 |
| Italy | 125 |
| Portugal | 65 |
| United Kingdom | 15 |
| Total | 400 |

# Relations with the Gulf Cooperation Council (GCC)

**Informal energy meeting**

An informal energy meeting between the Commission and the GCC took place on 22 and 23 September in Brussels.

The GCC delegation was headed by **Mr Suleiman-Jasir Al-Herbish**, the Saudi Arabian Assistant Deputy Minister for Petroleum and Mineral Resources who is the head of the GCC energy working team. The Commission delegation was headed by **Mr C.J. Audland**, the then Director-General for Energy.

The GCC representatives met Mr C. Cheysson, Commission Member with special responsibility for North-South relations and Mediterranean policy, and Mr N. Mosar, Commission Member with special responsibility for energy.

The delegations had a broad exchange of views on the energy policies of the GCC and of the European Community.

During the discussions, the GCC clearly indicated its wish to secure a reasonable share of the world oil market, and confirmed that, as far as it was concerned, a price range of 17-19 dollars a barrel would enable there to be a degree of market stability.

The Commission presented the new Community energy objectives for 1995 recently adopted by the Council. It emphasized the need for the Community, in the context of a market economy, to strive towards achieving better balance between the Community's sources of energy supplies.

The discussions also covered matters concerning refining and trade in crude oil and petroleum products between the two areas. In this respect, the GCC confirmed (a) that there were no further plans to build refineries for export purposes and (b) its desire to pursue a reasonable policy with regard to the marketing of crude oil and petroleum products. It congratulated the Community for its efforts to keep markets open, in particular in the OECD countries.

The next meeting is scheduled to take place in Rijadh in 1987.

# Commission mission to Kuwait and Iraq

**Kuwait**

OAPEC/EC **High-Level Meeting, Kuwait 8 to 9 December 1986**

The fifth annual high-level meeting between the General Secretariat of the Organization of Arab Petroleum Exporting Countries (OAPEC) and the Commission of the European Communities (EC Commission) took place in Kuwait on 6 and 7 Rabee al-Akher AH 1407, corresponding to 8 and 9 December 1986. Delegations were headed respectively by **Dr Ali Attiga**, Secretary-General of OAPEC, and **Mr Constantinos Maniatopoulos**, Director-General for Energy of the Commission.

Subjects reviewed included the European Community's energy policy objectives for 1995 and the short and long-term energy outlook in the European Community and the impact of the fall and instability of oil prices and revenues on the economic development of OAPEC and other developing countries.

Both sides recognized that these questions were of considerable economic importance and justified further examination and discussion to identify the areas of common interest of all the parties concerned.

The delegations discussed developments and likely prospects in refining and the trade in petroleum products, and reiterated their desire to maintain and further enhance liberalization of world trade in this sector.

The meeting reviewed cooperation between the two organizations in 1986 and expressed their satisfaction at the positive character of the various activities undertaken, particularly the launching of cooperation in training with the Arab Petroleum Training Institute (APTI).

Final arrangements were also decided for convening the trilateral EC/OAPEC/OPEC seminar on the medium and long-term energy outlook, which will be held in Luxembourg from 17 to 19 March 1987.

It was agreed that a pluri-annual technical cooperation programme would be discussed during 1987 with a view to establishing a more coherent framework for joint activities such as carrying out energy studies, training and seminars within the EC/developing countries network of energy institutes.

The EC delegation was also received by **HE Sheikh Ali al-Khalifah al-Sabah,** Minister for Oil of the State of Kuwait and Chairman of the Board of Directors of the Kuwait Petroleum Corporation (KPC). Also present was **Mr Abdul Razzak Mulla Hussain,** Deputy Chairman of KPC.

The next EC/OAPEC high-level meeting will take place in Brussels in early December 1987.

**Iraq**

In Iraq, the delegation visited the Arab Petroleum Training Institute (APTI) in Baghdad — a visit which underlined the willingness to continue a cooperation agreement and should result in a training grant for an Arab to study in the Technical University of Berlin in 1987 as well as three training opportunities for APTI officials to study informatics in DG XVII also in 1987. The delegation also had an extensive exchange of views with **Mr Isam Al Chalabi**, Vice-Minister for Oil in Iraq and also met **Mr Naji M. Khaleel** the President of the Science Research Council in Iraq. The delegation also visited the small solar lighting feasibility project which the Commission has cofinaced with the Council and which is working well.

# Oil refining and imports of petroleum products

As part of the system for monitoring trends in the refining industry and petroleum product imports into the Community, as decided by the Council on 20 June 1985, the Commission has issued a brief information memo of a factual nature containing statistics relating to developments in this area in the first half of 1986. This memo also updates some of the data contained in the Commission staff paper COM(86)263 concerning the Community oil market, its oil refining industry, and the external trade in petroleum products published in May (see *Energy in Europe* No 5).

At its meeting on 26 November, the Council noted the information in question and asked the Commission to continue to keep a close watch on all developments in this area.

### At international level

A similar monitoring system has been established by the International Energy Agency in accordance with the conclusions of the ministerial meeting held on 9 July 1985.

In particular, this system has made it possible to analyse the initial effects of the gradual liberalization of **Japan's oil import system** following the entry into force at the beginning of 1986 of a law authorizing imports of motor gasoline, gas oil and kerosene into Japan.

The harmonious approach adopted by the major OECD consuming areas with regard to keeping their markets open can therefore be seen to have resulted in promoting a fairly balanced distribution of exports, from the Middle East in particular. For example, exports of Saudi Arabian petroleum products in the first half of 1986 broke down as follows: 24% to the EEC, 20% to Japan and 15% to the USA.

### At the Community level

Where the Community is concerned, the trend as regards the refining industry and petroleum product imports from third countries is as follows.

### Refining

According to the table below, on 1 January 1986 the primary distillation capacity installed in the Community of Twelve totalled 613 million t/year (compared with the estimated 617 million t/year quoted in COM(86)263).

Some 20 to 24 million tonnes of capacity are likely to be closed down in 1986. Installed capacity on 1 January 1987 should therefore be between 589 and 593 million t/year.

Where **conversion capacity** is concerned, the most significant change since 1 January 1986 is the coming into service of the (1.8 million tonnes) flexi-coking unit at Esso's Rotterdam refinery. Several other conversion units have come on stream or will come on stream in 1986 in various countries.

It is estimated that there was a 6% increase in the **quantities processed** in Community refineries in the first half of 1986 compared with the corresponding period of 1985. This increase is due to the influence of the netback contracts, which made refining a more attractive proposition, and the 3% increase in demand for petroleum products during the period considered.

Crude oil was the main beneficiary (7% increase) of this increase in refinery processing, while semi-refined products are holding their position.

**EUR 12: Oil refining — Primary distillation and conversion capacities in 1986**

*(in million tonnes/year)*

| | Situation at 1 January 1986 | | | | | | | | Changes in 1986 (Estimate) |
|---|---|---|---|---|---|---|---|---|---|
| | Primary distillation | Reforming | Cracking Therm. | Cracking Catal. | Cracking Hydro | Vis-breaking | Coking | Hydro-conv. | |
| Belgium | 30.0 | 4.43 | — | 5.12 | — | 3.55 | — | | + 3.8 Distil. (?) |
| Denmark | 8.3 | 1.34 | 1.47 | — | — | 2.35 | — | | |
| FR of Germany | 88.1 | 15.35 | 6.25 | 9.15 | 4.90 | 5.30 | 5.34 | | – 2.3 Distil.<br>— 0.70 Cok. |
| Greece | 18.0 | 1.26 | — | 0.83 | — | 0.58 | — | | + 1.10 VB + 1.28 C. C. |
| Spain | 61.5 | 7.61 | — | 6.40 | 0.50 | 7.70 | 0.70 | | + 0.80 H. C. + 0.30 V.B.<br>+ 0.23 C. C. |
| France | 110.5 | 14.85 | 2.46 | 15.75 | 0.70 | 5.16 | — | | – 13.7 Distil. + 1.54 VB -<br>– 1.40 REF., – 1.86 C.C. |
| Ireland | 2.9 | 0.63 | — | — | — | — | — | | |
| Italy | 121.5 | 18.35 | 2.21 | 18.35 | 2.50 | 15.50 | 1.10 | | – 2.5 Distil. – 0.85 Ref.<br>+ 1.60 V.B. |
| Netherlands | 72.5 | 6.51 | 3.15 | 6.20 | — | 3.93 | — | | – 4.7 Distil. + 1.80 Flexicoker<br>+ 1.45 H. C. |
| Portugal | 14.4 | 2.20 | — | 0.70 | 0.50 | 0.60 | — | | |
| United Kingdom | 85.6 | 13.97 | 4.40 | 20.53 | 1.44 | 1.50 | — | | + 1.56 REF. |
| EUR 12 | 613.3 | 86.50 | 19.94 | 83.03 | 10.54 | 46.17 | 7.14 | | |

In the second half of 1986 there may be something of a slowing-down in refining activity because the increase in demand in the first half of the year was rather artificial since consumers took advantage of the extremely low prices in the second quarter in order to replenish their stocks, particularly in the case of domestic gas oil. The probable effect of this will be a reduction in deliveries to consumers in the second half of 1986.

The **rate of utilization** of primary capacity generally improved in the first half of 1986 compared with the average rates for 1985. The average utilization rate for the Community rose from 70% in 1985 to 77% in the first half of 1986.

**Petroleum product imports from third countries**

In the first half of 1986 the Commmunity imported more or less the same quantity of products from third countries as it did in the first half of 1985 (about 51 million tonnes).

It can be seen from the table below that there has been a 5% reduction in the volume imported from the developing countries (8% in the case of the GCC countries) to the benefit in particular of industrialized countries and State-trading countries. Deliveries from developing countries account for nearly half the total imported from third countries (47%), deliveries from State-trading countries approximately 32% and deliveries from industrialized countries 21%.

Where the **breakdown** of imports is concerned, the share of heavy oils (gas oils/fuel oils) has fallen slightly (67.7% compared with 69.9%) to the benefit of light and medium oils and especially other products (12.1% compared with 10.5%) including oil coke where there has been a significant increase (21.8% or 0.7 million tonnes).

Heavy oils' share had been steadily increasing since 1981, so this was the first significant reduction. It is, however, mainly attributable to fuel oil, in particular as a result of the ending of the British miners' strike. On the other hand, there has been a significant increase (32%) where gas oil is concerned.

**Net imports** of petroleum products (excluding feedstocks) into the Community of Twelve fell from 14.6 million tonnes in the first half of 1985 to 12.6 mil-

**EUR 12: Petroleum product imports into the European Community from third countries**

*1 000 t*

| Petroleum product imports from third countries into the EC | 1st half 1985 | 1st half 1986 | Variations 1st half 86/ 1st half 85 % |
|---|---|---|---|
| All products/all uses, of which: | 51 084 | 51 347 | + 0.5 |
| — light oils | 9 708 | 9 813 | + 1.1 |
| — medium oils | 289 | 557 | + 92.7 |
| — gas-oil | 12 841 | 16 995 | + 32.3 |
| — fuel-oils | 22 872 | 17 768 | − 22.3 |
| — other products | 5 374 | 6 214 | + 15.6 |
| All products/all uses, of which | 51 084 | 51 347 | + 0.5 |
| — specific treatment or chemical conversion | 21 046 | 23 392 | + 11.1 |
| — other uses (destined for consumption) | 30 038 | 27 955 | − 6.9 |
| All products/all uses, from | 51 084 | 51 347 | + 0.5 |
| — Industrialized third countries, of which: | 10 077 | 10 627 | + 5.5 |
| EFTA | 4 621 | 4 479 | − 3.1 |
| United States | 4 106 | 5 085 | + 23.8 |
| — Developing countries, of which: | 25 906 | 24 508 | − 5.4 |
| OPEC (total) | 19 362 | 19 787 | + 2.2 |
| • Venezuela | 2 020 | 1 627 | − 19.5 |
| OAPEC (total) (Egypt included) | 18 823 | 19 877 | + 5.6 |
| • Algeria | 4 726 | 4 335 | − 8.3 |
| • Libya | 1 878 | 3 806 | + 102.7 |
| GCC (total) | 8 966 | 8 244 | − 8.1 |
| • Saudi Arabia | 2 651 | 2 735 | + 3.2 |
| • Kuwait | 5 852 | 5 009 | − 14.4 |
| — State-trading countries, of which: | 15 101 | 16 212 | + 7.4 |
| USSR | 11 675 | 12 281 | + 5.2 |
| Romania | 2 177 | 2 663 | + 22.3 |

*Source:* The Community's external trade statistics (customs declarations: Nimexe system)
Feedstocks included.

lion tonnes in the first half of 1986, a reduction of nearly 14%.

# Energy technology projects

## Oil and gas

**Financial support for technological development projects in the oil and gas sector**

In accordance with the new rules, on 28 July the Commission granted financial support totalling 37.8 MECU for 76 technological development projects in the oil and gas sector.

This decision completed the support-granting process set in motion on 3 January 1986 with the publication in Official Journal C 1 of an invitation to submit proposals. A total of 122 proposals concerning technological development projects involving an estimated total cost of 247 MECU were received.

After consulting the Advisory Committee for oil and gas projects, the Commission selected the projects to be supported in the light of the criteria set out in Regulation No 3639/85.

**Priority was given to projects designed to reduce costs, increase safety and improve the efficiency of operations in areas of advanced technology. Preference was also given to projects involving at least two firms based in two different Member States or involving smaller firms. Approximately 60% of the support was allocated to these smaller firms.**

The projects for which support was granted concern all the sectors of activity covered by the programme, and in particular geophysics, and oil and gas production and transportation (see table). The following technical aspects were covered:

- development of energy sources and improved signal processing for seismic operations;
- acquisition and transmission of bottom-of-well measurements,
- development of resevoir models,
- methods of calculation for the design of production risers,
- underwater pipeline technology — knowledge of the environment, pipelaying methods, inspection, repairwork.

The Council, the European Parliament and the Member States were notified of the Commission's decision on 29 July. It became applicable on expiry of a period of 15 working days from the period of notification, since no Member State had referred the Commission's decision to the Council.

The Commission then informed the firms concerned by the decision and began negotiating the support contracts. In addition, it published a new invitation to submit projects for the 1987 financial year in *Official Journal* 183 of 22 July 1986. The time limit for that invitation was 28 November 1986.

**Table — Breakdown of support granted in 1986 to the various areas of technology**

| Area | Number of projects | Eligible investment (ECU) | Amount of support (ECU) | % |
|---|---|---|---|---|
| Geophysics and prospecting | 15 | 18 476 049 | 6 466 618 | 17.08 |
| Drilling | 3 | 4 482 181 | 1 568 763 | 4.14 |
| Production systems | 20 | 31 323 859 | 10 963 352 | 28.96 |
| Secondary and enhanced recovery | 9 | 12 083 175 | 4 229 111 | 11.17 |
| Effect of environment | 4 | 4 089 144 | 1 431 201 | 3.78 |
| Auxiliary and submersible vessels | 3 | 8 374 081 | 2 930 928 | 7.74 |
| Pipelines | 5 | 6 062 101 | 2 124 087 | 5.60 |
| Transportation | 7 | 9 431 917 | 3 301 171 | 8.72 |
| Natural-gas technology | 1 | 749 452 | 262 463 | 0.69 |
| Storage | 1 | 775 194 | 271 318 | 0.72 |
| Miscellaneous | 8 | 12 313 983 | 4 309 894 | 11.38 |
| **Total** | **76** | **108 161 136** | **37 858 906** | **100.0** |

## Publication of 1987 call for tenders – energy demonstration programme

The latest invitation for the submission of proposals for projects to be supported under the Energy Demonstration Programme has now been published in the *Official Journal of the European Communities,* 311 of 5 December 1986. The closing date for the receipt of proposals is 29 April 1987. Project proposals may be accepted in the following fields: — energy saving (industry, including agro-food; buildings; transport; energy industry), solar energy, biomass and energy from waste, geothermal energy, hydroelectric power, wind energy, use of electrical energy and heat, use of solid fuels and the liquefaction and gasification of solid fuels. Proposals will be subject to a selection procedure to ensure the optimum allocation of the Commission's available budget.

The procedure for the introduction of a proposal is described in a document entitled 'Demonstration Energy 1987: information note and submission procedure', which prospective proposers should obtain as soon as possible by writing to the Directorate-General for Energy, Commission of the European Communities, rue de la Loi 200, B — 1049 Brussels (Telex 21877 COMEUR-B, telecopier 02 235 0150).

## Seminar on third party financing in Europe – Luxembourg, 8 and 9 October 1987

Third party financing, i.e. the funding of energy saving investments by an outside company using the energy savings themselves to pay for that investment, has proved successful in accelerating the application of energy efficiency technologies in North America. The Commission of the European Communities has recently carried out a study on the application of this novel financing technique in Europe. A consultant is currently putting the finishing touches to a model contract suitable for use in the European context.

In order to give those in Europe a greater understanding of the concept of third party finance, the Commission will hold a seminar on the subject in Luxembourg on 8 and 9 October 1987. The participants will be addressed by experts from the United States and Canada as well as those providing and utilizing third party financing in Europe. On 9 October the Seminar will be divided into two workshops. One workshop will consider the application of the model contract to energy financing in the public sector (e.g. schools, hospitals, local authorities, etc.). The second workshop will deal exclusively with the application of the model contract to the private sector.

Further details can be obtained from the Directorate-General for Energy, Commission of the European Communities, rue de la Loi 200, B — 1049 Brussels (Tel. 02 236 0023 or 02 235 5600).

## Forthcoming conference on recent developments in energy saving in industry, Berlin, 19 and 20 October 1987

As part of the City of Berlin's 750th birthday celebrations the Commission of the European Communities is organizing a two-day conference on 19 and 20 October 1987 on recent developments on energy saving in industry.

The Commission is particularly keen to promote economic energy saving techniques in this sector, both as a method of reducing energy consumption and as a means of improving the competitivity of Europe's industry. To this end the Commission is hosting a conference with senior level speakers from industry, energy advisory bodies, public sector bodies including the Commission and research institutes. Topics will include new concepts for improving energy efficiency in industry and an overview of the Commission's activities on energy saving.

The accent will be on what economic benefits can be achieved and how to go about applying the techniques described. Case studies will be used in which independent industrial users will relate their own experiences. The conference should be of interest to senior management in industry responsible for achieving energy cost savings and those advising them, as well as other research or consultancy workers in these areas.

Details on the conference and application procedures will be announced in the next few months. Other queries may be addressed to the Directorate-General for Energy, rue de la Loi 200, Brussels, B — 1049 Belgium. (Tel. (02) 235 9786).

1 COM(86) 327 of 12 June 1986.

# Technology focus

## The Community's demonstration projects programme in wind energy

The demonstration projects programme of the European Community in the field of energy and alternative energy sources was started in 1978 and in 1983 it was extended to wind energy. **This article surveys the Community's wind energy projects.**

Since 1983, the Commission has received 275 proposals from which 98 wind projects have been selected. 26 MECU has been attributed by the Commission for the support of wind projects representing a total investment cost of more than 65 MECU. **In almost all of the selected projects, the financial aid granted by the European Communities applies to the design, construction and demonstration phases.**

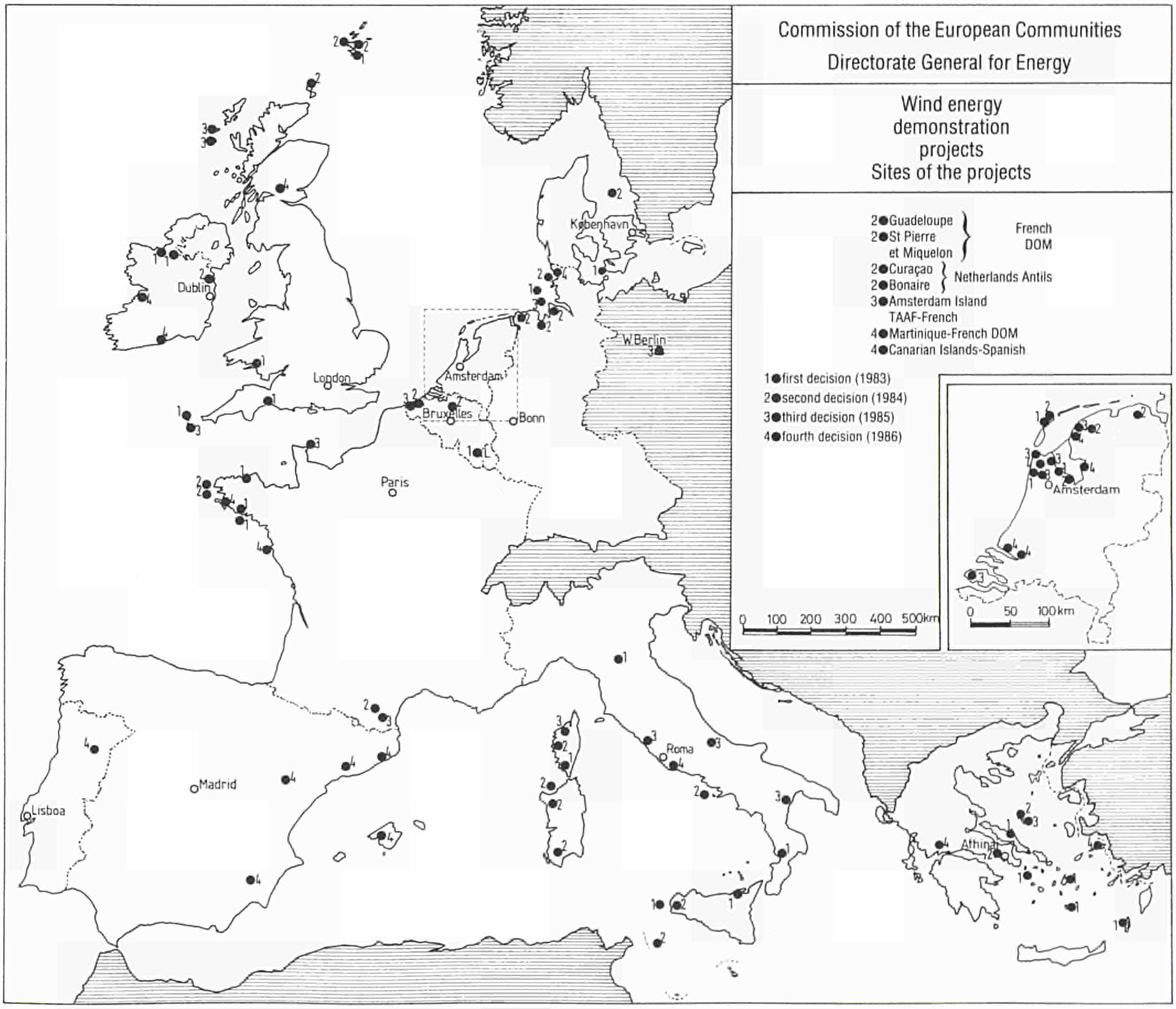


Table 1
Synoptic view of demonstration projects selected in 1983, 1984 and 1985

| System | | Applications | Grid connected | Autonomous | Diesel-based grid | Diesel auxiliary | Battery storage | Water pumping | Water desalination | Space heating | Hot water | Heating of greenhouses | Refrigeration | Irrigation | Various combinations | Total number of projects |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wind Farm | On land | | ● | | | | | | | | | | | | | 1 |
| | On shore | | ● | | | | | | | | | | | | | 1 |
| Large unit | (1 MW) | | ● | | ● | | | | | | | | | | | 6 |
| Medium | Large unit (350-999 KW) | | ● | | ● | | | | | | | | | | | 4 |
| | Small unit (100-349 KW) | | ● | ● | ● | ● | | ● | | | | ● | ● | ● | ● | 31 |
| Small unit | (10-99 KW) | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | | ● | ● | 45 |
| Mini-unit | ( 10 KW) | | | ● | | ● | ● | ● | | ● | ● | | | | ● | 17 |
| Total number of projects | | | 34 | 9 | 11 | 9 | 6 | 7 | 1 | 5 | 2 | 3 | 2 | 2 | 14 | |

**This latter phase comprises a measuring programme which makes it possible to establish the characteristics of the installation and to compare it with initial expectations in terms of energy produced, economic viability, maintenance costs and technical problems.**

**At present, contracts for 73 projects have been signed, varying by type and size (see table). As can be seen on the map, nearly all the projects are located near the coasts and on islands where the highest wind speeds occur.**

## Other actions

In order to stimulate the development of wind energy in the Community, the Commission's Directorate-General for Energy has been involved in other initiatives as well as the demonstration programme to promote wind energy.

For example:

— undertaking a critical and comparative study of the legislation concerning the use of wind energy within the European Communities. A first report was prepared and published in 1985 and is being updated;

— launching a market study of small and medium-sized wind turbines. A final report is expected soon;

— increasing collaboration between the national test stations for windmills. The Commission is supporting and stimulating this cooperation by funding four studies on:

- power curve computation and accurary of power curve measurements
- administrative procedures for licensing of WECSs
- development of practical standards for the measurement of acoustic noise emission for wind turbines
- safety requirements for small and medium-sized wind turbines

— preparing a reference book on wind energy in Europe to which all European manufacturers are invited to contribute;

— disseminating information on the Community's wind energy demonstration projects through the Sesame data base (see *Energy in Europe No 4).*

## Main technological characteristics of the wind projects and first results

The distribution of the projects indicates that the production of electricity is the main application. Projects aiming for connection to the national electricity grids generally involve large or medium-sized wind turbines. But the majority of the projects are smaller scale and aim at producing electricity for island grids from medium-sized wind turbines. These projects are already considered to be economically sound, due to the high costs of fuel for electricity production at those sites. The autonomous electricity production systems are mostly small wind turbines combined with diesel engines of approximately the same power output as the wind turbines. In these cases the diesel engine guarantees power supply, whilst the wind turbine serves to reduce the overall fuel consumption. Special mention should be made of the remaining projects for heating, water pumping, desalination, etc. There are also a number of projects involving hydro schemes, to cope with the intermittency of the wind. Below are some examples of successful wind energy projects:

— The Wind Energy Group (United Kingdom) has constructed a three-bladed, 25m diameter, 200 kW wind turbine, which is installed at Ilfracome (United Kingdom) and connected to the local grid. It is the first completed project (see *Energy in Europe No 5).*

— The NEWECS-45 wind turbine is a 1 MW machine with a diameter of 45m and a 60m-high tower, manufactured by STORK-FDO (Netherlands). It has been installed by the electricity company PEN, at Medemblik (Netherlands) and it is very successfully operational since last December. The estimated annual yield is 1.7 GWh, but it is expected to exceed 2 GWh. The demonstration phase is still ongoing.

— A windfarm comprising five identical 750 kW wind turbines, constructed by DWT (Denmark), in Masnedo, is at the final construction phase. The first machine is supported by the Commission and has been successfully put into operation last May. It is a 40m diameter machine with three variable pitch FRP blades. The estimated annual yield is 1.5 GWh. The demonstration phase is still ongoing.

— An 18.5 kW, 11m diameter wind turbine made by the Scandinavian Wind Energy Systems, de Odder (Denmark), is used at An Foras Talúntais (Ireland) for electricity generation in conjunction with a heat pump for heating purposes of a 600m² greenhouse with a 150 kW peak demand. Estimated annual yields is 365 MWh by the wind turbine and 52.5 MWh by the heat pump. The demonstration phase is still ongoing.

— A two-bladed 20 kW 8.6m diameter, downwind wind turbine, made by Aeritalia (Italy), operates in parallel with two diesel units of 20 kW each and a battery storage at a small factory in Calabria (Italy). The estimated annual energy production is 17 MWh and will be used for conservation of polyester, water pumping, lighting and space heating thereby facilitating the polymerization of polyester. The project is at an advanced stage.

## The cost of wind energy projects

In order to assess the economics of the projects, three phases have been analysed:

— **the design phase**: this includes the costs of the design and the engineering of the wind turbine installation as well as those of the side-measurements.

— **the construction phase**: this includes the construction, the assembly, the erection and the transportation of the wind turbine to the site. The cost of the foundation, the tower and the commissioning are also included.

— **the demonstration phase**: this includes the costs of the equipment, the operation, the evaluation and the reports.

The cost of each phase is expressed as a percentage of the total cost of the project. All calculations have been carried out in current prices.

Future wind energy applications should show a reduction in comparison to the demonstration project-cost between 20% and 34% because future design and demonstration

**Table 2: Percentage of the cost of each phase by the size of the machine**

| System Size (Power in kW) | | Projects | Design % | Construction % | Demonstration % |
|---|---|---|---|---|---|
| I | P 10 | 7 | 9 | 70 | 21 |
| II | 10 P 100 | 24 | 12 | 66 | 22 |
| III | 100 P 350 | 17 | 17 | 70 | 13 |
| IV | P 350 | 8 | 10 | 80 | 10 |
| Total | | 56 | 12 | 71 | 17 |

costs should be discounted. A potential further 30% cost reduction due to mass production is not included in these figures. Summarizing, the realized cost of the wind turbines should not, in general, exceed 35% of the cost of the demonstration project.

## Economic perspectives of wind energy

### Investment cost

There is considerable uncertainity at present concerning the economics and particularly as to the effect of size on cost of the wind turbines. Dr P. Musgrove considered, in his report,[1] the cost per unit rotor area versus the diameter and then he suggested correcting these figures according to the tower height by using the expression:

$$C_{10} = \frac{\text{cost}}{\text{area}}\,(10/Ht)\,3/7$$

where Ht is the tower height in metres and $C_{10}$ can be interpreted as the equivalent cost, per rotor area, relative to the wind speed experienced at a height of 10 metres using the fact that the velocity variation with height is given by the typical one-seventh power law. In applying this formula to demonstration projects figures show considerable scatter despite the clear trend towards increasing cost per unit area, with increasing diameter and despite the beneficial effects for large machines due to their hub height. A new measure of standardized cost expressed per unit installed power and per square metre of swept rotor area has been suggested, i.e. $C_E/P/A$, where $C_{Er}1$ denotes the cost expressed in ECU, P is the installed power in kW and A is the rotor swept area in m². It is then possible to see the difference of the specific cost for machines with the same diameter but different installed powers.

This parameter can be interpreted as the equivalent cost of a device with one KW installed power and 1m² rotor area placed on a 10m high tower. It has the advantage that it can show any difference in the cost for two identical wind turbines placed on different tower-heights. Interestingly the points are less scattered, implying:

— the cost per kW and per m² is decreasing with the increasing size of machine, and
— very small wind turbines show very high values, but the large ones much lower ones.

### Energy costs of wind energy

The cost per kWh produced by the wind turbines has also been calculated for the demonstration projects, assuming:

— that the availability corresponds to approximately 2 500 hours of yearly operation and that of the wind turbine 80%,
— the operation cost is considered to be 5% for up to 100 kW machines, 3.5% for the 100 kW ones and 2% for the larger machines, and
— that the annuity has been estimated on the basis of 5% for a 20-year lifetime.

The cost per kWh produced by the wind turbines has been compared, as an indication, with the consumer figures given by Unipede for a consumer with an installed power of about 9 kW (reference consumer $E_1$). [2]

### Conclusions

— very few wind turbines are at present competitive for all Member States of the European Community,
— the competitiveness of wind energy is strongly dependent on local electricity prices;
— if manufacturers could mass produce wind turbines, the cost of the electricity produced would be significantly lower and wind energy could be competitive in many more cases.

Wind energy remains the most promising of the alternative sources of energy. The time at which wind energy will become competitive with other energy sources is not far off, provided it continues to be supported.

## Enhanced oil recovery: application to heavy oil deposits

The recovery factor for the oil in place in a deposit is a very important factor where oil production is concerned. Despite technological progress, the values achieved by conventional recovery methods using the natural energy of the deposit (primary recovery) and water injection (improved recovery) are, on average, in the vicinity of 30% for the fields exploited as a whole.

The purpose of enhanced-recovery methods is to provide the deposit with a quantity of additional energy to make up for the exhaustion of its own energy in order to improve the rate of extraction of the oil in place.

Under the programme of support for Community projects in the oil and gas sector, [3]the Commission has supported 57 projects designed to develop enhanced-recovery techniques and to apply some of them on an industrial scale. The great majority of these projects are concerned with thermal, chemical and gas injection methods.

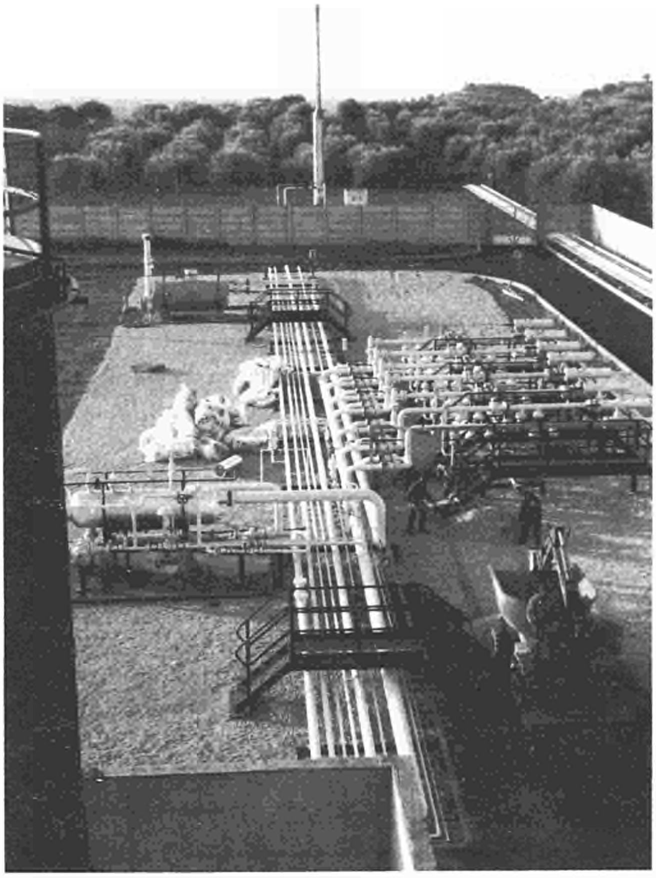
### The 'Ponte Dirillo' project

AGIP S.p.A. discovered the Ponte Dirillo field in the south-east of Sicily in Italy in November 1958. This deposit produces a very heavy oil, cumulative production of which by the end of 1984 was 1.38 million cubic metres with a recovery rate in the vicinity of 15%. Very close to the Gela deposit and with similar reservoir and oil characteristics, the Ponte Dirillo deposit was suitable for testing a process involving the injection of $C0_2$-enriched non-miscible gas capable of being used for the Gela deposit later.

After a feasibility study concerning the Gela field (contract TH. 16/74), AGIP S.p.A. received Community support for a pilot injection project concerning the Ponte Dirillo deposit, in order to verify the validity of the method (contract TH. 05.14/79).

### The technology developed

The Ponte Dirillo deposit produces a heavy oil — 10 to 15 degrees API — from two heavily-fractured carbonated resevoirs. Laboratory studies and well-logging of certain reservoir areas have made it possible to determine a recovery method involving injection of a non-miscible $CO_2$-enriched gas at the top of the deposit in order to replace



**Ponte Dirillo oil production station**

the natural thrust of the bottom water. In addition, gas injection at the water-oil contact level can reduce well problems caused by the water level rising. The fluid injected was a mixture of $CO_2$-enriched gas produced by the Gela field and natural gas from the regional grid.

### Results of the project

To carry out the project it was necessary to build gas-injection equipment for the wells selected, facilities to separate the oil produced and equipment linking up with the Gela field's production centre.

Several types of tests were carried out in project TH. 05.14/79:

- Injection of a large volume of high-pressure gas in a peripheral well at the oil-water contact level. The results were good, with an increase in daily production from 120 cubic metres in March 1984 to 1809 cubic metres in June 1984. This type of injection has proved to be an effective way of combating a rise in the water level.
- Gas injection in a central well with cycles consisting of injection followed, after a rest period, by bringing-into-production ('huff-n-puff'-method). The results were disappointing because of problems resulting from the vertical migration of the gas and too short a residence time in the vicinity of the well.
- Gas injection at the top of the deposit ensured a better rate of recovery of the oil in place without increasing water production (260 cubic metres a day in December 1985).

The work carried out by AGIP S.p.A. with Community support has made it possible to achieve significant results in terms of the production at the Ponte Dirillo field. The project has increased production of oil from a field situated in the territory of one of the Member States and has demonstrated the effectiveness of a method intended to improve the rate of recovery from heavy-oil deposits. These beneficial results will mean that the marketing clause provided for in the programme will be applied.

Further information can be obtained from AGIP S.p.A., C.P. 12069, I — Milan.

## Workshop on utilization of a high temperature water dominated geothermal reservoir (Rome-Latera, Italy – 13 and 14 October 1986)

The workshop was organized in cooperation with the project contractor, the National Electric Energy Board (ENEL) who are acting as operator of the joint venture ENEL-AGIP. Over 60 participants, coming from most Community Member States, attended.

The Latera geothermal field lies near the Bolsena Lake in the Monte Volsini volcanic area, 150 km north of Rome. Geothermal research began here in the 1970s and regional prospecting followed by additional studies led to the siting of exploratory wells, which demonstrated the existence of a geothermal reservoir of the water dominated type. The calcium carbonate in the brine initially gave scaling problems and this led to the use of scaling inhibitors which proved their effectiveness in the course of subsequent tests.

A single flash geothermal plant with an atmosphere discharge turbine rated at 4 MW has been producing electricity since September 1985.

**The objective of the workshop was to ensure that as many specialists as possible in the Community were informed about the development of this geothermal high enthalpy reservoir and to exchange information on water dominated reservoir exploitation.**

The fluid energy content in the Latera geothermal field is lower than that in steam dominated fields, and reaches about 400 t/h at 200°C; hence higher flow rates are necessary to obtain the same power output. Higher production rates imply larger reinjection plants and associated flow rates to maintain constant heat output.

Such water dominated reservoirs generally show scaling problems related to $CaCo_3$ deposition when the temperature is below 250°C, and this problem was aggravated by the incondensable gas content. However, scaling phenomena noted on casing, pipes and separators were eliminated by working at low pressure (12 Bars), reinjecting at atmospheric pressure and using organo-phosphoric scale inhibitors on the production line.

In the light of these encouraging results a total generating capacity of 45 MW is scheduled to be installed in Latera in the medium term. The existing power plant has a potential of an annual energy saving of about 6 500 toe, while upon completion of the first two new 15 MW units, a considerable quantity of water at 100°C will be available for use, after electricity generation, giving further important energy saving potential. A satisfactory pay back period is envisaged for the investment outlays for the production and reinjection wells and plant, totalling, at this stage, to an amount of LIT 5 900 M (out of which, the Community share is a LIT 1 400 M support for the wells Latera 3 and 3D and for the demonstration power plant).

Many geothermal projects in Europe and elsewhere operate in a difficult physical-chemical environment and consequently this successful experience might be of interest for the exploitation of other water dominated geothermal fields in the Community. The workshop proved to be very useful, both in interesting potential users of this type of reservoir but also in favouring a good exchange of information on scaling problems and on the choice of the appropriate type of power plant.

The Latera project appears under reference numbers GE-29/80 and GE-116/83 and information is contained in the Sesame data base. Further information may be obtained from the Commission (where the corresponding flag brochure No 26, in English, is available free of charge) and from ENEL itself.

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1 Dr P. Musgrove 'Wind Energy Evaluation for the European Communities', Commission of the European Communities, EUR 8996 (EN), 1984.
2 Unipede.
3 Regulations 3056/73 of 9 November 1973 and 3639/85 of 27 December 1985.

# Document update

## Main Commission energy documents, proposals, directives, etc. in 1986

**Energy saving**

COM/86/0393 Communication from the Commission to the Council — Rational use of energy in road, rail and inland waterway transport

COM/86/1398 Commission Decision of 28 July 1986 on the granting of financial support to technological development projects in the hydrocarbons sector

COM/86/1634 Commission Decision of 9 September 1986 on the granting of financial support for demonstration projects in the field of substitution of hydrocarbons by solid fuels

COM/86/1636 Commission Decision of 10 September 1986 on the granting of financial support for pilot industrial and demonstration projects in the field of liquefaction and gasification of solid fuels

COM/86/2033 Commission Decision of 7 November 1986 on the granting of financial support for demonstration projects in the field of wind energy

COM/86/2034 Commission Decision of 7 November 1986 on the granting of financial support for demonstration projects in the field of geothermal energy

COM/86/2035 Commission Decision of 7 November 1986 on the granting of financial support for demonstration projects in the field of the use of electricity and heat for the substitution of hydrocarbons

COM/86/2036 Commission Decision of 7 November 1986 on the granting of financial support for demonstration projects in the field of hydroelectric energy

COM/86/2037 Commission Decision of 7 November 1986 on the granting of financial support for demonstration projects in the field of solar enegy

COM/86/2049 Commission Decision of 11 November 1986 on the granting of financial support for demonstration projects in the field of energy saving

**Solid fuels**

COM/86/0869 Draft Commission Decision (ECSC) implementing decision on the Community rules for aids to the coal industry

SEC/86/1015 Memorandum on the financial aid granted by the United Kingdom to coal industry in 1985

COM/86/0319 Amendment to the proposal for a Council decision concerning contributions to the European Coal and Steel Community from the general budget of the European Communities to finance measures connected with the restructuring of the coal and steel industries

**Gas**

COM/86/518 Communication by the Commission to the Council - Natural gas

**Nuclear**

SEC/86/655 Communication by the Commission to the Council - Negotiation of a safeguards agreement between Spain, Euratom and the IAEA
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