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REVIEW OF MEMBER STATES' ENERGY POLICIES

(Communication from the Commission to the Council)

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C O N T E N T S

REVIEW OF MEMBER STATES' ENERGY POLICIES

INTRODUCTION

1. In its Resolution of 9 June 1980 on the Community's energy objectives for 1990 the Council requested the Commission to submit an annual report on Member States' programmes and to make recommendations and proposals with a view to increasing consistency between Member States' policies, bearing in mind five main guidelines for the Community as a whole, viz:

(i) to reduce to 0.7 or less the average ratio between the rate of growth in gross primary energy demand and the rate of growth of gross domestic product;

(ii) to reduce oil consumption to a level of about 40% of gross primary energy consumption;

(iii) to cover 70-75% of primary energy requirements for electricity production by means of solid fuels and nuclear energy;

(iv) to encourage the use of renewable energy sources so as to increase their contribution to the Community's energy supplies;

(v) the pursuit of energy pricing policies geared to attaining Community energy objectives.

The Council (Energy) in its report on energy policy of 4 November 1983 underlined the importance of this monitoring exercise.

2. The Commission published its last full review in June 1982[1], when it also made a number of suggestions for improving the monitoring process. Since then the Commission has submitted to the Council an examination of the main trends in each Member State in relation to the Community guidelines, together with their more recent projections to 1990[2].

3. The report that follows updates those projections and comments on their sensitivity to some key variables (notably GDP growth and oil prices). The bulk of the report, however, is devoted to a survey of the progress of each Member State in reducing dependence on imported oil through fuel-switching and improved efficiency of energy use. It discusses the main emphasis of policy in each country and the key policy issues for the coming years, concentrating on those points which are most relevant in a Community context.

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[1] COM(82)326 final

[2] COM(83)305 final

The report draws particular attention to areas where there are inadequacies in the existing programmes, where difficulties are arising in implementation or where important policy decisions are required in the near future. It also highlights successes and experiences in individual Member States which are of relevance to others.

4. The surveys of Member States' programmes do not deal **systematically** or **in detail** with a number of issues on which separate full reports have been or will shortly be made to the Council. The most important are:

- Member States' energy savings programmes (a report has been recently communicated to the Council (COM(84)36);
- pricing policy (report scheduled for the first half of 1984);
- natural gas supply and demand to 2000 (report to issue shortly);
- oil stocks policy (first half 1984);
- the situation of the oil refining industry in the Community
- combined heat and power/district heating (mid-1984).

But given the importance of pricing policy and energy savings programmes in particular to the success of energy policy as a whole, this report offers an assessment of **overall** progress in both the latter areas.

5. The report is in two parts.

Part One concentrates on the **trends and outlook at Community level,** drawing attention to the variations among Member States and to some major cross-country or sectoral issues.

Part Two consists of more detailed reports on **energy trends, outlook and key policy issues in each Member State.**

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PART ONE - THE COMMUNITY POSITION - OVERALL REVIEW

I. ENERGY TRENDS

6. **For the fourth successive year energy demand has fallen** in the Community. Inland primary energy demand (1983) is now 11% below its 1979 figure and 6% below the 1973 figure. **For the fourth successive year indigenous energy production in the Community has increased. Net energy imports have therefore fallen** even more quickly than energy demand (down to less than 42% of gross primary energy demand compared with 55% in 1979 and 64% in 1973).

7. The largest falls in demand have been registered in the oil sector (inland demand for oil is down by nearly 24% compared with the 1979 figure). Over the same period there has also been an important increase in indigenous oil supply of over 41 mtoe or 46%, essentially from the North Sea, which has helped to reduce net oil imports to **59%** of their 1979 level.

8. The other main features of the changing **primary** energy balance at Community level are:

- a decline in **solid fuel use** as a whole since 1979 (principally as a result of the contraction of output in the steel industry) but stabilisation in solid fuel use in power stations. Overall solid fuel use is now around 7% below its 1973 level;

- a doubling in the contribution of **nuclear power** since 1979 and a quadrupling since 1973, nuclear now accounting for the equivalent of 9% of total primary energy demand (78 mtoe) and for 27% of the inputs to electricity supply. The result has been a marked divergence in the **growth rates** of nuclear and solid fuels as substitutes for hydrocarbons in electricity generation.

- a decline in the use of **natural gas** since 1979, reversing the high rates of growth of gas demand throughout the 1970s. The fall in gas use was particularly marked in 1982 and since then there has been a limited recovery. But gas demand is still 6% below its 1979 level;

9. The results are set out more fully in Tables 1 - 2 (pages 39 and 40) and summarised on page 7 below. The key points are:

Oil use as a percentage of primary energy demand is estimated to be down to around 48% in 1983, compared with 56% in 1979 and 62% in 1973.

The share of **solid fuels and nuclear** as inputs to electricity generation is up to around 74%, compared with 61% in 1979 and less than 54% in 1973. Moreover the share of solid fuels, nuclear and **hydro** and other minor sources together has risen to 79%, while that of oil and **natural** gas has fallen to 21%, compared to 42% in 1979.

MAIN INDICATORS OF STRUCTURAL CHANGE - EUROPEAN COMMUNITY

Mtoe

	1973	1979	1982	1983 (estimated)
ENERGY DEMAND				
Gross primary energy demand	968	1012	908	896,5
Gross oil consumption	601	563	455	432
Gross oil consumption as % of primary energy consumption	**62,1%**	**55,7%**	**50,1%**	**48,2%**
ENERGY SUPPLY				
Indigenous production (total)	351	458	494	516
Oil	13	89	118	130
Solid fuels	197	180	182	174
Natural gas	112	137	116	119
Nuclear	18	37	64	78
Hydro and other	10	13,5	13,5	14
Net imports (total)	620	559	418	373
Net oil imports	**596**	**487**	**326**	**287**
INPUTS TO ELECTRICITY PRODUCTION (total)	253	278	280	283
Solid fuels	108	132	136	132
Nuclear	18	37	64	78
Hydro and others	10	13,5	13,5	14
Solid fuels and nuclear as % of total	**54**	**61**	**71,5**	**74**
ENERGY RATIO[3]	100	91	81	79
INTENSITY OF[4] FINAL ENERGY DEMAND	100	91	79	n.a.

Sources: 1973-1982: Statistical Office of the European Communities
1983 - Estimates by Commission services

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[3] Volume of inland energy consumption per unit of GDP (kg oe per ECU, 1973=100)

[4] Volume of final energy consumption per unit of GDP (kg oe per ECU, 1973=100)

10. During the last ten years too there have also been major improvements in the **energy ratio**[5] and in the level of the **intensity of final energy demand**[6] (Table 3). Final energy use per unit of GDP fell by over 20% between 1973-82. Energy consumption per capita fell from 3.66 mtoe in 1979 to 3.20 in 1982. A study by the Commission services of the reasons for changes in final energy use in the periods 1973-79 and 1979-81 in 7 of the Community countries[7] suggests, moreover, that a large part of the changes can be ascribed to **genuine increases in energy efficiency** rather than simply to changes in the level of economic activity and in economic and industrial structures.

11. Information on recent **energy price trends** is to be found in the Commission's Quarterly Bulletin of Energy Prices. The most significant developments (outlined in Figures 1 and 2, pp 10 and 11) are as follows:

(i) since 1979 there has been a sharp divergence in the trends in prices for **oil**, on the one hand, and **coal** on the other. The price which the Community has to pay in national currencies for its crude oil imports is now 3 times as high as in January 1979 in nominal terms and twice as high in real terms, despite a fall of 25% in the average dollar price of imported crude from the peak in early 1981. The price of key oil products (pre- and post-tax) has continued to increase in nominal ECU terms since 1980. On average the nominal 1983 prices of residual fuel oil and gas oil (ex-VAT) and heating oil (tax paid) were over 2.5 times those of 1979. **Steam coal prices, on the other hand, increased by only 1.5 times.** The price advantage of steam coal over competing oil products widened significantly during 1983;

(ii) the real prices of the main oil products in the four largest Community Member States are now generally higher than in January 1980 although somewhat below their peaks of 1981.

(iii) **natural gas** prices have risen sharply since 1981 in many Community countries. The available figures point to a marked change in the price competitivity of natural gas versus oil products in a number of Member States. In France, Belgium and the Netherlands the price of natural gas to small- and medium-sized industrial consumers increased by over 25% in 1982 alone at a time when the rise in the cost of competing oil products had slowed down to 5-10%. The same trend is understood to have occurred in Germany. During much of 1983 too, the price of natural gas continued to rise more quickly than that of oil products in all countries for which comparable figures exist, and notably Italy. One important factor appears to be the mechanisms in gas pricing contracts linking gas prices, **with lags,** to crude oil and oil product prices;

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[5] Ratio between inland primary energy demand and GDP.

[6] Ratio between final energy demand and GDP. Final energy demand as defined here equals primary energy demand less consumption by the energy sector itself (transformation and distribution losses, own consumption by the energy industries) and excluding use of energy as a raw material or feedstock.

[7] European Economy, N° 16 July 1983

(iv) ever since 1973 there has been a marked divergence between trends in **electricity prices**, on the one hand, and those for oil and gas on the other. In the last three years industrial electricity prices have continued to rise much more slowly than prices of competing oil products.

The effects of these absolute and relative price changes on the level and pattern of energy demand in the past 3-4 years have been significant, underlining the importance of energy pricing to both **operating decisions** (fuel-saving and fuel-switching with existing plant) and **energy investment decisions** (the introduction of new or replacement plant which is more fuel-efficient and/or involves substitution of oil for other products).

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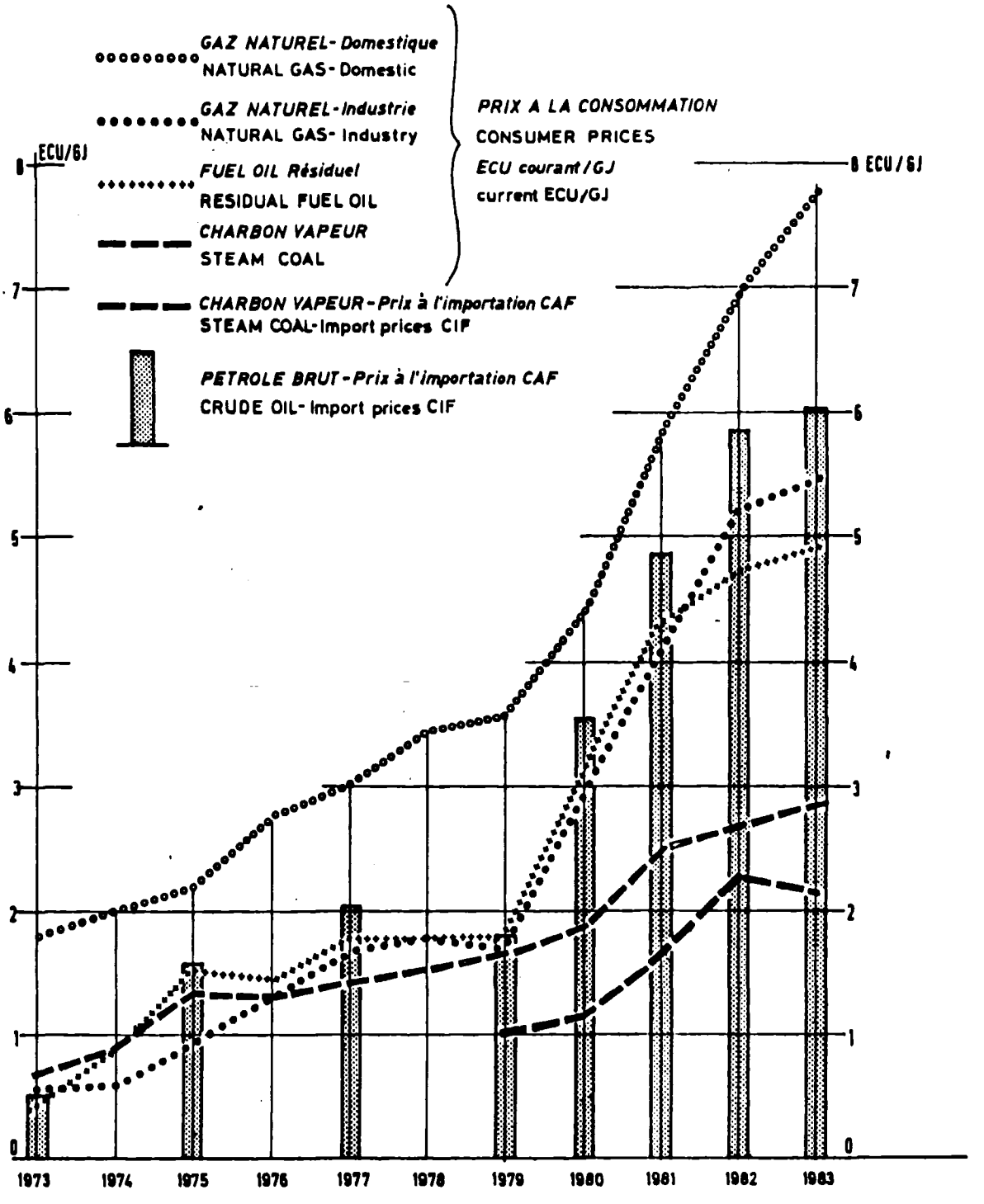
Fig. 1

EUR-10 : Energy Prices - *Prix de l'énergie*



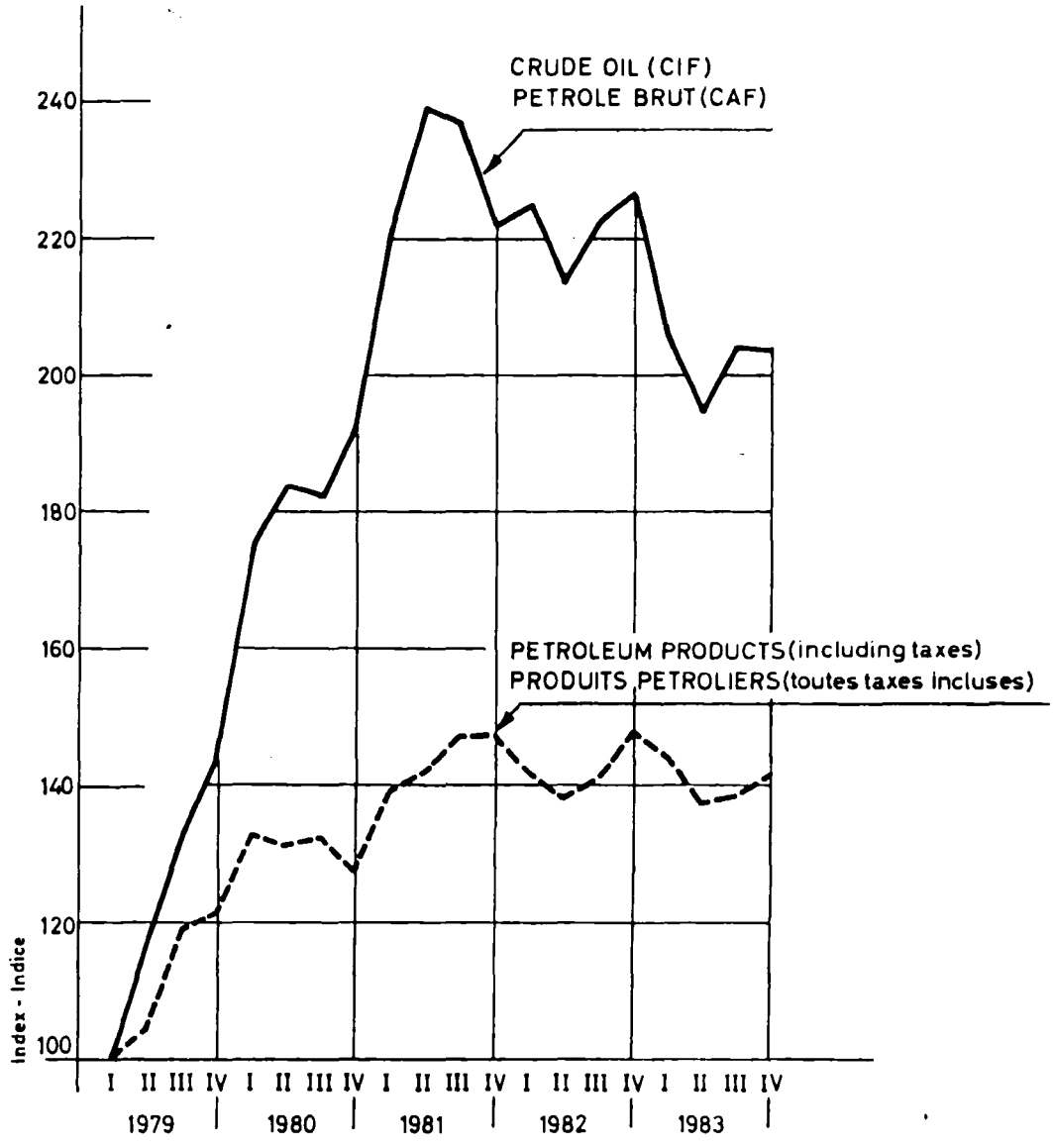
source: Bulletin of Energy Prices (n°2)

Fig.2

Real Oil Price Indices*
Indices des prix réels du pétrole*

* Calcuted as follow: The weighted sum of consumer oil prices or crude oil imports prices in current ECU for 4 member States (F, D, I, U.K.) is deflated by the weighted sum of the ECU deflators for the same 4 member States
NB: Weights are based on the 1982 structure of consumption / imports

Calculés comme suit: la somme pondérée des prix au consommateur ou des prix du brut importé en ECU courants pour 4 pays membres (F, D, I, U.K.) est déflatée par la somme pondérée des déflateurs de l'ECU des mêmes pays.
N.B.: La structure de la consommation ou des importations 1982 est le pondérateur



II. THE OUTLOOK TO 1990

12. During the past few months the Commission has received from every Member State revised projections of energy supply and demand in 1990. These are aggregated in Tables 1-3. It is interesting to compare these aggregate projections with those made for successive review exercises:

PROJECTED COMMUNITY ENERGY SUPPLY AND DEMAND 1990
Mtoe

	1981 REVIEW* (COM(81)64 final)	**1982 REVIEW** (COM(82)326 final)	**1983 STRATEGY PAPER** (COM(83)305 final)	**LATEST PROJECTIONS***
Gross primary energy demand				
total	1237	1165	1099	1061
oil demand (inc bunkers)	528	493	466	459
gas demand	237	211	202	194
solid fuels	284	288	270	245
Production				
oil	103	106	104	106
gas	118	110	109	114
solid fuels	193	199	188	178
Electricity generation (inputs)				
total	428	398	369	364
solid fuels	165	172	163	150
nuclear	160	146	132	144
oil	60	43	36	35
gas	29	23	19	19
Net oil imports	460	388	362	354
Net energy imports	671	578	538	496
Share of oil in gross primary energy consumption	43%	42%	42%	43%
Share of solid fuels and nuclear in power station inputs	76%	80%	80%	81%

* Figures given are mid-points of ranges submited by some Member States.
Sources: Submissions by Member States.

Many of the latest forecasts are still based on detailed reviews carried out in **1981** in the aftermath of the second "oil shock" but **before** the dramatic decline in energy demand had been registered. Although in some cases the 1981 projections (reflected in the 1982 review) have now been partially readjusted to take some account of the downward trend in demand over the past four years, **no fundamental reassessments** have been made as

yet in most countries. It can be assumed that, if they had been, there would be even more striking changes now compared with the forecasts in 1981.

But the changes are already significant:

- projections of total energy demand in 1990 are now some 14% (176 mtoe) lower than those made (in 1980) for the 1981 review exercise;

- projected oil demand is 13% lower (69 mtoe);

- projected net oil imports are down by 23% (106 mtoe) but,

- as a result of downward revisions in the projected contribution of **nuclear power** (-10%); in **solid fuel use** (-14%, essentially **outside** electricity-generation); and in **natural gas** demand (-18%), the projected share of oil in total energy demand is now, at 43%, precisely the same as projected in 1981[8].

  On all the projections since 1980, however, Member States expect the Community as a whole to achieve or even **over achieve** the main guideline for 1990 for the electricity sector.

  The projected outlook is presented in relation to the trends 1973-1982 in Figures 3-5 (pp 14-16).

13. The latest set of projections is based on GDP growth rates for the Community as a whole averaging 2.4% per annum 1985-1990 and a growth in inland energy demand of 1.6% p.a. for the same period[9]. The projections also assume in many cases constant **real** crude oil prices from a 1981/82 base[10]. On those assumptions gross inland energy demand would increase by 17% 1982-1990 or around 150 mtoe and electricity demand by around 20%.

This incremental demand would be met by:

nuclear energy	: 80 mtoe
solid fuels	: 29 mtoe
natural gas	: 36 mtoe
oil	: 0
(imported oil)	: **(+27)**
other	: 5 mtoe

14. There are signs that energy demand is now bottoming out as economic growth picks up. The rate of decline in energy and oil use in 1983 was slower than in 1981 and 1982 and there has been an upturn in electricity

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[8] It must be noted, however, that if bunkers are excluded from the calculation the projected level of dependence on oil falls to 41.5%. A similar effect was observed in the 1982 review.

[9] Again using central case assumptions for those Member States where different scenarios have been submitted.

[10] Information on assumptions about oil product prices is, however, limited.

Fig.3

EUR-10: Main Trends in the Energy Balance
Principales tendances du bilan énergétique
1973–1990

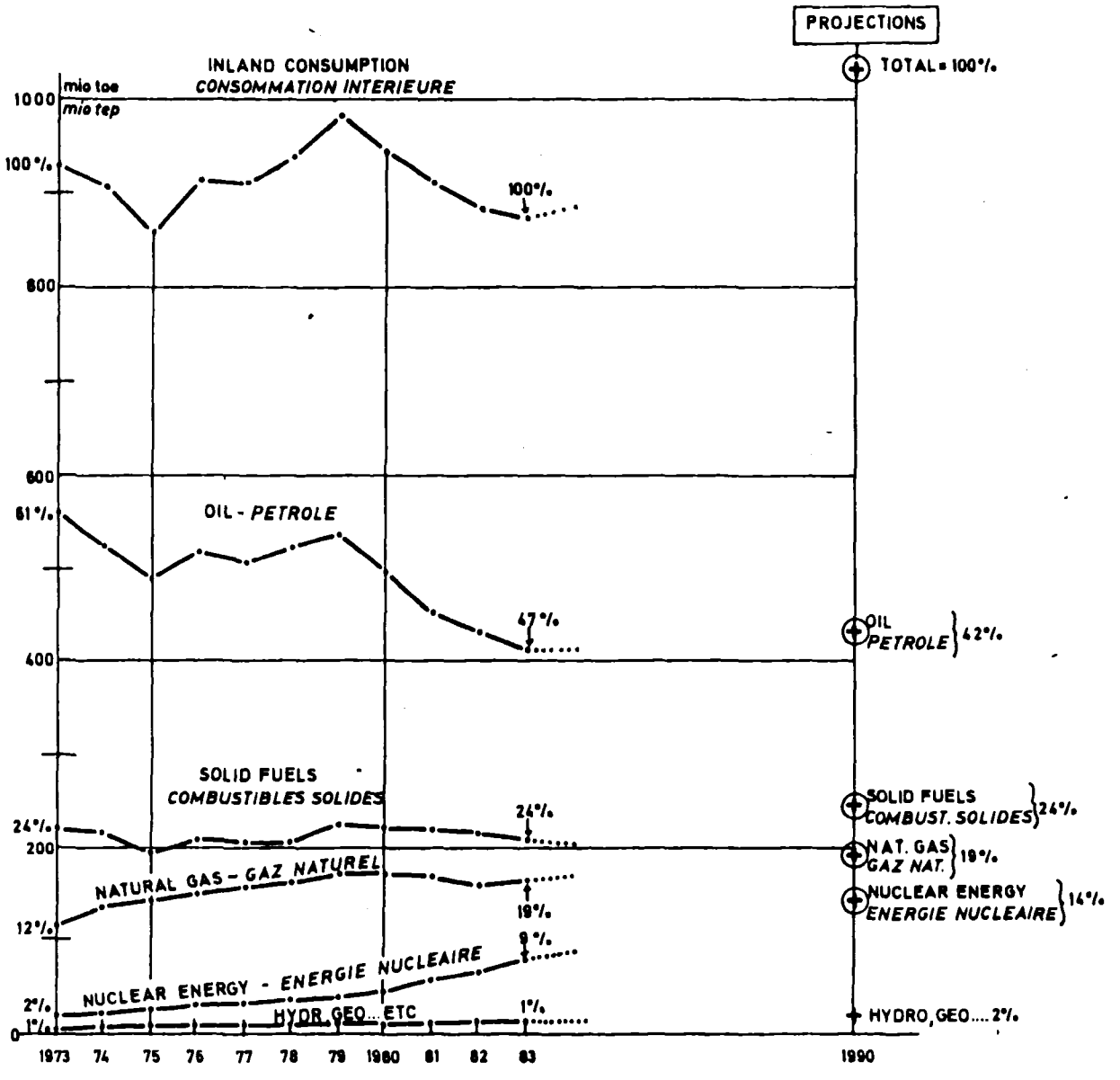

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Fig.4

EUR-10: ENERGY: Gross Consumption, Primary Production and Net Imports

Consommation brute d'énergie et approvisionnements

1973—1990

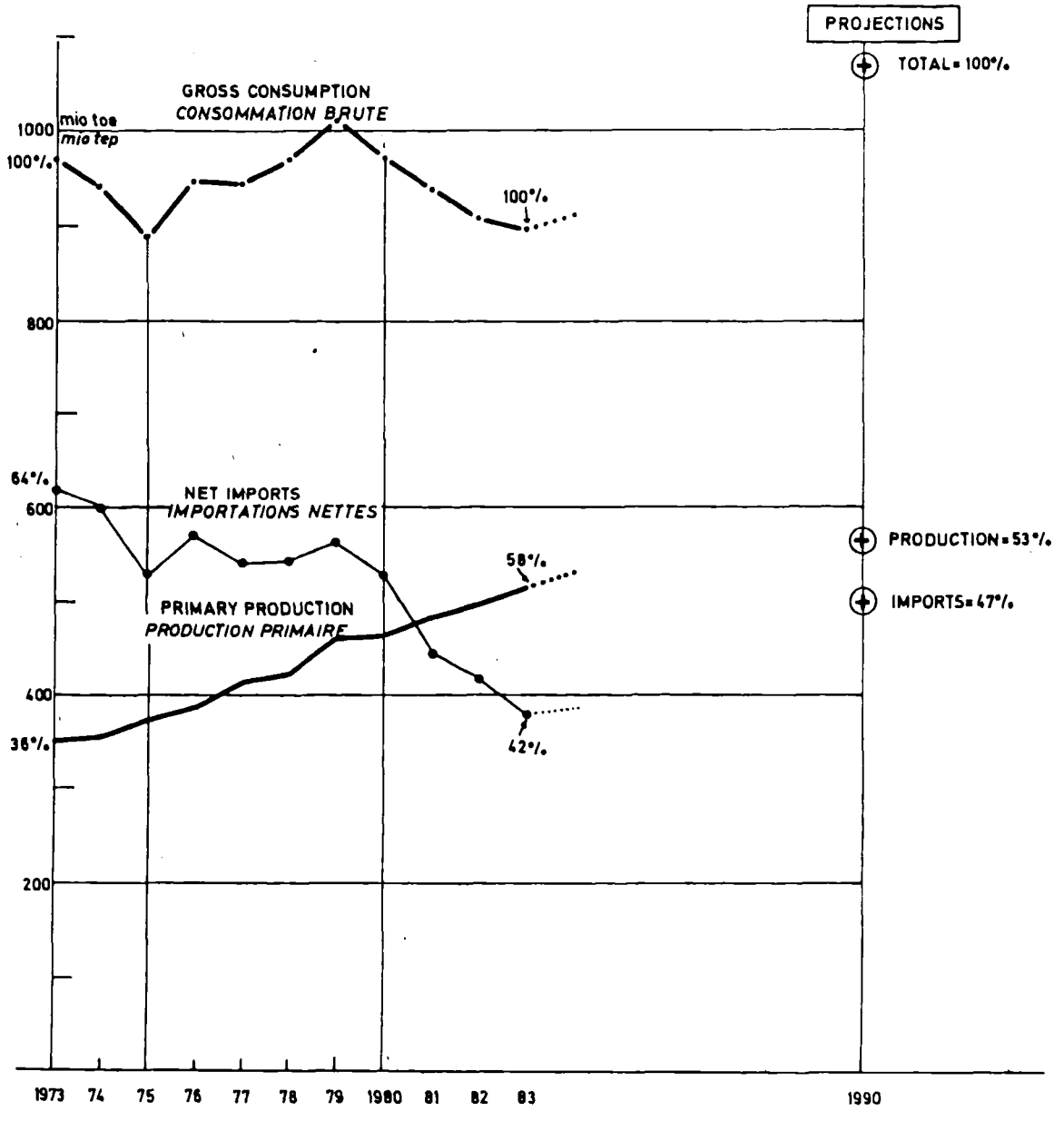

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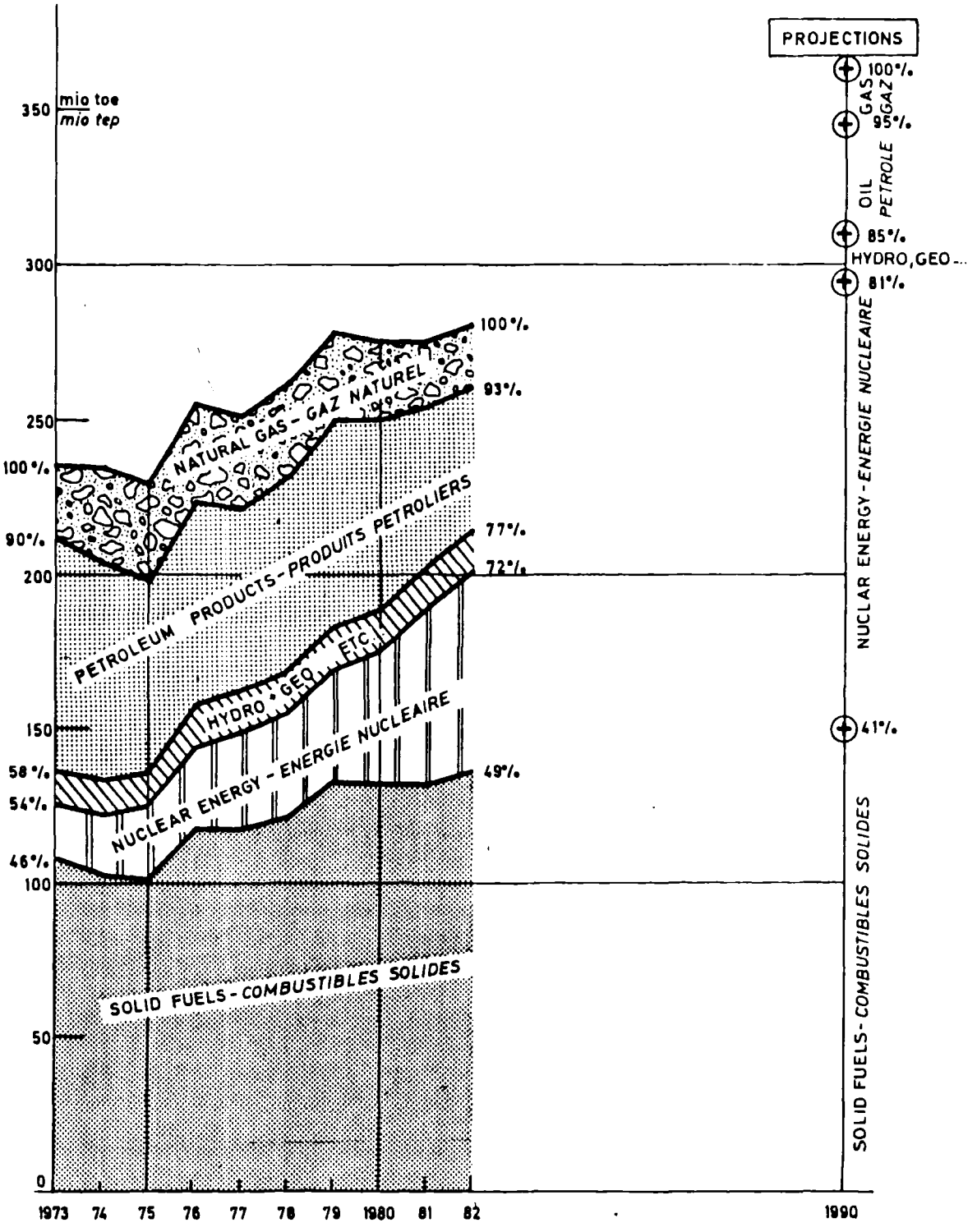
Fig.5

EUR-10: Electricity Generation-Primary Energy Inputs

Energie primaire transformée en électricité

1973-1990



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demand in many countries. Nevertheless, the more comprehensive revisions to energy projections currently underway in some Member States seem more likely to produce further **downward revisions** of energy and probably oil demand for 1990 rather than any upward adjustment. The main reasons are likely to be **(a)** lower expectations about economic growth, and **(b)** revised assumptions about the structure and intensity of demand. Many of the existing projections for the latter half of this decade have been made on the basis of a projected level of demand for 1985 which is clearly far too high, given the trends of the past three years. If energy demand assumptions are revised yet again downwards it does not of course follow that all other elements in the equation will be reduced accordingly. Nuclear capacity in 1990 is now more or less predetermined by the construction and commissioning programme under way. Natural gas demand will also be to some extent supply-determined given the existence of long-term contracts with minimum off-take provisions. But projected solid fuel demand could be affected more sharply.

15. In terms simply of the main quantitative Community guidelines, therefore, the projected outlook for 1990 for the Community as a whole is relatively satisfactory. On certain scenarios (e.g. notably, a much more rapid upturn in economic growth than currently seems likely, a major and sustained collapse in crude oil and product prices, or at the other extreme a major oil supply crisis) the evolution to 1990 could turn out to be rather different from the projections. But barring a major falsification of the key assumptions, the main guidelines should be broadly met at Community level, although oil dependence will still be on the high side.

This will be a welcome achievement, reflecting the **general** success of policies to move away from oil. But the fact that the Community is "on target" for 1990 does not weaken the need to sustain efforts. The gains must be consolidated if the Community is to prepare a sounder **long-term** future. The Community continues to rely heavily on imported oil and especially oil from the Middle East; oil demand in other main consuming areas could well increase, perhaps substantially, during the coming years and pressures on the world oil market return. There is always the risk in any case of an unpredictable supply crisis with damaging effects on world oil prices.

Five points are particularly relevant:

(i) the guidelines were fixed four years ago when conditions on the energy markets very different from those of today. **In some respects they are now out-of-date;**

(ii) if current projections are realised the main guidelines will be met at a **much lower level of demand** than assumed four years ago;

(iii) similarly, the **absolute** level of the contribution of alternative fuels will be much lower than expected. There will also be a different **balance** in the respective contributions of particular fuels within that level (notably much reduced expectations for solid fuels);

(iv) given the long lead-times for many energy investment projects (and particularly those in the field of electricity generation) many decisions taken during the next 2-3 years will have a major impact on the situation well **beyond 1990** and particularly on the level of the Community's dependence on oil in the longer term;

(v) the downturn in energy demand of the past few years has produced **surpluses of capacity** in the coal, electricity and natural gas sectors. The existence of these surpluses could delay the decisions needed to ensure further restructuring and diversification in the 1990s.

In its Communication of 4 November to the (Special) Council the Council (Energy) indicated the importance of a 1995 horizon for monitoring Member States' programmes. In view of the importance of this issue, the Commission intends during the coming year to make proposals to the Council about new guidelines for progress in the 1990s, which will take account of both experience with the 1990 guidelines and the new economic and energy situation.

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III. VARIATIONS AMONG MEMBER STATES

16. A further and important qualification to the success of recent years is the wide variation among Member States in the pace and depth of structural change.

Progress to date

17. The energy situation in **all** Member States in 1983 is an improvement on both 1973 and 1979 (Tables 4-6). All Member States have experienced some decline in absolute levels of oil demand since 1979 and (with the exception of Greece) since 1973; improvements in the mix of power station fuels; and in the intensity of energy use. But:

- differences in the level of dependence on oil and imported oil remain striking. Oil meets over 70% of gross primary energy demand in **Greece**, over two-thirds in **Italy** and around 65% in **Denmark** (all figures for 1982);

- in some Member States **oil** continues to play an important rôle in the power station sector. In 1982 oil accounted for some 60% of primary inputs to **Italian** electricity generation, for 30% in **Greece**, and for around 25% in Ireland, Netherlands and Belgium. There are broadly corresponding differences in the recourse to solid fuels, nuclear and new and renewables in the electricity system (Tables 4 and 5). **Denmark**, **France**, **Germany**, **United Kingdom** and **Luxembourg** are already a long way above the Community guidelines; **Italy**, **Ireland** and the **Netherlands** a long way below.

18. In terms of both the **energy ratio** and the **intensity of final energy demand** all Member States (except Greece) have experienced major improvements since 1973. But these have been most marked in **Belgium**, **Denmark**, **France** and **Luxembourg** and very much less significant in **Italy**, and the **United Kingdom**:

Reductions in the energy ratio and energy intensity 1973–1982 %

	B	DK	D	GR	F	IRL	I	L	NL	UK	EUR-10
Energy ratio	-23	-25	-19	+4	-19	-13	-15	-40	-23	-17	-19
Energy intensity	-28	-30	-22	+3	-25	-16	-12	-38	-20	-17	-15

In the industrial sector the biggest improvements have been registered in **Belgium** and **Denmark;** the lowest in **Greece** and the **Netherlands**:

Reduction in energy intensity in industry 1973–82 %

B	DK	D	GR	F	IRL	I	L	NL	UK	EUR-10
-35	-40	-26	-10	-20	-25	-27	-27	-11	-19	-27

In the residential-tertiary sector there have been very major gains in **Belgium, Denmark, Germany, France** and the **Netherlands**, and very limited gains in the **United Kingdom** and **Greece**, while in **Ireland** energy intensity in this sector has significantly increased:

Reduction in the intensity of energy use in the residential-tertiary sector 1973–1982

B	DK	D	GR	F	IRL	I	L	NL	UK	EUR-10
-28	-28	-26	-3	-35	+22	-16	-17	-29	-5	-23

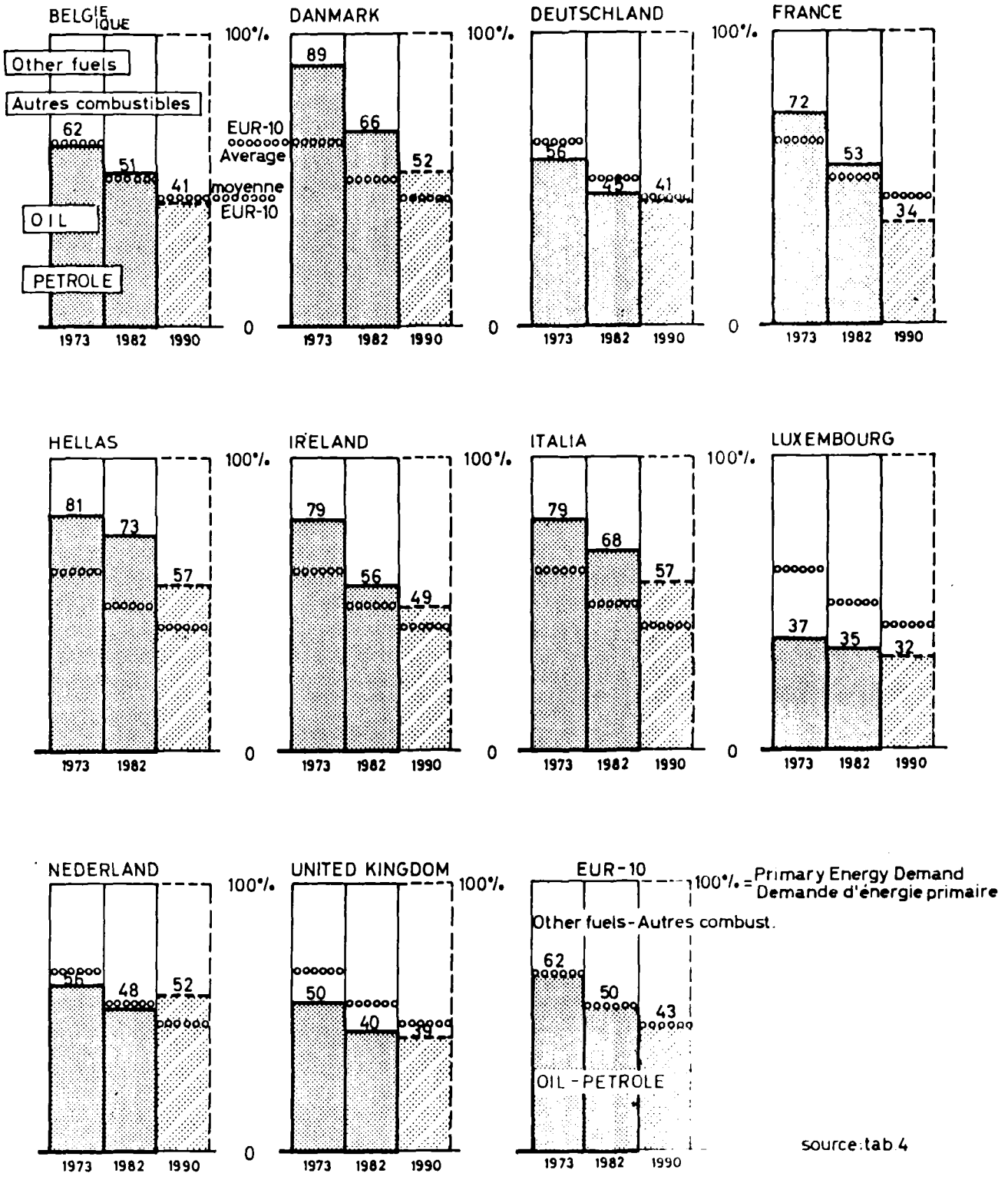
In absolute terms, the **United Kingdom** and **Ireland** have still the highest energy ratios in the Community (apart from Luxembourg) followed by **Greece,** the **Netherlands** and **Belgium**; and **Denmark** and **France** the lowest. In the industrial sector the **United Kingdom's** energy intensity is also significantly higher than that of other Member States, apart from Luxembourg and Greece.

	Energy Ratio	Energy intensity in industry	Energy intensity in household sector
		1982 - in ECU 1975	
EUR-10	100	100	100
B	107	140	104
DK	70	58	130
D	93	76	98
E	110	174	69
F	80	84	75
IRL	144	157	162
I	100	99	86
L	212	563	145
NL	107	138	129
UK	143	171	142

There are many reasons for these differences, which are a function of different trends and levels of economic activity, different economic and industrial structures, as well as genuine differences in energy efficiency[11]. Even allowing for these differences, the Danish

[11] It must also be noted that none of the figures given is temperature-corrected, a factor of some significance in assessing genuine structural changes, notably in the residential-tertiary sector.

Oil Dependence by member State (%)
Dépendance pétrolière par Etat membre (%)



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performance is striking; so too the achievement of a significant reduction in energy-intensity in France and Germany in the industrial sector from an already relatively low base in 1973. It should also be noted that Belgium, on the one hand, and the United Kingdom, on the other, have experienced very different rates of reduction in energy intensity in industry from very similar starting points.

The projected outlook

19. The projected energy balances to 1990 submitted by Member States are set out in the tables on each country in Part Two of this report, which discusses their underlying assumptions and key uncertainties. From the summary elements given in Tables 4-6 it is clear, however, that if the projections are realised:

- **five** Member States will still, in 1990, depend on oil for around 50% or more of their energy demand (Italy, Greece, Denmark, Netherlands, Ireland). In the case of Greece and Denmark, the 1990 situation will be a major improvement, however, on the present; in the case of Italy and Ireland a more modest achievement; in the Netherlands oil dependence is projected to rise, although this trend is heavily influenced by increases in oil bunkers rather than inland energy demand;

- **five** Member States will experience an absolute increase in oil use during the period to 1990 (Netherlands, United Kingdom, Germany, and, marginally, Luxembourg and Italy). It should be noted, however, that more recent figures provided by the German authorities show a much more modest level of oil use in 1990;

- in **three** Member States there will be an increase in oil use in power stations (Italy, Ireland, Denmark); and

- **three** Member States (Ireland, Netherlands and Italy) will still be well below the Community average in the combined contribution of nuclear, solid fuels, hydro and other renewables as inputs to electricity generation. The projected contribution in Italy (46%, including **hydro**), though an improvement on the 1982 situation, is particularly low.

20. Member States' projections of growth in final energy demand and in the intensity of energy demand vary substantially. In the Community as a whole the figures suggest that energy intensity will increase to 1985 and then reduce. For the reasons given earlier, however, undue importance should not be attached to the figures for 1985. Around the average for 1990 the projections from some countries (Luxembourg, Greece and, marginally, Germany) imply an increase in energy-intensity; Italy, United Kingdom, Denmark and Ireland expect a fall. Some of the reasons for these differences are evident from the breakdown of projected energy intensity by main economic sectors given in the tables in Part Two:

- in the **residential/tertiary sector** Member States generally expect to see continuing improvements in the intensity of energy use and further reductions in oil demand;

- in the **transport sector** the projections assume an increase in energy demand below the projected increase in GDP and some reduction in energy intensity. This sector will continue to be dominated by oil. On these assumptions greater fuel-efficiency of the transport fleet would at least offset any tendency towards increased mileage. These projections may be pessimistic . Improvements in fuel efficiency may well be greater than allowed for as the results of ongoing R & D programmes are incorporated in future models. Another key factor will be the probable maintenance of high levels of taxation on motor fuels[12];

- in the **industrial sector**, however, there are much wider divergences in the projected trends. These reflect different growth rate assumptions for industry, different industrial structures, varying rates of substitution for oil and in improvements in energy efficiency. Improvements are projected in Greece, Ireland, Italy, the Netherlands and UK; but in Belgium in particular the projected trends are adverse.

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21. Part Two of this report explains the background to some of the variations among Member States in both primary and final energy demand as well as energy supply. The fact that Member States vary around the Community average is inevitable and not in itself an argument for questioning the degree of consistency of some Member States' energy policies with Community objectives. Another factor to consider in this context is the rate of improvement, both achieved and projected. Between 1973 and 1982 there were wide variations in the rate of reduction of dependence on oil, with France and Denmark (and Ireland as a result of the arrival of natural gas) reducing their dependence much more quickly than other Member States, and Greece, Italy and the Netherlands much more slowly (Table 7). The current projections suggest that France will actually increase the previous rate of change; that Denmark and Belgium will sustain the past rate of progress; and that Greece could make up some of the lost ground. There will be improvements in Italy, but these will be insufficient to narrow the gap with the other larger Member States; rates of progress in Germany and the United Kingdom will decline; and the position of the Netherlands relative to other Member States will worsen.

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[12] It should also be noted that the calculation of energy intensity in transport as a function of total GDP provides only a particularly crude measure of real changes in efficiency.

IV. CROSS-COUNTRY AND SECTORAL ISSUES

(i) Energy Investment

22. In a number of earlier Communications to the Council, the Commission has emphasized the importance of adequate levels of energy investment to the achievement of the Community's long-term energy objectives and in the context of economic policy more generally[13]. This concern relates both to investment in production, transformation and transport and to investment in energy saving and substitution for oil. Information available to the Commission on trends in energy investment is, however, much less satisfactory than that in other areas of energy policy. Some information is submitted to the Commission by governments or enterprises on a regular basis on electricity, gas and coal, but the coverage, detail and form of this information varies considerably (some is in physical units, some is presented in financial/economic terms), which makes ready identification of trends or cross-country comparisons difficult. Similar points apply to the information on government funding of investment. On the demand side, there are in addition some conceptual problems in identifying the purely "energy" elements in those investments which are not undertaken purely for energy saving or substitution reasons. Some Member States have provided useful indications of general energy investment trends in this year's submission of data for the Review of National Programmes, but the absence of comparable information from others and the global nature of the information rules out fully reliable comparison.

23. The information available to the Commission on six Community countries from statistical surveys itself and estimates by Euroinvest[14] is summarised below. As a percentage of gross domestic fixed capital formation (GDFCF), trends in investments in the **energy industries themselves** are as follows:

	B	D	F	IT	NL	UK	EUR-6
1973	5.86	6.84	5.74	7.23	8.29	8.27	6.87
1977	6.80	6.71	7.18	7.23	7.84	15.41	8.28
1980	6.10	6.50	9.31	8.55	8.74	14.02	8.66
1981[15]	6.04	6.91	9.76	8.98	8.55	16.19	9.30
1982[16]	5.79	6.69	8.41	-	9.75	16.36	-
1983[16]	5.97	7.63	8.45	-	-	14.97	-

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[13] COM(81)540 final, COM(81)64 final, COM(82)24 final, COM(83)305 final and COM(83)315 final.

[14] Association of national economic forecasting institutes.

[15] Source: Commission OSCE/DG II.

[16] Estimations: Euroinvest 1983

As a percentage of GDP (volume) these shares represent:

	B	D	F	IT	NL	UK	EUR-6
1973	1.28	1.72	1.41	1.65	1.93	1.65	1.62
1977	1.48	1.49	1.59	1.41	1.64	2.83	1.74
1980	1.28	1.55	2.03	1.72	1.70	2.53	1.86
1981[15]	1.09	1.49	2.09	1.80	1.50	2.74	1.87
1982[16]	0.98	1.37	1.78	1.79	2.55	-	-
1983[16]	0.99	1.58	1.72	-	-	2.38	-

The exceptionally high levels of investment in the United Kingdom reflect its importance as a major energy producer. In many of the countries for which figures are available energy investment appears to have been affected more sharply by the recession than some other investment sectors, mainly because of the slowdown in electricity programmes reflecting revised expectations of electricity demand.

24. A comparable series of figures is not available for investment in rational energy use. But in 1982 the Commission made a survey of such investments in the industrial sector which indicated the following trends:

RUE investments[17] as a share of GDFCF in industry

	B	D	F	IRL	IT	UK
1981	4.3	4.2	11.0	10.0	4	5.7
1982	6.2	4.5	11.0	11.0	4	5.6

25. In the present state of knowledge, the outlook for investment on the supply and the demand side is difficult to assess with precision. In 1980 a questionnaire on investment was sent by the Commission to Member States in the context of the preparation of the 1981 Review of National Programmes and the results were incorporated in COM(81)64 final. At that time Member States estimated that some 500 milliard ECU (1980 prices) would be spent 1981-1990 by the public and private sectors in the energy field, 80% of this amount devoted to supply and the remainder to investment to improve the productivity of energy use. This was equivalent to 2.1% of estimated GDP and to 9.3% of estimated GDFCF (assuming average annual GDP growth of 3.2%), compared with 1.5% and 6.8% respectively in the period 1968-1980. Circumstances have changed significantly since 1980. GDP growth rates assumed by Member States for this year's review of energy programmes are down to an average of 2.4% per year 1985-1990. Even assuming a rate of growth of supply side investment above this figure, investments by the energy supply industries would be unlikely to exceed 350 milliard ECU 1983 - 1990 (1980 prices). Information on the demand side is too patchy for clear trends to be identified. Impressions of investor intentions in this area have however

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[17] Measures aimed at energy saving, reducing energy costs, substitution for oil and achievement of greater supply security.

suggested to the Commission a general lack of confidence among businessmen because of, notably, the economic climate, uncertainties about the future evolution of oil prices and the high cost of money.

26. Much more information is needed about investment in order to be able to assess what is happening in the Community, the problems that may be arising in individual Member States, and the outlook for the future. In view of the importance of this issue, the Commission is now developing proposals for a European data base on energy investments designed to cover:

- realised investments and those under way in energy production, transformation, transport and distribution, by main fuel categories;

- disinvestment;

- investment by energy consumers, the aim being to identify the share devoted to energy saving, inter-fuel substitution or to improve security of supply;

It is intended that the data base should also include information on costs, employment and import content of investments; financing arrangements; and rates of return.

(ii) Energy Pricing Policy

27. The essence of the agreements on energy pricing into which Member States have entered at Community level is three-fold:

(i) the consumer should bear the full costs of supplying him with energy, including the full long-run cost of production and distribution or of acquisition on world markets. Government intervention in the form of financial support to energy suppliers or consumers should be discouraged, except where there are strong energy policy reasons to the contrary;

(ii) Member States will work progressively towards the elimination of differences in policies and practices which give rise to distortions in energy prices within the common market and undermine the optimal allocation of resources. As the Commission has already made clear[18], this does not mean necessarily that consumer prices should be identical throughout the Community. On the contrary, it is inherent in Community policy that differences in investment and productivity in energy transformation (refining, transport, distribution and electricity-generation) between Member States should be reflected in energy prices, while price discrimination should be avoided;

(iii) energy prices should be made more transparent so that individual consumers and investors can make the best-informed choices about relative fuel prices, and trends can more easily be identified.

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[18] COM(82)651 final

28. Following a round of contacts with Member States the Commission will be presenting a separate report shortly on the practice of Member States in relation to these objectives. Pending the submission of that report to the Council, the Commission wishes to limit itself here to some remarks of a general nature in relation to each main sector[19]:

Oil Product Pricing. With the exception of the UK, Germany and the Netherlands, all Member States administer pricing régimes which control the relationship between pre-tax oil product prices and movements in the price of crude oil.

During the past two years steps have been taken in France and Italy to liberalise in certain areas the former systems of administered prices; and in the Netherlands the former system of price controls has been effectively abandoned. In other countries there has been little or no change. Prices remain particularly closely controlled in Greece which also operates a state monopoly of crude oil and oil product imports for the domestic market.

It is difficult to judge how far the continuing operation of price control regimes in normal supply conditions, however modified, gives rise to distortions. The existence or not of such regimes does not of itself explain the differences in pre-tax oil product prices between Member States. Pre-tax prices for the main oil products in Denmark, for example, have been consistently higher than those of other Member States; those of the UK consistently higher than those of Germany. Other factors include the sources of supply, refinery balance and market size and structure. In any case, differences in the level of taxation on oil products are the most important source of differences in **consumer prices.**

Electricity Pricing. Pre-tax electricity prices differ widely among Member States and between different classes of consumer. The variations are even larger for post-tax prices: in ECU terms, industrial electricity prices for small and medium sized consumers in Denmark are around twice those of Greece and Luxembourg though there is a substantial closing of the gap if purchasing power parities are used. The pre-tax differences for comparable consumers or off-take conditions reflect differences in the costs of generation (as is noted later, those Member States with a high share of nuclear and coal tend to have lower prices as a whole); differences in the construction of tariffs; and different accounting conventions. In all countries, however, prices are subject to direct or indirect control or regulation by government or local authorities, including supervision under national competition legislation. In Italy and Greece in particular, price control systems continue to operate which could adversely affect the internal cash flow of the electricity industries. In France the outlook for electricity pricing seems likely to depend on the balance that is struck between the requirements of counter-inflation policy, the promotion of electricity and the desirability of improving the financial health of Electricité de France (EdF).

Natural Gas. Natural gas pricing in the Community has undergone an important change in the past few years with the arrival of increasing amounts of gas from external suppliers under contracts linking gas to oil prices. The effect on the relative price of gas has already been

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[19] Figures quoted in the text are derived from the Commission's Bulletin of Energy Prices.

discussed (paragraph 11). The Commission has made clear its view[20] that the aim of gas pricing policy should be to encourage the progressive allocation of gas to premium uses as a first priority so as to ensure that limited and valuable resources are exploited as efficiently as possible; this is one of the aims of the Council Recommendation on gas tariffs. Progress is slower than expected in developing premium markets in some countries (notably Ireland and Italy). In view of the short-term over-supply situation in some countries there may be pressures to sell gas both in non-premium markets, and in certain circumstances in premium markets, at prices which cover neither the immediate costs of supply or the longer-term cost of replacement supplies. The Commission intends to monitor very carefully the level and duration of contracts for gas sales to power stations, notably in Italy and the Netherlands.

Pricing of Solid Fuels. The ECSC Treaty and legislation derived from it provide a framework for the downward alignment of prices of Community coal against the price of imports, which are lower than average indigenous production costs. The bulk of Community coal is currently being sold at aligned prices, which has led to the regulation of support to the Community coal industry. There have been no recent changes in the operation of the alignment systems.

In the case of other solid fuels, there is no international market. Lignite development is generally in the hands of the electricity industries themselves and internal transfer pricing therefore applies. In Greece it is particularly important for the generation of capital for the exploitation of lignite resources that the real long-term costs of lignite mining are passed through into the formation of electricity prices. In Ireland, too, optimal peat development will not occur unless attention is paid in pricing policy to long-term costs of supply.

(iii) Energy Efficiency

29. Detailed guidelines for national energy savings policy were set out in the Council Resolution of June 1980 on New Lines of Action in the Field of Energy Saving. The Council has subsequently issued[21] a Recommendation to Member States on investment in rational energy use[22]. The Commission's separate report analyses Member States' energy savings programmes in detail and draws some general conclusions about the effectiveness of different kinds of action.

Energy conservation programmes, apart from pricing policy, can be classified under three broad headings:

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[20] COM(82)651.

[21] Official Journal N° L247, 28 August 1982, p.9 Recommendation N° 82/604/EEC Council.

[22] COM(84)36

(a) Regulatory actions - both primary legislation and administrative action

(b) Financial Support - grants, subsidised loans, tax concessions, etc.

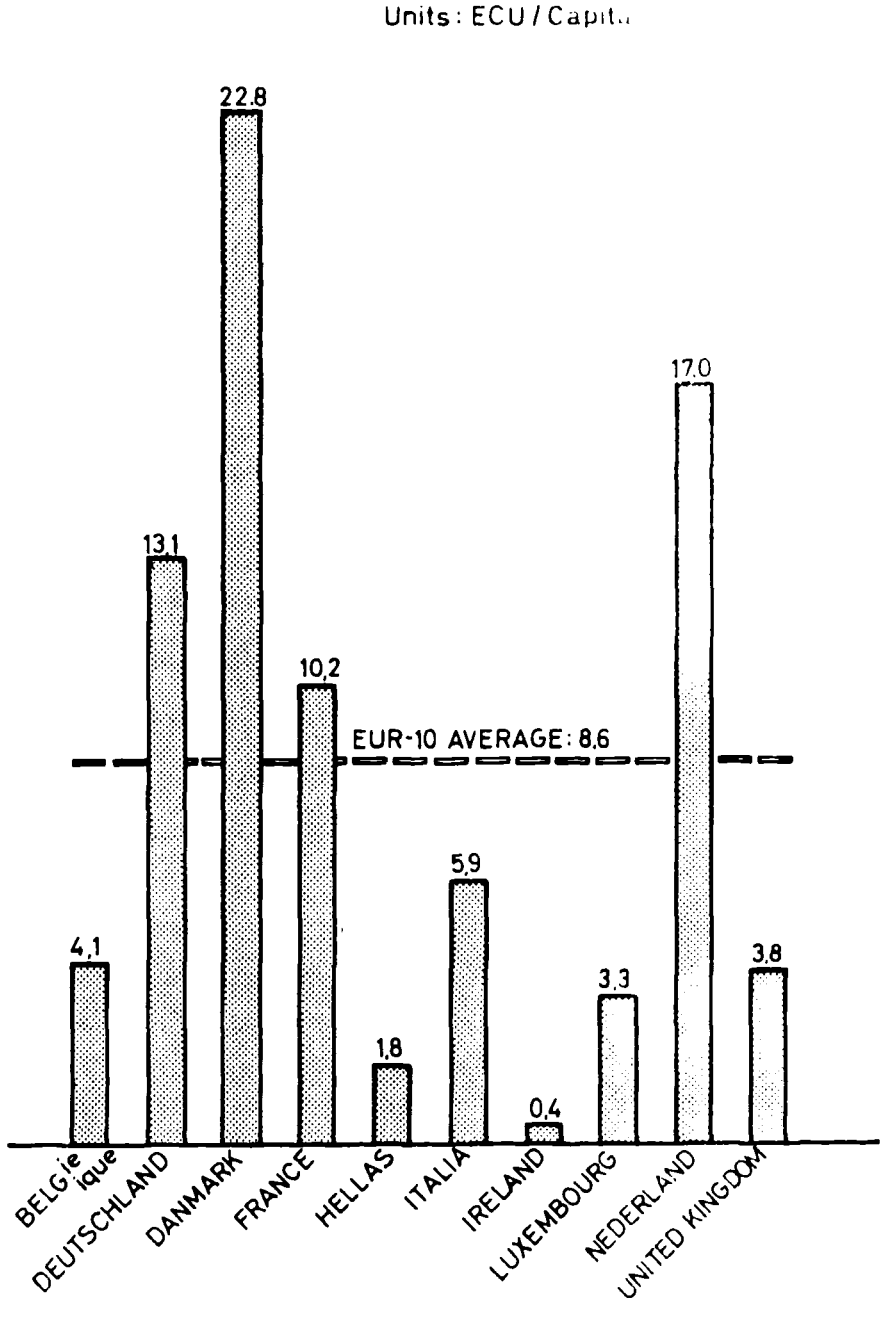
(c) Information and Consultation Programmes - public awareness campaigns, advisory centres, energy audits, etc.

In general, the rôle of energy savings policies in contributing to the reduction in intensity of energy use over the past few years is difficult to disentangle from the effects of higher energy prices and the structural changes that have taken place in the economies of Member States. The value of coherent energy savings policies that integrate pricing policy, regulations, information programmes and financial incentives in relation to clear objectives is however evident. Such comprehensive programmes have been developed only in **France**, **Denmark**, the **Netherlands** and **Germany**. In other countries greater priority has been given to the management of the supply side of the economy. In recent years pricing policy in the United Kingdom and Belgium has been regarded as the main instrument for encouraging greater energy efficiency. There are signs now of a more wide-ranging approach. In Belgium recent efforts have been made to improve conservation policy and in the UK the recent creation of the Energy Efficiency Office reflects, hopefully, a new policy emphasis in the Member State with one of the least satisfactory records in reducing energy intensity. In Italy the rate of future progress hangs on the implementation of the 1982 Energy Conservation Law, which could radically improve the outlook. Part Two of this report indicates that in Ireland, Greece and Luxembourg much also remains to be done.

30. Figure 7 below shows the financial support to energy conservation per capita in each EEC member country in 1982. While the totals for one particular year may understate or overstate the ongoing level of support for energy conservation, the contrast among Member States is large, with Denmark (22.8 ECU per capita) providing the highest level of financial assistance, and Ireland (0.4 ECU per capita) the lowest. Germany, France and the Netherlands are also well above the average for the EUR-10 in this respect:

Fig.7

EUR-10: Public Financial Support for Energy Conservation per Capita in 1982 by Member State



(RD+D and information programmes excluded)

31. The general issue of the cost-effectiveness of schemes of financial inducement is examined in the separate report on energy saving programmes. Many attempts have been made to improve the 'rate of return' on programmes and to reduce the 'free-rider' effects. All countries with the highest levels of per capita government spending on energy saving in the past few years are now giving increasing attention to this issue. This coincides with moves in some countries to focus programmes more sharply on selective areas rather than to provide across the board assistance. **There could be useful lessons from the results of the evaluation exercises in some Member States for other Community members with less developed programmes**, although account has to be taken of differences in the administrative and cultural frameworks.

32. In its Recommendation to Member States of 28 July 1982 on Investment in the Rational Use of Energy, the Council reminded Member States of the risk that undue centralisation of decision-making in this area could itself be a barrier to effective results. Member States were encouraged to adapt energy savings and substitution programmes to local and regional conditions. It is too early to comment on the action undertaken by Member States in response to this Recommendation. The Commission, for its part, however, is already financing studies of regional energy planning in the Community which should help to cast further light on the rôle for decentralised action in this field.

(iv) Oil - the changing structure of demand

33. The rapid fall in oil demand of the past four years has affected all petroleum products, apart from motor gasoline. But it has been most marked for fuel oil (-48%), and less so for gasoil and diesel oil (-22%). The largest falls in consumption have been registered in the industrial, household and tertiary, and power-generation sectors; oil use in transport has actually increased:

Changes in the Community's oil consumption by sector and by fuel : 1979 - 1983

Mtoe

	1979	1983*	Difference 1983-1979
Total inland oil consumption	537	410	-127
of which: industry[23]	142	91	-51
residential/tertiary sectors	138	95	-43
transport	150	155	+5
inputs to electricity generation	67	36	-31
others (energy industries, etc)	40	33	-7
among which: deliveries of - motor gasoline	88	88	-
gas/diesel oil	179	139	-40
residual fuel oil	140	73	-67

*Estimate

[23]Including non energy use.

34. This new pattern of oil demand, and notably the reduction in outlets for fuel oil can be expected to continue in the future.

Oil use in power stations in the Community as a whole in 1990 is projected to be below the 1983 level. Even if industrial demand for oil grew by 2% a year 1983-1990, which seems unlikely, it would still be 37 mtoe less than the 1979 level. The effects of higher insulation standards in new buildings, continued retrofitting of older buildings and the likelihood of continuing substitution for oil as long as the relative price disadvantage of oil is maintained will constrain the growth in oil demand in the household and tertiary sector. Transport use is unlikely to increase.

The projections from Member States of oil consumption in 1990 are broadly in line with estimates by some of the oil companies themselves. The general picture that emerges is of a further fall in demand for fuel oil of some 20% to around 12% of the barrel (compared with 34% in 1973) while both gasoil/kerosene and motor gasoline could rise to, respectively, around 18% and 38% of the barrel by 1990, compared to 12% and 33% in 1973.

35. These developments obviously have a strong bearing on the oil refining industry in the Community which has been engaged for several years in a process of rationalisation involving both the closure of excess distillation capacities and an expansion of conversion facilities.

The Commission is closely monitoring the evolution of the situation in consultation with the oil industry. It publishes on a regular basis an assessment of the developments in Member States and at Community level. The latest report, issued in June 1983[24], indicated that progress was being achieved in all Member States, but that further efforts were needed in order to bring capacity into line with likely demand.

(v) Oil - indigenous supplies

36. Current projections assume a peak in the supply of North Sea oil later in this decade. But the actual evolution will depend on the rate of development approvals and expenditure. The outlook for the 1990s will, of course be a function of the level and success of further exploration activities both in the North Sea and elsewhere in the Community.

The trends in exploration for and development of Community oil (and gas) resources continue to be dominated by North Sea activities. Offshore field development expenditure in this area has reached a level of around $8 billion per year, while exploration and operating costs are bringing total capital expenditures to a level approaching $10 billion annually.

Recent changes in the UK taxation system have improved the economics of investment in the UK sector of the North Sea. Drilling activity during the last few months has reached a record level, about 20% higher than in 1982, perhaps partly as a result of decisions made in 1979/80 when world oil prices were rising. Exploration activity has also reached new heights in Denmark and the Netherlands. The main provisions of the UK modified

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[24] COM(83)304 final

system are a doubling of the oil allowance on new fields, extended reliefs on exploration and appraisal expenditure, a phased reduction in the rate of advanced petroleum revenue tax and abolition of royalties on new fields. These provisions are expected to encourage the development of so-called "marginal" fields. In other Member States, the trends are less encouraging, Germany and France continue to record poor exploration results, while in Italy there is some uncertainty about the future oil and gas exploration programme.

(vi) Solid fuels

Demand

37. In 1980 highly optimistic forecasts were being made by governments about future coal demand (notably the Declaration of the main industrialised countries at their Summit meeting in Venice in June 1980). Each year since then the expectations have fallen.

In **all** Member States the principal customer for solid fuels is the electricity-generating sector. Member States are currently projecting a rise in solid fuel-fired capacity of nearly 21 Gw or 18% by 1990 (Table 8) and an increase in solid fuel use in power stations of some 13 mtoe (or 10%) over the 1982 level. These projections are based on an average annual growth in the demand for electricity of 3.5% between 1985 and 1990. The major programmes for new power station construction and conversion to solid fuels are those of Italy, Germany, the Netherlands, Greece and Ireland. Any major change in the projected Italian programme would significantly reduce the total available capacity in the Community as a whole in 1990.

38. In the industrial sectors the prospects for increased solid fuel use are even more uncertain. The structural changes currently underway in European industry are likely to reduce the share of heavy energy-intensive industries which have been a natural market for solid fuels in the past. The steel industry is currently the second largest consumer of solid fuels, and it should hold that position in the coming years. If it continues to contract there will be obvious consequences for overall demand for solid fuels. Even if its level of activity remains constant, the use of solid fuels could fall as a result of technological progress. Member States' projections suggest that **total** industrial solid fuel use (excluding power-generation) could rise by 5 mtoe between 1985 and 1990 as new outlets are found to compensate for a likely decline in use in the heavy industry sector. The main sources of this expected additional demand will be the United Kingdom, France and Germany . In other sectors solid fuel demand is expected to remain at its present level.

39. The precise level of solid fuel use in the coming years will depend on four main factors, apart from likely power station and steel industry demand:

(i) **the maintenance of a long-term price advantage of coal and other solid fuels over competing oil products.** This seems to be assured unless oil prices collapse. Long-term coal prices will be set in effect by the marginal world market producer, the USA, which is the free world's largest as well as major swing producer of coal. These prices are likely to rise over time but less quickly than those for oil, barring unexpected oil market developments;

(ii) **uncertainty about the introduction, impact and cost of new environmental measures**, notably to reduce SO_2, NOX and particulates in emissions. There is evidence that some industrialists are deterred from switching from oil to coal because of possible future environmental legislation. The current arrangements in force in Member States vary widely. The Commission has recently proposed a Draft Directive on Emissions from Large Installations which should set a clearer framework for decision-making;

(iii) **the scope and effectiveness of policies to promote solid fuel use.** Only the UK and France have been operating grant aid schemes to encourage conversion to coal in industry. In the UK the take-up rate was initially low, partly because of restricted coverage and partly because the technical/preparatory work was more complicated that originally envisaged. Now the scheme is understood to be operating much more satisfactorily and is expected to increase industrial coal consumption capacity by 0.5 mt annually during the years of its operation. Roughly the same result is apparently expected of the French programme. No information is available on the success of the arrangements in Greece, Denmark and Germany of a more indirect nature (depreciation allowances, general investment aids).

(iv) **the success of R,D & D policies to promote solid fuel use technology, including solid fuel gasification and liquefaction.** In the United Kingdom, the NCB has been involved extensively in the development of fluidised bed combustion and some work of a similar nature has been carried out in the Netherlands and Germany.

In the field of solid fuel gasification the major efforts are in Germany and the United Kingdom. Other countries supporting work in this area are France and Belgium. Greece is interested in gasification of lignite.

A small coal liquefaction plant is to be built by NCB in Wales (Point of Ayr). The German government is considering support for a full-scale coal liquefaction plant.

Community supply

40. Output of hard coal in the Community in 1982 was around 150 mtoe or 16% below the 1973 level. Stocks held by Community producers at 31 December 1983 had risen to more than 50m tonnes (an average of 2.5 months of Community production), involving costs of some 10 ECU per tonne per year (ie: 12/16% of the current value of coal on the international market). Current forecasts point to a further reduction in output, down

to a little over 140 mtoe by 1990. Lignite and peat production, on the other hand, is expected to rise (from 31.4 mtoe in 1982 to 34.8 mtoe in 1990), principally as a result of the Greek lignite programme.

41. The lower level of coal output projected for 1990 is expected to be produced at lower cost as output capacity is modernised and rationalised. Major investments are underway to this end. Investment in the Community coal-mining industry reached 1800 million ECU in 1982: 1200 million ECU (68%) in the United Kingdom, 400 million ECU (22%) in Germany, and 200 million ECU in France and Belgium together. As the Commission has already pointed out[25], it has been possible to finance such a high level of investment only by continuously increasing the national aids to the coal industries. These rose from 1358 million ECU in 1974 to 3844 million ECU in 1981. In other words, the aid per tonne produced was multiplied in nominal terms by a factor of three (from 5 ECU to more than 16 ECU). The Commission has made proposals, now under discussion in the Council, for Community aid to help finance the investments that continue to be required to put the Community coal industry on a more viable footing. It has also made proposals to support the development of increased peat and lignite capacity, and to help deal with the social consequences of the restructuring in the coal industry.

(vii) Nuclear

42. As noted earlier, the contribution of nuclear power to electricity-generation in the Community as a whole has increased significantly since 1979 in particular. Recourse to nuclear power (Table 8) is concentrated in France (53% of Community nuclear capacity), Germany (22%), UK (15%) and Belgium (6%). Considerable further increases can be expected by 1990 as additional capacity now under construction comes on stream. Net capacity is expected to rise from 44 Gw in 1982 to around 100 Gw in 1990, with the largest increases occurring in France (+22 Gw), Germany (+13 Gw) and UK (+7 Gw). The level of capacity in 1990 is now largely predetermined by construction and commissioning programmes under way and could be seriously affected only by a very major disruption to them. More important now, in view of the long lead-times involved in bringing nuclear stations on stream, are the decisions which will have to be taken in the next 2-3 years on nuclear capacity for the mid-1990s. Here the picture is much less clear:

- in **France** the implications of reduced expectations of electricity demand for the future rate of ordering of nuclear plant are currently being assessed (see (viii) below);

- in **Germany** the situation is likely to be affected by the electricity demand outlook and the commitments of the electricity industry to maintain minimum levels of German coal burn;

- in the **United Kingdom** the outcome of the Sizewell PWR enquiry, on which the inspector's report is expected before the end of 1984, will have an important impact on the long-term nuclear programme;

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[25] COM(83)447 final

- in **Italy** some 12 Gw is expected to be in operation by 1995 but currently only 2 Gw additional capacity is forecast for 1990. Securing all the site approvals for the further 10 Gw capacity in the next two-three years is a precondition to fulfilling this ambitious programme;

- in **Belgium** the options for the 1990s are currently under assessment and final decisions are expected shortly;

- in **Denmark** a government report on nuclear safety and waste disposal is expected to be completed during 1984 which should then lead to a referendum on whether there should be a nuclear component in the Danish energy mix in the 1990s;

- in the **Netherlands** the role of nuclear in the 1990s will depend on the results of and government response to the Public Debate on energy which is now drawing to a close;

- in **Greece** a decision on whether to include a nuclear element in the electricity-generating sector in the 1990s also remains to be taken.

43. In the case of those three countries (Denmark, Netherlands, and Greece) where particular uncertainties exist, clear decisions will need to be taken as quickly as possible about the future rôle for nuclear power so that the longer-term planning of the electricity supply system can proceed on a satisfactory basis. For the same reasons early action on the Sizewell report is important for planning by the UK electricity supply industry. In Italy particular efforts must be made to ensure agreement on the sites required to accelerate the rate of introduction of nuclear power.

44. Continuing nuclear development is important to the Community as one of the key elements in energy security in the 1990s. Despite certain difficulties in some Member States in recent years it is now moving ahead. The Commission will continue to play an important rôle in promoting R & D on nuclear reactor safety and waste disposal, in particular, which should also help to strengthen public confidence in nuclear power.

(viii) Electricity

45. During the past three years electricity demand has been stagnant and considerably lower than suggested by the forecasts made several years ago which formed the basis for electricity investment programmes. There has been a consequent substantial increase in plant margins, notably in France, Belgium, Germany and the UK. In the **short-term** this situation has had an adverse effect on the overall costs of electricity production, with serious financial consequences for some of the enterprises concerned. For the **medium-term**, however, provided that there is an adequate internal interconnection system, lower than expected demand for electricity should encourage more rapid decommissioning of less-efficient and oil-burning plant and produce a better structure of supply in the industries. There are, however, constraints. In the case of Germany, the electricity utilities will be compelled to take a certain level of

German coal up to 1995 which may make it difficult to exploit to the full the available nuclear capacity. For the **longer-term** plant margins are generally expected by the industry to be reduced. The resultant improved overall plant load factors and the entry into service of new nuclear and solid fuel plant should combine to produce much better plant mixes and lower overall production costs.

46. Electricity penetration (i.e. the share of electricity in final energy consumption) in the Community increased from 11.9% in 1973 to 15.3% in 1982 and is forecast to increase further to 17.0% by 1990 (see Table 9). This represents a significant shift towards electricity use; in the period 1982-1990 electricity consumption is expeced to increase by some 21%, compared with an increase in total final energy consumption of only 14%. The electricity sector has clearly provided the major means of utilising solid fuels and nuclear in final energy consumption and will increasingly do so (Table 5). Further increases in electricity penetration are desirable and the Commission is currently examining where this can be achieved (e.g. for thermal applications in industry) in substitution for oil and the most appropriate means of encouraging it. The Commission emphasises that increased electricity penetration should take place only in those applications where it is economic and efficient; in Ireland, Italy and the Netherlands efforts must take place in parallel to increase the proportion of nuclear and solid fuels in energy inputs to electricity production.

47. The increasingly extensive system of international electrical interconnections, built up over the years by the electricity producers, has resulted in improved economy and increased security of electricity supply. With this continuing extension of the system the total interchanges of electrical energy (imports and exports) are increasing significantly. The exchanges do not, however, represent a major intra-Community market in electricity, since **net** exchanges have increased only marginally. In general, Member States (with the exception of Luxembourg) have aimed at self-sufficiency in electricity production capacity. With widening differences in the structure and costs of electricity production among Member States there is evidence of increasing interest in greater net transfers of electrical energy. The most obvious example of this is in France, where the problems posed by the combination of reduced demand expectations and a large availability of nuclear-based electricity are acute. The French government and EdF are actively considering the scope for larger net exports of electricity to other Member States in the short and longer-term. The Commission believes that increased net transfers of electrical energy can contribute to the reduction of overall Community dependence on hydrocarbons for electricity production and to further economy in electricity supply. It is currently examining the scope for encouraging this development by accelerating the development of transfrontier interconnections.

48. The effects of the structure of electricity-generation on the costs of electricity supply are important and wide divergences exist between Member States. It is interesting to note that the cost advantages of a relatively large nuclear, coal and hydro component in the generating system are already showing up in relative prices charged. Generally

speaking, those countries which have a high share of nuclear, coal and hydro have the lowest electricity prices, although - as noted earlier - many other factors also play a rôle.

(ix) Natural Gas

49. In the past 2-3 years, a number of Member States have concluded new contracts for supplies of natural gas from third countries for delivery during the second half of the decade and beyond. Imports from third countries are expected to rise from 44.2 mtoe or 28% of gas consumption in 1982 to 80 mtoe or 41% of projected 1990 gas consumption.

50. These contracts were in the main negotiated before the impact of the recession had been felt and before the recent fierce price competition between gas and oil products. In the meantime too, there has been a significant upward re-evaluation of Dutch gas reserves and this, combined with the adverse effect on government income of lower than expected demand for Dutch gas at home and abroad, has led to a re-examination of Dutch gas policy.

The effects of these new circumstances on the natural gas market seem likely to be:

- the burning, in some countries at least, of larger quantities of **gas in power stations** than was earlier planned. In the case of the Netherlands and Italy contracts are now in operation between the gas companies and the electricity industries which are expected to result in a significant displacement of oil by gas in power-stations over the next 3-5 years. This is seen as an **interim measure** in the transition to coal (in the case of Netherlands) and coal and nuclear (in the case of Italy). The duration of these measures is of major importance. It is essential that extensions beyond the existing contracts should not be made without the fullest examination of the energy policy consequences. The Commission intends to monitor this situation carefully.

- some **renegotiation of contracts** with external suppliers to alter the timing of planned volumes of deliveries, minimum offtake or price. Renegotiation is already under way, for example, in relation to existing arrangements between Belgium and Algeria.

51. It can be expected that the trends in gas consumption will resume an upward path over the coming years, but the speed at which that occurs will depend heavily on oil price developments. Under most pricing contracts, there is a lagged relationship with oil prices (often a weighted mix of crude and product prices). When oil prices are rising, gas prices tend to move upwards but more slowly and competitivity of gas versus oil products is maintained or increased. In a market of falling oil prices the reverse is the case. The effect of price competition has been experienced most significantly in Belgium and Germany during the past three years.

52. While contracted gas supply in the 1980s is more than adequate to meet likely demand in all the continental Member States, the situation in the United Kingdom could be somewhat less satisfactory, with a potential, if small, supply gap opening up by the end of the decade. There are a number of difficult issues in relation to UK gas policy which are dealt with in Part Two of this report. One key policy issue for consideration should be the establishment of gas links with the continent which could be beneficial both to the UK and to other Community members.

53. In the longer-term (the 1990s) there is a potential "supply gap" for both the UK and a number of continental European countries. In that context the possible availability of larger quantitis of Dutch gas for export will be one element of major importance. The issues that arise are examined separately in the Commission's report on natural gas supply and demand to 2000.

(x) New and renewables and new energy technologies

54. The existing and projected use of new and renewable energy sources varies considerably among Member States. Significant amounts of electricity are already produced from hydro plants in Italy and France, and from geothermal sources in Italy. But the overall contribution of new and renewables is limited to around 1.7% of gross primary energy demand in the Community as a whole and the bulk of that is hydropower. By 1990 the volume of new and renewable output is expected to double, and by 2000 to treble. Hydro-electric output is expected to remain at roughly its present level; the increment will therefore come from other sources.

55. Major efforts are underway in a number of Member States to develop and commercialise new and renewable sources. The most important programmes are in France, Italy, Denmark, Greece and Netherlands, while in Germany considerable support has been given to new energy technologies (especially heat pumps). France has by far the largest R, D & D programme and the highest expectations, forecasting a contribution from new and renewables of 6-9 mtoe by 1990 in addition to hydro and geothermal output of 5-6 mtoe. For the moment these projections can only be noted by the Commission. Assessment of their realism must await the results of national evaluation programmes. It is noteworthy, however, that the projections have been somewhat scaled down since 1980, essentially because of more conservative French and Italian expectations.

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Table 1 SUMMARIZED ENERGY BALANCE - EUROPEAN COMMUNITY

in million toe	1973[a]	1979[a]	1982[a]	1985[b]	1990[b]
I. **Gross Energy Consumption**	968,04	1011,67	908,05	980,5	1061,5
- Bunkers	37,36	26,86	24,67	28,1	29,2
- Inland consumption	930,68	984,81	883,38	952,4	1032,3
II. **Inland Energy Consumption**	930,68	984,81	883,38	952,4	1032,3
- Solid fuels	221,97	223,36	215,80	225,0	245,3
- Oil	563,93	536,63	430,06	434,4	430,0
- Gas	115,83	172,45	158,15	181,3	193,9
- Primary electricity, etc.	28,95	52,37	79,37	111,7	165,1
III. **Indigenous Production**[1]	351,29	457,93	494,46	550,2	565,5
- Hard coal	171,16	149,20	151,37	145,8	143,6
- Lignite & peat	26,49	31,00	31,38	32,5	34,8
- Oil	13,17	89,32	118,08	141,7	105,7
- Natural gas	112,20	137,49	115,92	120,3	113,8
- Nuclear energy	17,73	37,19	63,88	95,1	144,3
- Hydro & geothermal[2]	9,38	12,19	12,28	12,5	12,6
- Others & renewables	1,16	1,54	1,55	2,3	10,7
IV. **Net Imports**[3]	619,91	558,68	418,28	430,1	495,8
- Solid fuels	19,00	33,77	46,20	46,5	64,7
- Oil	596,21	487,26	326,19	320,8	353,5
- Natural gas	4,01	36,21	44,22	61,0	80,1
- Electricity[2]	0,69	1,44	1,67	1,8	-2,5
V. **Stock changes**[4]	+3,15	+4,83	+4,69	-0,2	-0,2
- Solid fuels	-5,32	-9,41	+13,15	-0,2	-0,2
- Oil	+8,09	+12,98	-10,45	..	..
- Gas	+0,38	+1,26	+1,99	..	..
VI. **Electricity Generation Input**	235,13	278,72	280,39	309,7	363,8
- Solid fuels[5]	108,33	132,04	136,62	139,3	150,0
- Oil	75,04	66,76	46,20	35,0	35,4
- Natural gas	23,51	29,00	19,86	26,1	19,5
- Nuclear energy	17,71	37,19	63,88	95,1	144,3
- Hydro & geothermal[2]	9,38	12,19	12,28	12,5	12,6
- Others & renewables	1,16	1,54	1,55	1,7	2,0
VII. **Electricity Gross Production** (in TWh)	1040,90	1261,72	1264,94	1359,3	1575,7
- Hydro & geothermal[6]	109,11	141,73	140,09	144,6	145,8
- Nuclear	58,82	138,07	242,87	363,8	552,9
- Conventional thermal	872,97	981,92	881,98	850,9	877,0
VIII. Electricity Gross Consumpt (in TWh)	1054,15	1284,95	1292,03	1377,3	1546,3

Sources: a. Statistical Office of the European Communities
b. Review of National Energy Programmes 1983
Mid-point of ranges submitted by Member States.

Notes:
1. Production of primary sources, including recovered products.
2. The conversion of electricity, including hydro and geothermal, is based on its actual energy content: 3600 kjoules/kWh or 860 kcal/kWh
3. The (-) sign means net exports
4. The (-) sign means a stock decrease
5. Including coke oven gas and blast furnace gas (derived from coal)
6. Without pumped storage hydroelectricity.

General notes:
1° figures submitted by Member States have been adapted where necessary to ensure consistency with SOEC statistical definitions or conversion factors.
2° direct comparisons between 1982 and 1985 are not always possible, given that some forecasts use 1980 or 1981 as the basis for projection.

Table 2 MAIN ENERGY INDICATORS - EUROPEAN COMMUNITY

(related to 1990 Objectives)

	1973	1979	1982	1985	1990
I. Share of Oil in Gross Energy Consumption	62.1%	55.7%	50.1%	47.2%	43%
II. Fuel inputs to Electricity production(1): Shares taken by:					
- Solid fuels	46.1%	47.4%	48.7%	45.0%	41%
- Nuclear	7.5%	13.3%	22.8%	30.7%	40%
- Hydro and others	4.5%	4.9%	4.9%	4.6%	4%
- Natural Gas	10.0%	10.4%	7.1%	8.4%	5%
- Oil	31.9%	24.0%	16.5%	11.3%	10%
III. Supply dependence on:(2)					
- Imported oil	61.6%	48.2%	35.9%	32.7%	33%
- Imported solid fuels	2.0%	3.3%	5.1%	4.7%	6%
- Imported natural gas	0.4%	3.6%	4.9%	6.2%	7.5%
IV. Share of imports in (3) gross consumption of:					
- Energy	64.0%	55.2%	46.1%	43.9%	47%
- Oil	97.8%	86.5%	71.7%	69.4%	77%
- Solid fuels	8.6%	15.1%	21.4%	20.7%	27%
- Natural gas	3.5%	21.0%	28.0%	33.7%	41%

	1973/63	1975/73	1979/75	1982/79	1990/85
V. Average annual growth rates:					
G D P	+4.7%	+0.3%	+3.6%	+0.4%	+ 2.4%
Inland Energy consumption	+4.6%	-3.8%	+3.4%	-3.6%	+.1.6%
Final Energy consumption(4)	+4.8%	-4.0%	+3.3%	-4.4%	+ 1.0%
VI. Energy coefficient(5)	0.98	-	0.94	-	0.67

	1973	1979	1982	1985	1990
VII. Energy ratio(6) (in kg oe per 10^3 ECU)	833.0	760.6	673.3	695.0	669.0
VIII. Energy intensity(7) (in kg oe per 10^3 ECU	573.8	521.9	455.6	472.4	439.5

Sources and General notes: see footnotes under Table 1.

Notes:
1. Basic data expressed in oil equivalent terms.
2. Respective shares of imported oil, imported natural gas or imported solid fuels in gross energy consumption.
3. Share of each imported energy source, in gross consumption of that source.
4. Non energy use included.
5. Energy coefficient = ratio between growth rates of Inland Energy consumption and GDP.
6. Energy ratio = volume of inland energy consumption per unit of GDP, expressed in real terms, at 1975 prices in kg of oil equivalent per 10^3 ECU.
7. Energy intensity = final energy demand per unit of GDP, expressed in real terms, at 1975 prices.

Table 3 TRENDS IN FINAL ENERGY CONSUMPTION - EUROPEAN COMMUNITY

	1973	1979	1982	1985	1990
INDUSTRY:					
Energy consumption (1) (in million toe)	247.94	237.54	193.06	219.2	228.4
Share in final consumption	38.7%	35.1%	32.3%	33.9%	33.7%
Energy consumption per unit of value-added(2) (in kg oe per 10^3 ECU)	753.8	646.5	549.5	604.7	551.2
TRANSPORT:					
Energy consumption (1) (in million toe)	128.22	152.44	156.37	161.8	168.9
Share in final consumption	20.0%	22.6%	26.2%	25.0%	24.9%
Energy consumption per unit of GDP (3) (in kg oe per 10^3 ECU)	114.8	117.7	119.2	118.1	109.5
HOUSEHOLDS, etc...					
Energy consumption (1) (in million toe)	264.94	285.76	248.37	266.4	280.8
Share in final consumption	41.3%	42.3%	41.5%	41.1%	41.4%
Energy consumption per unit of private consumption (4) (in kg oe per 10^3 ECU)	395.6	356.8	304.2	318.7	297.6
FINAL ENERGY CONSUMPTION (in million toe) (1)	641.10	675.74	597.80	647.4	678.1
of which: Oil	59.1%	55.3%	51.4%	49.3%	45.7%
Final non-energy use (in million toe)	70.25	69.37	52.77	61.4	67.9

Sources and General Notes: see footnotes under Table 1.

Notes: (1) non-energy use, not included.
(2) volume of energy consumed in the industrial sector, per unit of value-added produced by industry, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(3) volume of energy consumed in the transport sector, per unit of GDP, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(4) volume of energy consumed in the residential + tertiary sector, per unit of Private Consumption, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).

TABLE 4

Oil Use 1973 - 1982 - 1990

Mtoe

	Trends in inland oil demand					Share of oil in gross primary energy demand	
	1973	1982	1982/73 % change	1990	1990/1982 % change	1982 %	1990 %
Belgium	27.3	19.6	-28%	17.5	-11%	50.6	41.2
Denmark	17.2	11.0	-36%	9.7	-12%	65.9	**51.8**
Germany	146.2	109.0	-25%	**119**	**+ 9%**	44.5	40.6
Greece	9.3	11.0	**+18%**	12.2	- 3%	73.2	**57.4**
France	123.8	91.43	-26%	71.5	-22%	52.9	34.5
Ireland	5.5	4.47	-18%	4.3	- 4%	55.9	**49.4**
Italy	95.2	83.57	-12%	**84**	**+0.5%**	67.8	**57.0**
Luxembourg	1.6	1.04	-37%	**1.1**	**+ 6%**	34.9	32.1
Netherlands	29.5	22.7	-23%	**26.2**	**+15%**	48.2	**51.8**
United Kingdom	108.2	76.28	-30%	**84**	**+10%**	40.1	37.4
EUR-10	563.9	430.6	-24%	430	0%	62.1	43.0

TABLE 5

Primary energy inputs to electricity generation

%

	1982			1990		
	Solid fuels, nuclear, hydro, other renewables	Oil	Natural gas	Solid fuels, nuclear, hydro, other renewables	Oil	Natural gas
Belgium	71	25	4	90	8	2
Denmark	92	8	-	91	9	-
Germany	86	5	9	88	3	10
Greece	70	30	-	93	7	-
France	88	10	2	97	2	1
Ireland	**25**	27	48	**61**	36	3
Italy	**33**	59	8	**46**	46	8
Luxembourg	81	2	-	80	7	3
Netherlands	**31**	23	45	**51**	14	35
United Kingdom	88	11	1	95	5	-
EUR-10	76	16	7	85	10	5

TABLE 6

Oil and natural gas use in power stations

Mtoe

OIL

	1973	1982	1990	1990-1982 % change
Belgium	5.1	2.9	1.2	-58
Denmark	2.8	0.5	0.6	**+20**
Germany	9.7	3.9	3.0	-24
Greece	1.7	1.6	0.6	-63
France	15.4	5.9	2.0	-66
Ireland	1.1	0.7	1.2	**+64**
Italy	19.1	20.3	21.6	**+6**
Luxembourg	0.11	0.03	0.02	-33
Netherlands	1.6	3.0	1.7	-43
United Kingdom	18.3	7.4	3.5	-53
EUR-10	75.0	46.2	35.4	-23%

NATURAL GAS

Belgium	2.3	0.5	0.3	-40
Denmark	-	-	-	-
Germany	7.8	8.2	11	**+34**
Greece	-	-	-	-
France	2.1	1.0	0.5	-50
Ireland	-	1.32	0.09	-32
Italy	1.0	2.64	3.5	+33
Luxembourg	0.04	0.00	0.01	-
Netherlands	9.4	5.8	4.1	-29
United Kingdom	0.9	0.4	0.0	-
EUR-10	23.5	19.9	19.5	-2%

TABLE 7

Reduction in dependence on oil 1973-1982-1990*

% change

	1982/1973	1990/1982	1990/1973
Belgium	-18.5	-19.0	-34.4
Denmark	-25.6	-21.1	-41.3
Germany	-21.0	-8.0	-27.3
Greece	-9.4	-21.5	-29.0
France	-26.2	-31.0	-49.1
Ireland	-29.5	-12.3	-38.2
Italy	-14.3	-16.0	-28.0
Luxembourg	-4.9	-8.3	-13.0
Netherlands	-14.4	**+7.5**	**-8.0**
United Kingdom	-19.8	-4.0	-23.0
EUR-10	-19.3	-14.2	-30.8

*
Change in ratio between oil consumption and gross primary energy demand.

TABLE 8

Electricity Production Capacity 1982-1990 (projected)

Gw

COUNTRY		NUCLEAR	SOLID FUELS	HYDRO
B	1982	2.6	4.1	0.1
	1990	5.4	3.8	0.1
DK	1982	-	5.6*	-
	1990	-	6.2*	-
D	1982	9.8*	41.9*	2.7
	1990	23.0*	49.0*	3.0
E	1982	-	2.5	1.7***
	1990	-	5.7	2.2***
F	1982	23.3	13.0**	18.5**
	1990	55.8	13.1**	19.2**
I	1982	1.3	5.2**	8.1**
	1990	3.3	12.8**	13.0**
IRL	1982	-	0.4*	0.2**
	1990	-	1.4*	0.2**
L	1982	-	0.1	0.02
	1990	-	0.1	0.02
NL	1982	0.5	2.2	-
	1990	0.5	3.4	0.02
UK	1982	6.5	40.9**	1.4
	1990	11.3	41.0**	1.4
EUR-10	1982	43.9	115.8	32.7
	1990	99.3	136.6	39.2

* Member State submission for review of national programmes
** UNIPEDE forecast
*** UNIPEDE forecast for 1988

TABLE 9

Electricity penetration 1973 - 1982 - 1990

Share of electricity in final energy consumption - %

	1973	1982	1990
Belgium	8.9	13.4	15.9
Denmark	8.5	15.1	15.3
Germany	12.5	16.6	19.1
Greece	13.1	16.1	17.2
France	10.2	15.9	18.4
Ireland	10.2	12.8	16.1
Italy	12.3	15.3	17.3
Luxembourg	6.0	10.4	12.1
Netherlands	9.4	12.5	10.5
United Kingdom	14.2	15.2	15.4
EUR-10	11.9	15.3	17.0

PART TWO - THE ENERGY PROGRAMMES OF MEMBER STATES

1. In its Communications on Community energy strategy[1] the Commission has underlined the importance of **greater consistency** among the energy programmes of Member States and **equality of effort** in the pursuit of long-term energy objectives. The call for greater consistency is reflected in the 1980 Resolution on 1990 objectives. The corollaries must be a **greater reflection of the Community dimension in national policy-making** with moves towards a **better integrated supply system**[2] and **a pooling of policy and technical experience.** The reports that follow have been prepared with these points in mind.

2. The Ten Member States of the Community vary considerably as to:

(i) their **level of economic development.** GDP per capita in Greece and Ireland for instance is considerably below of that of Germany or Denmark;

(ii) their **geographical situations.** Greece has no land or undersea gas or electricity links with other Community members; the energy supply system of Ireland is completely independent of the UK mainland system; the UK has no direct gas links with continental Europe and only a limited electricity connection (the cross-Channel link); Italy, and especially Southern Italy, is geographically distant from the main Community coal-producing or gas producing countries;

(iii) the **political, cultural and administrative framework** within which energy policy decisions are made. In France there is a long tradition of state intervention in the energy sector and involvement with the energy supply industries. In Denmark a long tradition of cooperative action at the municipal and regional level has made it easier to mobilise resources for collective energy projects. In Germany a Federal Governmental structure is combined with a more regionalised supply system than in other countries and arms-length relations between Government and the private sector energy supply companies. In Belgium the national and regional administrative structure is balanced by close Government involvement in the supply industries through state participation and control over investment programmes. In the United Kingdom the legislation setting up the post-war nationalised supply industries has given Government major powers of intervention through control over capital programmes and financing which remain and qualify a general philosophy of non-intervention.

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[1] COM(81)540 final and COM(83)305 final.

[2] The logic of such a system, both from an economic point of view and as a means of increasing flexibility and security, was underlined by the Commission in its proposals for a five-year energy programme, COM(83)315 final.

(iv) their **energy resource endowments.** The United Kingdom has substantial reserves of oil, gas and coal and is currently the fifth largest oil producer in the world and largest Community coal producer. The Netherlands is a major gas exporter and is likely to remain so for the foreseeable future. Other countries are less fortunate. France's only major indigenous resource endowments remain uranium and hydropower (the Lacq gas field has been largely depleted and the prospects for offshore hydrocarbons development remain speculative). Italy has extensive hydro potential, geothermal energy, some onshore gas and possibly limited offshore hydrocarbons, but the overall resource picture and outlook is poor;

(v) **their degree of dependence on imported oil when the first oil crisis occurred in 1973.** The success of progress away from oil can be measured in relation to the situation of Member States in 1973. Some countries (the UK, Germany) were already **relatively** well-placed given the diversification of supplies through coal. Others, such as France and Italy, were not.

All five factors are relevant to the assessments that follow.

* * * * * *

3. The country reports draw heavily on quantitative and non-quantitative data submitted by Member States to the Commission during the period July 1983-January 1984. In most cases the Commission services have also been able to complement information from these sources by means of specific visits to the countries concerned in the context of the review exercise. In some areas, notably projected final energy demand, the Commission has had to make estimates of its own to supplement the information supplied by Member States. The statistical data transmitted by Member States have been reworked, where possible, to conform to classifications of the Statistical Office of the European Communities. Data on prices have been derived from the Commission's Quarterly Bulletin of Energy Prices.

* * * * * *

BELGIUM

ENERGY TRENDS

4. Since 1973, there have been major changes in the Belgian energy economy. During the 1960s, imported oil fuelled Belgium's export industries, underwriting its traditional trading activities; coal - the sole indigenous fuel - declined in importance; and energy and oil demand grew faster than GDP. By 1973, imported oil provided over 62% of primary energy supply and dominated the electricity supply system.

Ten years later, gross primary energy demand has fallen by over 10%; oil demand by nearly 30%; dependence on imported oil is down to around 50%; and only one-quarter of electricity is generated by means of oil. On the supply side, the major change is the advent of nuclear power, currently providing 33% of the inputs to electricity generation.

5. Belgian energy consumption has fallen for four consecutive years since 1979. In 1982 inland energy consumption was 15% less than in 1979, with oil demand some 22% lower. Electricity demand was more or less flat 1979-1982 but rose by 2.5% in 1983, whilst gas deliveries have plummeted from the 1979 peak levels (-27%). The difficulties of the steel industry have led to a fall of some 20% in coke deliveries to industry, compared with levels of three years ago. The fierce contraction of the energy-intensive industries in relation to the rest of the Belgian economy has been a major reason for the substantial improvement in the energy ratio and in the intensity of final energy demand in the industrial sector.

THE EVOLUTION OF ENERGY POLICY

6. The most significant energy policy decision of the 1970s was the commitment to nuclear power. Coal policy has been focussed essentially on the problems posed by the high cost of output and the long run contraction of the industry. Greater diversification of energy supplies has been sought by means of natural gas imports, but there are specific problems on the demand and supply sides discussed later. Only recently has the development of a comprehensive energy savings policy been given high priority.

7. The Belgian Government has considerable influence over its energy industries. It has a 70% interest in the largest coal producer, a 50% share in Distrigaz (the gas purchasing utility) and veto power over the electricity industries production plans. The Government also controls the mechanisms for calculating oil prices.

8. The present Government was the first Belgian Government to nominate a Minister for Energy. In addition, the Government initiated a long-overdue energy debate in the Chamber of Deputies (June 1982) and the Senate (ended in March 1983).

The two texts that were finally approved in Parliament are more or less complementary and are a set of carefully worded, regionally balanced resolutions. The main points are:

- Priority should be attached to the **rational use of energy.** A programme should be established without delay. Waste should be eliminated and mandatory measures set for new buildings, automobiles and boilers. Appropriate financial incentives should be given to each sector.

- Energy supply should be **diversified** - geographically and away from oil.

- Energy prices should be as **low** as possible but compatible with energy saving policies. Prices should be transparent, cost reflective, and allow for "normal" profitability in the energy industries.

- **Close cooperation with regional executives** should be sought and the benefits of policy should be fairly distributed.

- **Gas supply** should be diversified and used for "specific" end use, in line with EEC directives. Large gas contracts should be traded for sales of Belgian goods and services to balance commercial payments (Senate). Distrigaz' petroleum activities should be terminated (Senate).

- The scope for increased **coal use** should be reevaluated. Coal gasification should be pursued. Further use of Campinois coal in a 600 MW coal-fired power plant should be considered.

- The option of participationin the **French nuclear power station** at Chooz should be promoted, but reciprocity for the Belgian nuclear industry should be sought.

- **New and renewable energies** should be promoted with the aim of meeting a significant fraction of energy consumption by the end of the century.

9. Development of energy policy in Belgium in the past has not always been successful on all fronts - particularly in respect of clearly defining national and regional responsibilities. The Parliamentary resolutions, therefore, provide important consensus guidelines for future political and administrative action. It is of importance that they are acted upon in a timely way.

THE ENERGY OUTLOOK

10. Belgian energy projections for 1990 are unchanged on the figures submitted in 1982 and reflected in COM(83)305, despite further falls in energy and oil demand in 1983 and some revival of electricity demand against the background of slightly negative GDP growth. Total inland energy consumption is expected to be 13% higher in 1990 than in 1982, based around GDP growth assumptions of 1%/year 1981-1985 and 2.4%/year from 1985-1990. Industrial output is expected to grow at 2%/year. The central features of the projection are as follows:

(i) Supply

- Coal production maintained at around present levels (in spite of the highest losses per tonne in the Community);

- Nuclear output more than doubles from 1982 to 1990 rising to 18% of projected gross inland consumption in 1990 (from 9% in 1982), and providing 56% of the inputs to electricity generation in 1990;

- Net imports of oil (20.5 mtoe) will be 6% lower than in 1982, although higher than in 1983.

- Imports of natural gas are projected to be 23% higher than in 1982. (The authorities now believe this projected demand to be too high).

(ii) Demand

- Transport demand will **decrease** in 1990 from today's levels by 5% in spite of a projected 40% increase in the car fleet between 1980 and 1990.

- Industrial demand will be 16% higher than at present, with a strong revival in demand for all fuels. The share of the energy intensive industries is assumed constant at 75% of total industrial consumption. Energy intensity in industry will rise significantly;

- Residential and tertiary demand expands by 15% - led by a particularly strong increase in gas demand (+ 28%) and further electricity penetration (+ 27%). Given the more modest projections for growth in GDP there will be some worsening in the intensity of final energy use in this sector;

  The overall intensity of energy demand is expected to remain broadly the same as in 1982;

- Electricity demand, overall, is projected to increase by 3%/year from 1982-1995, which could be on the high side. By 1990, electricity demand is 24% higher than in 1982;

- Further fuel switching in power stations away from oil and gas to coal is expected to be limited, but the pace of substitution by nuclear power is much more rapid than in the past. Coal and nuclear should represent 90% of inputs for electricity generation in 1990;

- Oil consumption in 1990 is expected to be 10% lower than in 1982 and will represent 41% of total primary energy requirements compared to 51% in 1982;.

- Solid fuel consumption increases in line with the assumed recovery in the energy-intensive industries and higher coal burn in power stations, and at much the same rate as energy demand as a whole;

- Natural gas takes 18% share of overall consumption in 1990, 2% higher than at present.

The projections on the demand side, and notably the projected increase in the intensity of final energy demand in industry and the household sector, are in some respects surprising and need to be re-evaluated carefully so as to facilitate supply side planning.

SECTORAL AND HORIZONTAL DEVELOPMENTS

Energy Pricing Policy

11. Most energy prices in Belgium are regulated. Consumer oil prices, for example, are controlled through a system called the "contrat de programme", which is a system of maximum prices. Maximum domestic prices are set equal to the international prices for refined products so long as the latter are within 89% and 111% of calculated refined cost. The system is intended to protect consumers from excessive profit margins in the oil industry and protects refiners from excessive losses. Oil product prices are relatively high in Belgium, and VAT is set at 25% for motor fuels and 17% for other fuels (fuel oil, gasoil).

12. Domestic coal prices are set in three different ways. Firstly, all fossil fuels for electricity generation are purchased by a single national entity called the "pool des calories". A share of domestic coal is purchased at prices set equal, each 6 months, to the weighted average of purchased oil, gas and imported coal. Domestic coal prices are, therefore, higher than imported coal prices, but still well below the costs of production. Coking coal prices to the steel industry tend towards imported coking coal prices, whilst other industrial and domestic prices are aligned on the prices for similar quality coal imports. VAT is levied at 6%.

13. Average natural gas prices are set by Distrigaz according to a "cost plus" formula based on import acquisition prices, with a differential between interruptible and firm suppliers. VAT is levied at 17%. It is interesting to note that since the first quarter of 1982, gas prices to industry have increased by 16%, whilst gas prices to the electricity producers **declined** by 4%. The influence of Algerian gas prices on total costs is a source of concern to the administration.

14. Electricity prices are set by a control board. An automatic adjustment formula links prices to fuel costs, salaries and capital charges and is designed to ensure that prices reflect costs. Electricity prices should be favourable in Belgium in the future as the nuclear component increases. However, in recent years, the formula-dictated price has been modified to support Belgian industrial competitivity. This modification has, amongst other things, brought forward some of the gains from low cost operation of nuclear power plants. The total value of a package of reductions in 1982 was that the bills for high voltage consumers were 3 billion BF less than the index system would have demanded. VAT is levied at 17% in the electricity sector.

15. According to the Commission's latest energy prices bulletin (September 1983), the relative prices of gas and fuel oil to industry moved in favour of fuel oil between 1981 and 1982 and seems to have remained there. There is evidence that this has led to some substitution back to oil. The high prices that Belgium has contracted to pay for Algerian volumes of gas to come on stream in the second half of the 1980s will tend, if anything, to push gas prices even higher, and this relative price disadvantage for gas could persist for sometime if oil prices remain weak.

Energy Efficiency

16. Until recently, Belgium did not have a comprehensive policy for energy savings and rational energy use. In the last two years, however, a range of RUE policies has been adopted in tune with the Parliamentary Resolutions recently adopted, and the Government has backed up the policies with finance.

17. In 1983, Belgium was the only country which expanded its budget for energy saving, with the result that per capita expenditure increased from about 4.1 ECU/capita in 1982 to 12 ECU/capita in 1983. The total budget in 1983 is about 12 billion BF, excluding tax reductions for homeowners. The major schemes currently operating are:

- an industrial tax deduction scheme (value 1.75 billion BF) whereby up to 35% of the cost of a range of energy saving measures can be written off against corporate taxation for profitable industry. For industries not making profits, a direct subsidy is possible.

- In the domestic sector, a deduction from taxable income of 40% of the cost of home insulation, double glazing, etc. The rented housing market (40% of the housing stock) is not covered. The budget is substantial.

- 2.1 billion BF is available for efficiency improvements in public buildings (schools, hospitals, administrations, etc.).

- The horticultural, agricultural and fishing industries are covered by a 1981 programme encouraging energy savings (for heat recovery, new energy use, conversion to coal, etc.). Value 250 million BF in 1983 - total budget left for future years 1 billion BF.

- Other measures include publicity campaigns, energy bus, demonstration projects, energy audits, etc (value 1.2 billion BF).

These initiatives will remain the main thrust of policy in the next few years, although the budgets for each line will be renegotiated each year.

18. Overall, the Government has upgraded the importance of these policies. This is a laudable development given the financial straitjacket within which it has had to operate. There have been important improvements in the intensity of final energy use in industry since 1973, only part of which can be explained by the reduced importance of heavy industries. But the projections of energy intensity discussed earlier suggest that much remains to be done. Policies for the rented housing sector need to be considered. It is also not clear how, in the absence of new policy measures, overall energy demand in transport can be expected to fall as indicated.

CHP/District Heating

19. So far this plays a small part in the Belgian energy mix. District heating provides only 0,4% of domestic heating and hot water energy requirements and 5.3% for industrial low temperature heat.

Oil

20. Between 1979 and 1982, Belgian oil demand fell by 23%, with fuel oil falling by 23%, motor spirit by 15% and gas/diesel by 27%. Demand has fallen further in 1983. Deliveries to power stations in 1982 were 1 million tonnes lower than in 1979, transport use unchanged (the result of substantial switching to diesel oil for road transportation) and domestic and tertiary use over one third lower. Overall, Belgium consumed 5.5 million tonnes less oil in 1982 than in 1979 - a substantial structural change. Oil demand in 1990 is projected to be about the current level and will represent just 37% of inland energy demand, compared to 60% in 1973.

21. Belgium imports all its oil and has been, traditionally a large export refiner of products. Since the fall in European oil demand some Belgian refineries have closed and distillation capacity is now about 35 mt - some 20 mt less than in 1979. Capacity utilisation in 1982 was still low.

Solid Fuels

22. There has been a long-run contraction in the Belgian coal industry. Production was 6,5 m tonnes in 1982 - some 20 m tonnes less than the peak levels achieved in the 1950s. Productivity, however, is the lowest by far in the Community and state aids per tonne of coal produced the highest in the Community. The present Government, attempting to rein in

its own expenditure, has placed a subsidy limit of 32 billion BF for Belgian coal production to 1987, excluding some special investments for the period 1983-1987. Losses in 1983 have been reduced and are within the desired range, mainly because domestic prices of coal have increased as the Belgian franc has devalued against the dollar. Coal stocks, however, increased in 1983.

23. The 1990 projections show solid fuel demand is expected to be 13% higher than in 1982, with a strong revival in iron and steel use. Coal's share in total energy demand in 1990 will be the same as in 1982 (26%). National production is forecast to remain at about current levels.

24. The Government is encouraging coal use in industry. Several schemes are operational - and the obvious candidate industries for coal burning have already switched (notably cement). There are some new prospective chemical clients which could result in a further 200.000 tonnes (coal tonnes) increase in coal use in substitution for oil. The tertiary sector's use of coal also grew slightly in 1982 - mainly due to substitution for oil in the horticultural sector. In the electricity sector, 750 MW of oil capacity has been transformed to coal burning, replacing 1 MTOE of oil since 1980. A further 600 MW of capacity (Langerlo-Genk) is scheduled for transformation in 1985 and 1987 to coal use. Impediments to further coal penetration are said to be the fear of tighter pollution controls, a feeling of uncertain supply, the large capital cost of new coal boilers in industry compared to oil and, the high cost of Belgian coal.

Electricity & Nuclear

25. By 1990, 90% of electricity generation in Belgium will be coal or nuclear based. The nuclear component will be 55%, and coal 35%. This is a bold policy and one of immense importance in terms of long-term relative energy prices in Belgium. The official projections assume a 2.5%/year electricity growth rate from 1982 - 1995 with a strong revival in demand in the industrial and tertiary sectors (+ 47% and + 27% respectively). For these forecasts to be realised, the up-turn of 1983 will have to be sustained.

26. There is currently a large surplus of generating capacity in Belgium. Taking into account the fact that three new nuclear units with capacity of 2900 MW are coming on stream in 1983 and 1985 (Tihange 2 and 3, Doel 4), together with decommissioning based on normal plant life - it is difficult to see how new capacity will be needed before the early 1990s except on very high growth scenarios.

27. The Government recently approved the "National Equipment Plan" of the Comité de Gestion des Entreprises d'Electricité (CGEE) for the period 1983-1993. This document considered a range of equipment options under different electricity growth scenarios (1.5%/year - 3.5%/year). The equipment options include participation or not, in Chooz; a 1300 mw

purely Belgian nuclear plant option; a 600 MW coal plant (with or without desulphurisation facilities). The scenarios were also tested under different energy price scenarios.

The conclusions of the study are that:

(1) On the 2.5% growth rate no new capacity is needed until 1993.

(2) Nuclear capacity is the most economic and remains economic even at 1.5% growth rates of electricity demand.

(3) Under these conditions, the CGEE opts for participation in Chooz (2 x 348 MW - one in 1992 and the other in 1994). This strategy involves reciprocal capacity being made available to EDF when the next Belgian nuclear power station is built. In CGEE's view, this plan is the most robust against unfavourable circumstances.

(4) The CGEE underlines the importance of maintaining coal-firing units to absorb all Belgian low grade coal production. Currently, CGEE capacity is higher than the latter. Furthermore, the CGEE is proposing a 1 x 300 MW conversion to coal at Ruien after the decision on a 2 x 280 MW conversion to coal at Langerlo-Genk.

(5) The time delays for commissioning of new plant must be reduced (6 years for conventional equipment and 10 years for nuclear).

No final decisions have been taken by the Government within the context of this plan about the specific capacity options for the 1990s, but these are expected shortly.

Another longer-term possibility for Belgium would be to seek export outlets for surplus electricity in other Member States, if the current overcapacity still exists in the 1990s.

Natural Gas

28. Natural gas consumption has been directly affected by the recession. Total natural gas consumption fell every year from 1979 to 1982, with the 1982 level being 27% below the 1979 peak. Demand in 1982 fell by 17% over 1981 levels. The fall in demand since 1979 has come from two sources - firstly power stations (- 73%) and secondly industrial energy use (- 32%). Household demand has held at the 1979 level, with increased gas penetration being offset by energy savings.

29. This sharp fall in demand has led to some difficult policy decisions because Belgium currently has an oversupply of gas. Belgium has three gas contracts. The first with the Netherlands runs to 1996 - and has a minimum offtake of around 3.1 billion m3/year. The second is Norwegian gas for 2 billion m3/year. The third is Algerian LNG which was for 2.5 billion m^3/year to 1985 and 5 billion m^3 thereafter - now renegotiated to 1.5 billion m^3 October 1983 - October 1984 and expected to be the same for the following year. Minimum supply is now more than the normal market can bear, with the result that the excess quantities are being burned in power stations replacing fuel oil, but at fuel oil prices.

This involves financial losses. The Government hopes that this situation will change when work is completed on adapting the gas network for rich gas - but this could be optimistic because there is another problem - price. The new Algerian rich gas supplies are expensive and indexed, with a six month lag, to crude oil prices. Industry with dual firing capacity will tend to burn oil rather than gas as long as this price discrepancy remains. The high gas prices will also discourage conversion to gas, especially in view of cheap nuclear electricity available on the market. The oversupply situation could, therefore, deteriorate, at least in the short and medium term.

30. In this context, the forecasts used in Table 1, which show an increase of 27% in gas demand by 1990, seem questionable. The current projections suppose domestic demand will increase by 28% and industrial demand by 65% (including non-energy use). Both are very high.

31. The Belgian Government has invested heavily in the construction of the LNG terminal at Zeebrugge. The short-term economics of the project are not good and the Government is currently considering the volume of storage capacity to be built. However, it is possible that the long-term economics could turn in Belgium's favour. If the gas market continues to grow in Northern Europe, and if new LNG suppliers come onto the market (Middle East, Nigeria, etc.), Belgium could have the only LNG port in Northern Europe. The future of the terminal is under active examination.

New and Renewables and New Energy Technologies

32. The future share of new and renewables in Belgian energy consumption is difficult to estimate. However, the Government estimates this to be very small - and certainly no more than 0,2% of primary energy requirements in 1990 and 0,7% in 2000. Biomass will be by far the largest contributor in this sector.

CONCLUSIONS

Belgium has succeeded in considerably improving her energy situation since 1973. The major factor has been the decision to make nuclear power the base of the electricity supply system, a decision which stands the country in good stead for the rest of the 1980s and beyond.

Until recently, less attention has been given to energy saving policies as a whole than to the management of the supply side of the economy. But a policy of relatively high energy prices, combined with the industrial restructuring of the past ten years, has brought considerable improvements in the intensity of energy use. In the last two years a range of savings policies has been adopted, backed up by finance from the Government, which should sustain and improve the momentum.

Belgium expects to reduce her oil dependence still further during the rest of this decade as nuclear output doubles. New efforts are being made in the energy saving field. The recent Parliamentary Resolutions on energy policy should help to provide a good general framework for policy development. But there are a number of areas where important issues arise:

(i) the high cost of Belgian coal production;

(ii) the projected deterioration in energy intensity in industry and the household sector;

(iii) the rôle of natural gas;

(iv) final decisions on the options for electricity supply in the 1990s.

To clarify the outlook, it is desirable that the energy projections by the Government should be re-examined and updated in the light of recent developments.

Table 1 SUMMARIZED ENERGY BALANCE - BELGIQUE - BELGIE

in million toe	1973[a]	1979[a]	1982[a]	1985[b]	1990[b]
I. **Gross Energy Consumption**	48,81	50,95	43,68	47,3	49,7
- Bunkers	3,03	2,43	2,48	3,0	3,0
- Inland consumption	45,78	48,52	41,20	44,3	46,7
II. **Inland Energy Consumption**	45,78	48,52	41,20	44,3	46,7
- Solid fuels	11,31	11,36	10,84	11,2	12,3
- Oil	27,29	25,11	19,62	18,1	17,5
- Gas	7,19	9,31	6,79	7,7	8,6
- Primary Electricity, etc.	-0,01	2,74	3,95	7,3	8,3
III. **Indigenous Production**[1]	5,89	7,38	8,77	11,6	12,6
- Hard coal	5,79	4,50	4,83	4,2	4,2
- Lignite & Peat	-	-	-	-	-
- Oil	-	-	-	-	-
- Natural gas	0,04	0,03	0,03	0,0	0,0
- Nuclear energy	0,02	2,77	3,84	7,4	8,4
- Hydro & geothermal[2]	0,01	0,02	0,03	0,0	0,0
- Others & renewables	0,03	0,06	0,04	..	..
IV. **Net Imports**[3]	42,92	44,85	35,47	35,5	36,9
- Solid fuels	5,31	6,76	6,63	6,8	7,9
- Oil	30,53	28,83	21,83	21,1	20,5
- Natural gas[2]	7,14	9,37	6,97	(7,7)	(8,6)
- Electricity[4]	-0,06	-0,11	0,04	(-0,1)	(-0,1)
V. **Stock changes**	-0,00	+1,28	+0,55	-0,2	-0,2
- Solid fuels	-0,21	-0,10	+0,62	-0,2	-0,2
- Oil	+0,22	+1,30	-0,28	..	..
- Gas	-0,01	+ 0,08	+0,21	..	..
VI. **Electricity Generation Input**	9,66	12,27	11,67	13,0	15,0
- Solid fuels[5]	2,24	3,52	4,37	4,1	5,1
- Oil	5,07	4,03	2,88	1,2	1,2
- Natural gas	2,29	1,87	0,51	0,3	0,3
- Nuclear energy	0,02	2,77	3,84	7,4	8,4
- Hydro & geothermal[2]	0,01	0,02	0,03	0,0	0,0
- Others & renewables	0,03	0,06	0,04	..	..
VII. **Electricity Gross Production** (in TWh)	40,62	51,91	49,98	54,6	64,3
- Hydro & geothermal[6]	0,17	0,24	0,33	(0,3)	(0,3)
- Nuclear	0,08	11,41	15,66	33,3	35,5
- Conventional thermal	40,37	40,26	33,99	21,0	28,5
VIII. **Electricity Gross Consumpt** (in TWh)	40,31	51,02	51,19	53,8	63,5

Sources: a. Statistical Office of the European Communities.
b. Review of National Energy Programmes 1983. Belgium - January 1983.

Notes:
1. Production of primary sources, including recovered products.
2. The conversion of electricity, including hydro and geothermal, is based on its actual energy content: 3600 kjoules/kWh or 860 kcal/kWh.
3. The (-) sign means net exports.
4. The (-) sign means a stock decrease.
5. Including coke oven gas and blast furnace gas (derived from coal)
6. Without pumped storage hydroelectricity.

General notes:
1° figures submitted by Member States have been adapted where necessary to ensure consistency with SOEC statistical definitions or conversion factors.
2° direct comparisons between 1982 and 1985 are not always possible, given that some forecasts use 1980 or 1981 as the basis for projection.

Table 2 MAIN ENERGY INDICATORS - BELGIQUE - BELGIE

(related to 1990 Objectives)

	1973	1979	1982	1985	1990
I. Share of Oil in Gross Energy Consumption	62.1%	54.1%	50.6%	44.6%	41%
II. Fuel inputs to Electricity production(1): Shares taken by:					
- Solid fuels	23.2%	28.7%	37.4%	31.5%	34%
- Nuclear	0.2%	22.6%	32.9%	56.8%	56%
- Hydro and others	0.4%	0.7%	0.6%	0.2%	0%
- Natural Gas	23.7%	15.2%	4.4%	2.3%	2%
- Oil	52.5%	32.8%	24.7%	9.2%	8%
III. Supply dependence on:(2)					
- imported Oil	62.6%	56.6%	50.0%	44.6%	41%
- imported Solid fuels	10.9%	13.3%	15.2%	14.4%	16%
- imported Natural gas	14.6%	18.4%	16.0%	16.3%	17%
IV. Share of imports in (3) gross consumption of:					
- Energy	87.9%	88.0%	81.2%	75.1%	74%
- Oil	100%	100%	100%	100%	100%
- Solid fuels	47%	59.5%	61.2%	60.7%	64%
- Natural gas	99%	99%	99%	100%	100%

	1973/63	1975/73	1979/75	1982/79	1990/85
V. Average annual growth rates:					
G D P	+4.9%	+1.2%	+3.0%	+0.7%	(+2.3%)
Inland Energy consumption	+5.0%	-4.8%	+3.9%	-5.3%	+1.1%
Final Energy consumption(4)	+5.2%	-5.7%	+3.5%	-6.3%	+0.8%
VI. Energy coefficient(5)	1.02	-	1.3	-	0.48

	1973	1979	1982	1985	1990
VII. Energy ratio(6) (in kg oe per 10^4 BFR)	206.5	190.2	158.1	167.3	157.7
VIII. Energy intensity(7) (in kg oe per 10^4 BFR	148.8	134.8	106.8	116.3	107.7

Sources and General notes: see footnotes under table 1

Notes:
1. Basic data expressed in oil equivalent terms.
2. Respective shares of imported oil, imported natural gas or imported solid fuels in gross energy consumption.
3. Share of each imported energy source, in gross consumption of that source.
4. Non energy use included.
5. Energy coefficient = ratio between growth rates of Inland Energy consumption and GDP.
6. Energy ratio = volume of inland energy consumption per unit of GDP, expressed in real terms, at 1975 prices. (in kg of oil equivalent per unit of national currency).
7. Energy intensity = final energy demand per unit of GDP expressed in real terms, at 1975 prices.

Table 3 TRENDS IN FINAL ENERGY CONSUMPTION - BELGIQUE/BELGIE

	1973	1979	1982	1985	1990
INDUSTRY:					
Energy consumption (1) (in million toe)	15.18	13.91	10.86	(13.3)	(14.0)
Share in final consumption	46.0%	40.4%	39.0%	43.2%	43.9%
Energy consumption per unit of value-added(2) (in kg oe per 10^4 BFR)	259.5	210.6	169.8	228.1	229.5
TRANSPORT:					
Energy consumption (1) (in million toe)	4.97	5.94	5.79	5.4	5.5
Share in final consumption	15.1%	17.3%	20.8%	17.5%	17.2%
Energy consumption per unit of GDP (3) (in kg oe per 10^4 BFR)	22.42	23.28	22.21	20.39	18.58
HOUSEHOLDS, etc...					
Energy consumption (1) (in million toe)	12.85	14.55	11.18	(12.1)	(12.4)
Share in final consumption	38.9%	42.3%	40.2%	39.3%	38.9%
Energy consumption per unit of private consumption (4) (in kg oe per 10^4 BFR)	96.70	92.03	69.94	82.10	74.55
FINAL ENERGY CONSUMPTION (in million toe) (1)	33.00	34.40	27.83	30.8	31.9
of which: Oil	53.1%	49.5%	47.2%	43.2%	39.5%
Final non-energy use (in million toe)	3.70	3.11	2.85	2.1	2.2

Sources and General Notes: see footnotes under Table 1

Notes: (1) non-energy use, not included.
(2) volume of energy consumed in the industrial sector, per unit of value-added produced by industry, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(3) volume of energy consumed in the transport sector, per unit of GDP, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(4) volume of energy consumed in the residential + tertiary sector, per unit of Private Consumption, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).

DENMARK[3]

ENERGY TRENDS

33. Alone among Member States of the Community, Denmark was almost 100% dependent on external energy supplies and around 90% dependent on imported oil supplies when the first "oil crisis" occurred in 1973. Solid fuels provided 39% of primary energy inputs to electricity generation but elsewhere oil was the dominant fuel.

34. Ten years later the situation has been transformed. Oil use in 1982 was down to 66% of primary energy demand; coal provided 92% of the inputs to the electricity sector; there had been a very large reduction in the intensity of energy use, notably in the residential sector. During the same period primary energy demand fell by 14%; oil demand by 34%; while electricity demand rose by some 36%. Finally, by 1982 there was a small but growing contribution to oil supply from the Danish sector of the North Sea and natural gas fields were being developed. Some of the most dramatic changes have occurred during the past four years, including a particularly impressive fall in household energy consumption.

THE EVOLUTION OF ENERGY POLICY

35. These changes were engineered against the background of successive Danish Energy Reports or Plans (1976, 1979 and 1981) which provided a framework for four main lines of policy:

(i) a substantial programme of conversion/construction in the **electricity-generating** field with a view to ensuring that coal could replace oil as the dominant power station fuel;

(ii) a comprehensive **energy saving programme** with high mandatory standards in the residential and commercial sectors and wide-ranging financial incentives. This programme was buttressed by high taxation of **oil products and electricity**;

(iii) the development of a nationwide **Heat Plan** (under legislation effective from 1 September 1979). This ambitious programme was based on the extension of the existing District Heating system and CHP, and the introduction of **natural gas** into the Danish energy

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[3] Energy balances (Tables 1-3) include Greenland and the Faroe Islands and exclude non-commercial energy sources.

economy from Denmark's North Sea fields. Already when the Plan was formulated, some 30% of Danish homes were connected to DH, probably the highest rate of penetration in the world.

(iv) the investigation and development of **hydrocarbon resources** in the Danish sector of the North Sea, building on the discovery there in 1968 of natural gas.

36. The Danish Energy Plan of 1981, which looked forward to the year 2000, was presented to the Danish Parliament at the end of 1981. The main approach of that Plan was confirmed by the present Government in spring 1983 in a key energy debate in Parliament. The Plan concentrated especially on:

(i) **heat supply and use** - the effective and economic implementation of the Heat Plan with the aim of creating a highly structured energy supply system; by 2000 some 60% of energy supplies should pass through a fixed distribution system (gas, CHP/DH, electricity);

(ii) **energy saving** - the projections in the Plan presupposed improvements in total energy efficiency of 20% 1980-1990 and 30% 1980-2000. The highest savings were expected to occur in the space heating sector and in transport. To further these ends the Plan envisaged an intensification of policy activity, notably in the fields of information, consultancy and regulation.

(iii) **development of Danish oil and gas resources**, including the construction of pipelines to link the offshore fields to the oil refinery at Fredericia (Jutland) and the Danish gas distribution network. Under the Plan it was assumed that Danish oil output would rise from negligible amounts in 1980 to around 4.2 mtoe in 1990 or over 45% of forecast consumption; while natural gas from North Sea fields, gradually introduced in the mid-1980s, would supply 2.2 mtoe in 1990, equivalent to nearly 11% of total inland primary energy demand;

(iv) higher priority than hitherto for **new and renewable energies** so as to improve the longer-term indigenous supply picture.

The Plan also discussed in some detail the options for electricity supply in the 1990s, and especially the possible future rôle for **nuclear power.** It recognised the **economic logic** of a commitment to nuclear power in the next phase of the power station programme, provided that safety and environmental concerns could be met. A domestic examination of the problems of reactor (light water reactor) safety and storage was already under way when the Plan was prepared. The Government stated its intention in the Plan that once this examination was completed and analysed it would organise a referendum on nuclear power before taking any decisions on construction of a nuclear power plant to enter into operation during the 1990s. This too has been confirmed by the new Government.

THE ENERGY OUTLOOK

37. While the general thrust of policy remains unchanged, the Danish authorities have now adjusted their projections for 1990 in the light of the trends in energy demand of the past 3 years and these have been reflected in a new report on Energy Planning in Denmark issued by the Government in July 1983. Table 1 shows both lower energy demand, lower overall oil demand and significantly lower oil demand in electricity generation in 1990 than previously projected. At the same time projections of oil and gas production for 1990 remain unchanged, so that net oil imports are expected to fall by over 35% from their already low 1982 figure and energy import dependence will be down to around 65%.

SECTORAL AND HORIZONTAL DEVELOPMENTS

Energy Pricing

38. Prices for oil products, electricity, natural gas and heat are monitored and controlled by official bodies which include organisations of producers and consumers. Oil product pricing has been periodically subject to general legislation on price freezes but maximum prices are normally determined in relation to world market prices. Prices of electricity and heat must be based on actual costs, including allocations to investment funds. In order to ensure the equitable implementation of the Heat Plan, however, Parliament decided to set the maximum gas price for residential consumers at the price of light fuel oil. In addition the individual gas consumer is to be given an introductory discount of about 15%.

39. Energy taxes in the residential and transport sectors are high, including taxes of around 35% on domestic electricity use. Industry does not pay taxes on energy. Energy prices to industry have been moderately high in relation to those of other Community countries; while the prices (post-tax) in the residential, tertiary and transport sectors have been at the top of the range.

Energy Efficiency

40. Denmark has had a comprehensive and well-funded energy savings programme for a number of years involving (in 1982) the highest per capita Government spending on energy savings; tough legislative controls in the transport sector (including rigorous speed limits); the highest thermal standards for new buildings in the Community; mandatory servicing for oil-fired heating appliances. The details are given in the Commission's separate report on energy saving programmes. The **residential** sector is by far the most important sector of final consumption (over 40%), with industry accounting for only 18%. Budgetary expenditure has been concentrated in the past in this area (78% of total public sector spending on energy saving in 1982 or 10 times the spending on energy saving in industry).

41. In June 1981, the "Act to Reduce Energy Consumption in Buildings" was passed to encourage retrofitting in public and residential buildings constructed before 1 February 1979 (new buildings after that date were already required to conform to high thermal efficiency standards). Under this legislation, public buildings have to be brought up to an "acceptable level of thermal efficiency" before the end of 1987, and a generous subsidy scheme was introduced for the residential sector to finance improvements in insulation, control of heating plant and so on. This effectively doubled public sector spending in this sector between 1981 and 1982. The arrangements for this scheme were amended in June 1982 to improve its cost-effectiveness in the light of experience. Spending more than doubled again from 1982 to 1983. In 1984 expenditure will fall sharply as the rate of subsidy is reduced. It is also expected to be the final year of the programme.

As noted earlier, there has been an important fall in household energy demand, to which these vigorous policy measures have undoubtedly made a major contribution.

Coal, Nuclear and Electricity

42. Electricity demand is projected to increase by some 24% between 1982 and 1990. This may be on the high side given the trends of the last few years, the success of energy conservation policies, and the high level of electricity taxation to domestic consumers.

Total net capacity is expected to increase by around 11% (650 MW) by 1990. The main elements on the generating side will be **new** coal-fired combined heat and power units with dual coal/oil firing capacity. In addition two remaining oil burning plants in Northern Jutland are to be converted to coal.

43. The projections currently imply a balance in 1990 between domestic consumption and domestic production. In 1982 however, nearly 10% of Danish electricity was provided by imports from the Nordic grid (hydroelectricity from Norway and hydro and nuclear electricity from Sweden), which are relatively cheap.

44. Coal imports amounted to 5.8 mtoe in 1982. By 1990 imports are expected to rise to 7.3 mtoe. About one-third of imports have come from South Africa in past years, with substantial supplies also coming from the United States and the United Kingdom. Efforts are under way to diversify coal import supplies further. In January 1983 the Danish Parliament adopted a resolution calling for a gradual phasing out of coal imports from South Africa by 1990.

45. The switch from oil to coal for power generation has reduced total sulphur dioxide emissions. But there are still air pollution concerns and a committee has been asked to investigate the issue of acid rain and report to the Minister for the Environment at the beginning of 1984. So

far no desulphurisation equipment has been used in power plants. In the Copenhagen area, fuel oil with a sulphur content of less than 1% has to be used.

46. As noted earlier, reports on nuclear reactor safety, storage and waste disposal are expected to be published in 1984 and to form the backdrop to further examination of a possible contribution from nuclear power in the 1990s.

Natural Gas

47. Natural gas from Germany entered the Danish market for the first time in a limited way in October 1982. Gas from the Danish fields (see below) is expected to be used from October 1984 following the completion of the major part of the transmission system. The municipalities which are to be supplied with this gas have organised five regional gas companies to supply and deliver gas to households. Preparations for the introduction of gas on a significant scale from 1985 are apparently now well under way, despite some initial organisational difficulties. Latest forecasts are that under the Heat Plan Danish natural gas will meet 15-20% of heat demand in the year 2000, second only to surplus heat from cogeneration plants, refuse incineration plants and industry, which is expected to cover around 35% of expected demand.

Two gas export contracts have been signed with Germany and Sweden, starting in 1984 and 1985 respectively.

48. Forecast penetration in the domestic market remains high and may now be overambitious. The very success of the Danish energy saving programme in the residential sector is likely to constrain the growth in gas demand despite the effective ceiling set for prices. The outlook for industrial gas use is also far from certain. The pricing arrangements, on the other hand, have opened up the risk, in a situation of declining oil prices, of a gap between gas prices and the full costs of gas supply to the consumer taking into account the high costs involved in bringing the gas ashore and amortising the construction of a complex distribution network. It is now estimated by the authorities that the natural gas project, which involves investments of 15 bn Dkr for the grid alone, will have a payback period of 25 years. Considerable efforts will need to be made to try to minimise the costs of the operation so that the return can be maximised and the financial outlook for DONG, the State company which is responsible for buying the gas at the well-head and bringing it ashore, improved.

Offshore Hydrocarbon Exploitation

49. Proven reserves of gas were 81.8 bcm at the end of 1982, equivalent to some 30 years gas consumption on the basis of projected 1990 consumption. Oil reserves are considerably smaller in relation to projected requirements but if development goes according to plan, Denmark will be producing over two-fifths of its own needs for oil in 1990 and

this could increase still further in the 1990s before tailing off unless new discoveries are made. The Government has made clear its interest in ensuring that exploration efforts continue.

50. In that latter context there have been important changes recently in the arrangements for North Sea concessions. Up until 1 January 1982 exploration and development in the Danish sector of the North Sea were in the hands of one concessionaire (DUC). Following negotiations between DUC and the Danish Government, half of the area was relinquished to the Government at the beginning of 1982. A first licensing round was announced in the summer of 1983 and thirty-two companies have submitted applications. Exploration activity is on the increase.

51. On the fiscal side, there have been no major changes; there are high rates of tax on successful discoveries but these are not as high as those of UK and Norway and do not appear to have deterred exploration and development efforts. Special taxation arrangements are in force to encourage the development of small fields.

New and Renewable Energies and New Technologies

52. In the summer of 1981 the Parliamentary Finance Committee approved a proposal for separate Government funds for activities to **commercialise new technologies**, the main aim being to assist the introduction of new technologies based on research results from Government research programmes. These funds are managed by a special secretariat for R, D & D. In addition there are grants of up to 30% of cost to users of renewable technologies. Some 152 million Dk have been granted since 1980, mainly for **windmills** (84 million) and **heat pumps** (52 million). These sums are much smaller than total public sector spending on energy saving but they are important reflections of a continuing wish to develop and introduce these technologies despite short-term oil market developments. This wish has been confirmed by the present Government. In addition to these subsidy programmes, DONG has a programme of exploration and development of **geothermal energy** to provide heat supplies to those areas which will not be connected to the gas distribution network or to a district heating system supplied from cogeneration.

CONCLUSIONS

In Denmark there has been an impressive switch away from oil over the past ten years as a result of the shift to coal for power generation, vigorous energy saving policies, realistic energy pricing and high energy taxation, and the development of collective heat arrangements. Further consolidation of progress away from oil is planned, bringing projected oil dependence down to 52% by 1990.

Important decisions have been taken to develop Denmark's offshore hydrocarbon resources. Offshore oil now meets 15% of Danish oil requirements and by 1990 this could be as high as 40%. Natural gas is planned to play an increasingly important rôle in the domestic and industrial heat supply systems as the decade progresses.

The Danish experience in energy conservation and district heating should be of considerable interest to other Community members. The Commission has already suggested in its report on investment in the rational use of energy that certain Danish practices could usefully be imitated. The continuing support for the commercialisation of new technologies is also to be commended.

Energy planning in Denmark has produced very successful results. The expertise developed in this field needs to be brought to bear to help minimise the costs involved in the introduction of natural gas into the energy system.

Early action is also desirable in the light of the reports expected during the coming months on nuclear safety and waste disposal so as to facilitate planning of the electricity supply system for the 1990s.

Table 1 Summarized Energy Balance - DANMARK

in million toe	1973[a]	1979[a]	1982[a]	1985[b]	1990[b]
I. **Gross Energy Consumption**	20,21	20,73	17,36	19,0	19,5
- Bunkers	0,68	0,42	0,48	0,5	0,4
- Inland consumption	19,53	20,31	16,88	18,5	19,1
II. **Inland Energy Consumption**	19,53	20,31	16,88	18,5	19,1
- Solid fuels	2,32	4,35	5,74	7,1	7,3
- Oil	17,23	15,67	10,96	10,6	9,7
- Gas	-	-	-	0,7	1,9
- Primary electricity, etc.	-0,02	0,29	0,18	0,1	0,2
III. **Indigenous Production**[1]	0,07	0,43	1,70	4,1	6,6
- Hard coal	-	-	-	-	-
- Lignite & peat	-	-	-	-	-
- Oil	0,07	0,43	1,70	3,0	4,0
- Natural gas	-	-	-	1,0	2,4
- Nuclear energy	-	-	-	-	-
- Hydro & geothermal[2]	0,00	0,00	0,00	0,0	0,0
- Others & renewables	-	-	-	0,1	0,2
IV. **Net Imports**[3]	20,28	20,20	15,47	14,9	12,9
- Solid fuels	1,96	4,62	5,77	7,1	7,3
- Oil	18,34	15,29	9,53	8,1	6,1
- Natural gas[2]	-	-	-	-0,3	-0,5
- Electricity[2]	-0,02	0,29	0,17	-	-
V. **Stock changes**[4]	+0,14	-0,09	-0,19	+0,0	+0,0
- Solid fuels	-0,36	+0,28	+0,03	..	..
- Oil	+0,50	-0,37	-0,22	..	..
- Gas	-	-	-	+0,0	+0,0
VI. **Electricity Generation Input**	4,66	5,53	5,74	6,6	6,7
- Solid fuels[5]	1,82	3,62	5,27	6,1	6,0
- Oil	2,84	1,91	0,47	0,5	0,6
- Natural gas	-	-	-	-	-
- Nuclear energy	-	-	-	-	-
- Hydro & geothermal[2]	0,00	0,00	0,00	0,0	0,0
- Others & renewables	-	-	-	-	0,1
VII. **Electricity Gross Production** (in TWh)	19,12	22,47	23,74	27,8	31,9
- Hydro & geothermal[6]	0,02	0,03	0,03	(0,03)	(0,03)
- Nuclear	-	-	-	-	-
- Conventional thermal	19,10	22,44	23,71	(27,8)	(31,9)
VIII. **Electricity Gross Consumpt** (in TWh)	18,90	25,58	25,77	27,8	31,9

Sources: a. Statistical Office of the European Communities.
b. Review of National Energy Programmes 1983. Danmark - July 1983.

Notes:
1. Production of primary sources, including recovered products.
2. The conversion of electricity, including hydro and geothermal, is based on its actual energy content: 3600 kjoules/kWh or 860 kcal/kWh.
3. The (-) sign means net exports.
4. The (-) sign means a stock decrease.
5. Including coke oven gas and blast furnace gas (derived from coal)
6. Without pumped storage hydroelectricity.

General notes:
1° figures submitted by Member States have been adapted where necessary to ensure consistency with SOEC statistical definitions or conversion factors.
2° direct comparisons between 1982 and 1985 are not always possible, given that some forecasts use 1980 or 1981 as the basis for projection.

Table 2 MAIN ENERGY INDICATORS - DANMARK

(related to 1990 Objectives)

	1973	1979	1982	1985	1990
I. Share of Oil in Gross Energy Consumption	88.6%	77.6%	65.9%	58.4%	52%
II. Fuel inputs to Electricity production(1): Shares taken by:					
- Solid fuels	39.1%	65.5%	91.8%	92.4%	90%
- Nuclear	-	-	-	-	-
- Hydro and others	0%	0%	0%	0%	1%
- Natural Gas	-	-	-	-	-
- Oil	60.9%	34.5%	8.2%	7.6%	9%
III. Supply dependence on:(2)					
- Imported oil	90.8%	73.8%	54.9%	42.6%	31%
- Imported solid fuels	9.7%	22.3%	33.2%	37.4%	37%
- Imported natural gas	-	-	-	-	-
IV. Share of imports in (3) gross consumption of:					
- Energy	99.6%	97.4%	89.1%	78.4%	66%
- Oil	99.6%	95.0%	83.3%	73.0%	60%
- Solid fuels	100%	100%	100%	100%	100%
- Natural gas	-	-	-	-	-

	1973/63	1975/73	1979/75	1982/79	1990/85
V. Average annual growth rates:					
G D P	+4.5%	-0.9%	+3.6%	+0.9%	+2.9%
Inland Energy consumption	+5.3%	-5.3%	+3.8%	-6.0%	+0.6%
Final Energy consumption(4)	+5.4%	-5.8%	+3.4%	-7.3%	+1.4%
VI. Energy coefficient (5)	1.18	-	1.06	-	0.21

	1973	1979	1982	1985	1990
VII. Energy ratio (6) (in kg oe per 10^3 DKR)	88.8	81.7	66.3	68.6	61.4
VIII. Energy intensity (7) (in kg oe per 10^3 DKR	71.7	65.2	50.1	51.9	48.2

Sources and General notes: see footnotes under Table 1

Notes:
1. Basic data expressed in oil equivalent terms.
2. Respective shares of imported oil, imported natural gas or imported solid fuels in gross energy consumption.
3. Share of each imported energy source, in gross consumption of that source.
4. Non energy use included.
5. Energy coefficient = ratio between growth rates of Inland Energy consumption and GDP.
6. Energy ratio = volume of inland energy consumption per unit of GDP, expressed in real terms, at 1975 prices. (in kg of oil equivalent per unit of national currency).
7. Energy intensity = final energy demand per unit of GDP expressed in real terms, at 1975 prices.

Table 3 TRENDS IN FINAL ENERGY CONSUMPTION - DANMARK

	1973	1979	1982	1985	1990
INDUSTRY:					
Energy consumption (1) (in million toe)	3.37	3.32	2.26	(2.9)	(3.6)
Share in final consumption	21.4%	20.5%	17.7%	20.7%	24.0%
Energy consumption per unit of value-added(2) (in kg oe per 10^3 DKR)	74.83	67.72	44.79	53.49	57.83
TRANSPORT:					
Energy consumption (1) (in million toe)	3.21	3.41	3.17	3.3	3.4
Share in final consumption	20.3%	21.0%	24.8%	23.6%	22.7%
Energy consumption per unit of GDP (3) (in kg oe per 10^3 DKR)	14.59	13.71	12.45	12.24	10.93
HOUSEHOLDS, etc...					
Energy consumption (1) (in million toe)	9.20	9.47	7.33	(7.8)	(8.0)
Share in final consumption	58.3%	58.5%	57.5%	55.7%	53.3%
Energy consumption per unit of private consumption (4) (in kg oe per 10^3 DKR)	76.87	70.52	55.44	57.16	54.15
FINAL ENERGY CONSUMPTION (in million toe) (1)	15.78	16.20	12.76	14.0	15.0
of which: Oil	84.5%	79.5%	74.0%	65.7%	54.7%
Final non-energy use (in million toe)	0.62	0.41	0.48	0.5	0.5

Sources and General Notes: see footnotes under Table 1

Notes: (1) non-energy use, not included.
(2) volume of energy consumed in the industrial sector, per unit of value-added produced by industry, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(3) volume of energy consumed in the transport sector, per unit of GDP, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(4) volume of energy consumed in the residential + tertiary sector, per unit of Private Consumption, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).

GERMANY

ENERGY TRENDS

53. The German industrial economy, like that of the United Kingdom, was fuelled originally by indigenous coal. In the 1950s and 1960s imported oil (complemented by a limited indigenous contribution), together with a growing (though much smaller) contribution of gas and a very rapid growth in the direct use of electricity, brought major changes in the pattern of primary energy consumption. But hard coal (as well as lignite) was continuing to play a major rôle, notably in the electricity-generation field, even before the first oil crisis.

In 1973, oil accounted for over 56% of primary energy consumption (and net oil imports for over 95% of available oil supply); solid fuels (of which Germany was a net exporter) for nearly 32%; gas for 10%. Already in 1973 **72%** of German electricity was produced from solid fuels (68%) and nuclear (4%), with oil accounting for only 14% of primary energy inputs to electricity generation.

54. When the second oil crisis occurred in 1979/80 the contribution of nuclear power had risen to 12.5% of electricity supply. **Natural gas**, whose use in power stations had increased by nearly 60% since 1973, had become the second most important fuel in electricity generation after solid fuels. Growth in solid fuel use in electricity-generation had been modest and had failed to counteract the decline in solid fuel use in other sectors. Overall use of solid fuels fell by nearly 4% or 3 mtoe between 1973 and 1979.

Between 1973 and 1979 natural gas consumption (based on a considerable expansion of imports, notably from the Netherlands) as a whole grew by 68% (18.4 mtoe) to make up nearly 17% of inland energy demand in 1979 compared to only 10% in 1973. Over the same period inland energy demand grew by around 7% and oil demand fell by over 2.5% (or over 3 mtoe) while GDP grew by more than 15%. The intensity of final energy demand fell by around 7%.

55. Since the second oil crisis there has been a **sharp decline in inland oil use** (-24% 1979-82) and in **overall energy demand** (-12%) despite economic growth of 3.7% over the period; a substantial increase in the contribution of **nuclear power**; and a halt, indeed a **reversal of the trends in gas use**, notably in industry (overall gas use, however, began to pick up again slightly in 1983).

In 1982 oil accounted for only 44.5% of total energy demand; and solid fuels (64%) and nuclear (19%) for 83% of inputs to electricity production.

THE EVOLUTION OF ENERGY POLICY

56. The German Government agreed a basic energy programme just before the 1973 oil crisis. This was then reviewed in 1974, 1977 and most recently in 1981.

The essence of the immediate reaction to the 1973 crisis was a strategy aimed at reducing overall oil consumption through the development of **nuclear power**, encouraging further **domestic coal use** in the electricity sector, increased **natural gas imports**, and the **prohibition of new oil and gas-fired power plants.**

Energy conservation policy received very little attention before 1976-77. But the Second Revision of the German Energy Programme in 1977 gave increased importance to energy conservation, coupled with a more conservative view of the outlook for nuclear power, which had not developed as rapidly as planned because of political opposition and delays in reaching agreements on nuclear sites.

57. The Third Revision of the Energy Programme was adopted by the Federal Government in November 1981 and endorsed by the Bundestag in June 1982.

The main features of the Programme were:

(i) a wide-ranging set of energy conservation measures. **Regulations** (e.g. thermal insulation standards); **voluntary agreements** (e.g. on energy consumption of new automobiles); **fiscal and financial incentives** (tax credits for energy saving investments in buildings, grants towards investment costs of heat pumps, etc). These are discussed further in the Commission's separate report on energy saving programmes.

(ii) a continuing commitment to the German hard coal industry. Increasing sales of German hard coal to power stations remained guaranteed up to 1995[4], together with continuing support of coking coal sales to the steel industry. The programme called for the development of new coal fields in the context of a stabilisation of hard coal output. It looked forward however to reductions in Government investment aids and other coal subsidies.

(iii) streamlined licensing procedures for nuclear power. The constitutional structure of Germany requires close coordination of policy and harmonisation of State and Federal interests in the development of Germany's energy programmes. The difficulties

[4]This is formalised in a contract between the hard coal mining industry and the electrical power industry which also provides for a pro-rata increase in hard coal imports above a fixed ceiling once the commitments to take minimum quantities of German coal are met.

encountered in the 1970s in defining the respective responsibilities of Federal and State Governments in the siting of nuclear power stations, together with successful court actions in some states preventing the development of specific sites, were major factors in slowing down the nuclear power programme. In 1980 the Government announced the opening of negotiations with the states (Länder) and the industry to investigate possibilities for clarifying the legal position of the respective parties involved and for accelerating the administrative procedures. The 1981 programme marked the successful achievement of a consensus on the main lines of action, intended to ensure a more rapid implementation of the nuclear power programme.

(iv) a new incentive scheme for CHP/DH. District heating has a long tradition in Germany and, according to the 1981 programme, supplied at that time 1.4 million dwellings and accounted for 8% of room and water heating. For a number of years both Federal and State Governments have provided financial support for DH/CHP, notably investment grants (up to 35% of cost) under the Programme of Investment for the Future (these terminated in 1981); investment allowances for DH; grants towards the construction of or conversion to coal-fired CHP stations; 25% grants (up to 1982) or special tax write-offs for connection of centrally-heated buildings to DH systems. The 1981 Programme announced a new programme of financial support of DM 1.2 bn over five years for the development of district heating, with Federal and State Governments each paying half the share. The objective was to double heat supplies to consumers from 4 mtoe in 1980 to 8 mtoe by 1995.

(v) the importance of security and flexibility of gas supplies. The programme suggested that the use of natural gas would increase during the 1980s, in industry and especially in the domestic sector. The rising share of gas and the changing pattern of consumption were recognised to have important implications for gas storage requirements; the development of the gas grid; and the flexibility of external supplies.

(vi) the aim of greater diversification of oil supplies. During the past few years dependence on the Middle East has fallen sharply and the North Sea now predominates as a source of supply.

(vii) restructuring of the oil refining industry to reflect the new demand situation and especially the fall in heavy fuel oil demand. Considerable progress has already been achieved by the companies without financial intervention by the Government.

58. In his policy statement of May 1983 the new German Chancellor made clear that the energy policy objectives formulated in this programme remained valid after the change of Government of autumn 1982 and the elections of March 1983. But the changing energy situation and outlook have inevitably brought subsequent changes in some sectors. These are discussed further below. In the meantime a major new energy forecasting exercise is under way so as to prepare a better basis for future policy determination.

THE ENERGY OUTLOOK

59. The Federal Government does not make its own energy balance projections which are prepared instead by independent research institutions.

The 1981 Energy Programme included projections by three Institutes[5] to 1995, based on **1978** energy data. At that time, and on the basis of their own chosen assumptions about macro-economic growth rates 1978-1995 (2.7, 3.4 and 2.2% a year respectively) the Institutes projected increases in final energy demand of 0.5%, 0.7% and 0.4% a year and of 1.1%, 1.4% and 1.0% a year in primary energy demand. The Institutes also expected a distinct change in the shares of individual sources of energy by 1995: oil demand was expected to fall in volume terms by all three Institutes; hard coal use was expected to rise to between 60-65 mtoe by 1990; natural gas use would continue to rise but less quickly than in the past; and nuclear capacity to rise to 26.5 Gw in 1990 and 37-39.5 Gw in 1995. Electricity demand, despite high levels of penetration, would continue to rise faster than total energy consumption and faster even, on some scenarios, than GDP growth (between 2.7% and 3.2% a year).

60. It is recognised by the German authorities that the 1981 projections do not as a whole reflect any longer a tenable picture of likely future developments given the changes on the energy markets since 1979/80. A set of new projections on three different GDP growth assumptions has been commissioned by the Government (this time of one single Institute), the results of which should be available in the spring of 1984. These will include estimates up to 2000. In the meantime some limited adjustments have been made to the 1981 projections by the authorities themselves, notably in respect of:

- solid fuels demand (down to 88 mtoe in 1990) and domestic solid fuels production;

- nuclear power contribution (down to 36 mtoe - on SOEC conventions); and

- nuclear capacity (23 Gw).

No significant changes have been made to projected levels of gas supply and use, even though previous projections were prepared before the decline in gas use experienced in the past 3 years (see below). Projections made by some of the oil companies during 1983 suggest, however, a rather lower level of gas demand in 1990 than projected by the Institutes in 1981. The projections shown in Table 1 also point to a **volume increase in oil demand** outside the electricity generating sector. The German authorities have indicated more recently however, that these projections of oil demand are too high.

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[5] Deutches Institut für Wirtschaftsforschung in Berlin, Energiewirtschaftliches Institut at the University of Cologne and Rheinisch-Westfälisches Institut für Wirtschaftsforschung in Essen.

SECTORAL AND HORIZONTAL DEVELOPMENTS

Energy Pricing Policy

61. Oil product prices are not regulated in Germany, nor the prices of natural gas and (in general) electricity. The rôle of the Federal cartel office (Bundeskartellamt) is seen as important in avoiding abuse of dominant positions. However:

- domestic coal prices are subsidised partly through a special levy on electricity consumers (the so-called "coal penny" (Kohlepfennig) amounting now to 3.5% of the price of electricity;

- electricity tariffs to small-scale consumers are subject to approval by the Länder Governments.

The Commission will be examining developments further in its report on pricing policy which is to be published shortly. Pending the conclusions of that report it can be stated as a general proposition that the absence of Government controls over prices and of subsidies to the gas and electricity industries has allowed prices, on the whole, to play a helpful rôle in encouraging the substitution of oil products and increased energy efficiency.

Energy Efficiency

62. The intensity of final energy demand has fallen significantly in Germany over the past ten years both in industry and in the residential and tertiary sectors. Even allowing for the effects of structural change (the shift away from heavy industries) in improving the overall industrial figures, the performance is good and indicates very real improvements in the efficiency of energy use. Germany has the lowest level of intensity of final energy use in industry in the Community.

63. This performance has been encouraged in the past five years, in particular, by a wide-ranging set of voluntary and mandatory measures, information campaigns and financial incentives.

In 1982 Germany had the third largest per capita Government spending on energy saving (excluding R, D & D and information campaigns) in the Community (after the Netherlands and Denmark).

64. In September 1982 the Federal Government submitted to Parliament a report on the results of energy savings measures. The Parliament also received a related report commissioned by the Federal Ministry of Economic Affairs and compiled by the IFO Institute (Munich). The Government report to Parliament estimated that policy measures since 1978, in combination with the effects of higher prices, had led to real savings of 3.5% in gross primary energy demand.

65. There have been important changes in the past year in the support for conservation in the residential sector. Over a number of years there have been financial subsidies and tax reliefs for insulation, upgrading of heating systems, application of new technologies and hook-up with district heating. The subsidy scheme expired at the end of 1982 and the fiscal incentive scheme in mid-1983. In May 1983 the Federal Government decided to introduce a new fiscal incentive scheme only, to promote the application of new technologies in support of energy saving and sustain support for connection to district heating. This new scheme should come into effect in spring 1984. Financial support for measures such as insulation has now been discontinued, the authorities considering that sufficient momentum has already been achieved in this area.

Combined Heat and Power/District Heating

66. The 1981 Energy Programme gave particular emphasis to the encouragement of cogeneration of electricy and heat (noting that about 18% of total German electricity production capacity was already provided by cogeneration plant) and district heating. In 1979 the electrical power industry and industrial electricity producers entered into an Agreement on Cooperation in Electricity Production so as to facilitate the more flexible use of industrial electricity and waste heat. For a number of years also grants have been available for help with construction and conversion of coal-fired cogeneration plants. District heating itself has been encouraged by a large programme of financial support for heat suppliers (investment allowances and subsidies) and for consumers (see above).

67. The Government believes that it will be possible to raise the share of district heating considerably up to 1990. But progress is slower than envisaged. There could be difficulties for the future as a result of competition from gas and electricity directly and the new environmental legislation which is likely to affect coal-fired plant (see paragraph 71 below).

Solid Fuels

Coal Production

68. During the past two years there has been a sharp decline in the sales of German coking coal to the German and European steel industries. This and a consequent substantial rise in stocks, has contributed to a significant deterioration in the financial situation of the German hard coal mining industry. With total output at 90 mt (coal tonnes) a year, overcapacity is considered by the German authorities to amount to about 10 mt.

These developments led to the decision at the end of 1982 to close the first German coal pit for 10 years; to arrangements for adjustments to the numbers of shifts worked; short-time work and so on. Against that background the Federal Government began a series of discussions in 1983

(the so-called "coal round") involving the states (Länder) concerned (North Rhine-Westphalia and Saarland), the coal mining industry and the mining unions. These discussions have resulted in a recognition on all sides of the need to find ways of bringing capacity more into line with demand without causing redundancies in the industry. The companies are in the process of drawing up programmes to this end. The financial pressures on the industry are very serious. The Government is providing substantial financial support for the adjustment process but some of the costs of short-time working have to be borne by the companies themselves. Information supplied by the German authorities for this year's review exercise points to a reduction in indigenous hard coal supply of 5 mtoe or 8% between 1982 and 1990. Even this could be optimistic unless there is a sustained upturn in demand, despite the protection afforded to German coal by the guaranteed minimum offtake by the electricity industry, the "coal penny" system whereby a share of the extra costs of burning German coal is recouped from the electricity consumer, and restrictions on imported coal (on which a new regime has been in force since January 1981).

69. Apart from the Federal Government's subsidies to domestic coal production substantial subsidies were provided in 1983 for sales of coking coal to other Community countries.

Solid fuel use and the environment

70. Overall solid fuel use is currently projected to rise by 6% or 5 mtoe 1982-1990. Over two-thirds of this is accounted for by electricity-generation, where **domestic lignite** plays an important rôle (around one-quarter of inputs to total electricity production). Industrial solid fuel (mainly hard coal) use has declined in the past year, principally because of the steel industry and is not expected to recover fully the lost ground.

71. In response to the concern over the growing problem of emissions from coal-fired power generating plants in particular, the Federal Government introduced in June 1983 much more stringent controls on emissions than had previously applied. The Statutory Ordinance on Large-Scale Combustion Installations provides for new controls on emissions of SO_2, NO_x, CO and dust. As regards SO_2 emission, new combustion installations with a heat output of 300 MW and over must not exceed a ceiling of 400 mg/m^3 flue gas. Existing installations must observe the ceiling by 1993 at the latest.

72. The capital investment by power stations in installing desulphurisation equipment to meet the provisions of the Ordinance is estimated by the German authorities to cost between DM 8 bn and DM 13 bn. In consequence, the cost of electricity generated from solid fuels will rise by an average of 2.0 Pfennig/kWh. The overall effects on electricity prices will be of the order of 1.0 Pfennig/kWh (or some 6% on average).

73. The implications of these measures for projected solid fuel consumption are not yet reflected in the energy projections.

Nuclear energy

74. Germany has the second largest nuclear capacity in the Community (after France) and the third largest share of electricity generated from nuclear (after France and Belgium). Nuclear generating capacity was 9.8 Gw at the end of 1982 (11.0% of total capacity) and provided 17.3% (63.6 Twh) of electricity generated in that year. According to the latest information from the German authorities, capacity has now risen to 11.7 GW.

75. The effective moratorium on new construction permits came to an end in 1982 when, following the streamlined licensing procedures agreed between the Federal and State authorities, three new PWR plants received partial construction permits. These plants are expected to be commissioned by 1990, bringing total capacity to 23 Gw. The authorities are confident that the lead-times for completion of these three stations will be significantly lower than that of the nine other power stations (total capacity 8.6 Gw) currently under construction.

Capacity projected by the companies for 1995 has been scaled down to 28 Gw.

The ability of the electricity industry to make full use of this capacity will depend on the outlook for electricity demand and could be affected also by the provisions for minimum use of German coal in power stations.

Electricity

76. The shares of solid fuels and nuclear in inputs to electricity production are expected to change substantially by 1990, with solid fuel's share declining to 53% and nuclear's rising to 32%. The trends could be reinforced in the 1990s.

Current projections assume that electricity use will continue to grow much more quickly than energy demand, with electricity substituting increasingly for oil in the heating market. Gross electricity demand is expected to grow by some 22% 1982-1990. Electricity demand picked up markedly in 1983 after stagnation during the previous three years and if this trend is sustained the projections could conceivably be realised. But there seems likely to be increasing competition with natural gas, notably in the domestic sector, which is accentuated by the constraint on the further reduction of electricity costs imposed by the coal protection system.

77. The electricity supply companies in Germany are private companies in which the Federal Government, states and municipalities often have substantial share-holdings. The related and very distinct feature of the electricity system in Germany, compared with other Member States, is its

relative regionalisation, both in organisational and technical terms, and a consequentially more regionalised system of internal energy transfer. This constitutes a further constraint on the optimisation of the cost-effectiveness of electricity supply on a national basis.

Despite delays in new plant construction programmes (mainly nuclear) reduced electricity demand has led to high plant margins in recent years. However, this situation could be eliminated in the event of a return to higher electricity growth rates.

Natural Gas

78. Natural gas currently meets 15% of inland energy demand and around 10% of inputs to the electricity sector. Imports of natural gas meet over two-thirds of requirements (half coming from the Netherlands, 30% from the Soviet Union and 20% from Norway).

Natural gas demand is projected in Table 1 to increase by 1990 by more than one-quarter over its 1982 level and imports by 43%, with the USSR accounting for around 30% of total German gas supplies in 1990 and around 45% of imports. Of the total projected **increase** in gas use (13 mtoe), some 3 mtoe will be used in power stations, 3-4 mtoe in the residential/tertiary sector and 7-8 mtoe in industry. Industry should therefore become the most important market. There are many uncertainties attached to these figures. In industry the trends are likely to be influenced by the level of dual-fired oil/gas capacity and the relative movements in the prices of gas and those of competing oil products. In the past two-three years there has been a good deal of short-term switching from gas to oil as the relative price of oil has fallen but gas prices themselves have fallen by 3-4% during 1983 and demand for gas has revived a little. In the residential space-heating sector progress will depend essentially on the competition from electricity and district heating but the gas companies are engaged in an aggressive marketing campaign. More than 50% of new houses, moreover, are being connected to the gas grid. The German authorities are confident that minimum levels of offtake under import contracts can be absorbed without a higher projected level of gas burn in power stations than currently envisaged, and there are capacity limitations which would themselves restrict the total feasible level.

New and Renewable Energies and New Energy Technologies

79. The available forecasts suggest that new and renewable energies will make only a minor contribution to German energy supply in the foreseeable future. The contributions from heat pumps and solar are currently expected to amount to 2 mtoe in 1990 and 4 mtoe in 1995, which would represent at most 1% and 2% of total final consumption respectively. The German Government, however, continues to devote high levels of spending to R, D & D on new technologies in order "to assist the market introduction of new technologies" (1981 Energy Programmes). The focal points of R, D & D support are heat pumps, solar energy, wind and biomass.

80. In addition, the German Government is continuing to support technologies for the conversion of coal to gas or liquid. In 1981 provisions were made for investment grants (generally up to 40% of cost) for demonstration projects in the field of coal gasification and has subsequently promised official assistance for two coal gasification plants amounting to a total of DM 380.36 million. The Government is still considering the possibility of support for one large-scale coal-liquefaction plant in the light of preliminary studies now completed. Support for this area is seen as providing potentially the basis for exports of technology rather than, necessarily, new outlets for German coal.

CONCLUSIONS

During the past ten years Germany has consolidated an already relatively diversified structure of energy supply and demand by significantly greater recourse to nuclear energy, continuing commitments by the electricity industry to the German hard coal industry, more widespread use of natural gas and important improvements in the intensity of energy use. The process of change has been encouraged by a generally market-based approach to energy pricing and vigorous policies to improve energy efficiency. This process can be expected to continue, but:

(i) the out-of-date nature of current energy projections rules out a proper evaluation of the likely **level** and **pattern** of fuel use at the end of the decade and into the 1990s. The new projections likely to be available in the spring of 1984 are particularly important for an assessment of the outlook for electricity demand, solid fuels use and natural gas, where there are major uncertainties;

(ii) further difficult decisions could be required in the hard **coal mining** industry so as to adjust to a new and more depressed market outlook. These will have social as well as energy repercussions;

(iii) a clearer picture will need to be developed soon of the prospective rôles for nuclear and solid fuels in **electricity generation in the 1990s,** bearing in mind the likely outlook for demand, progress in the nuclear sector and the commitments relating to the burning of German coal;

(iv) those commitments, entered into at a time when demand expectations were higher than today, inevitably raise the **average costs of German electricity production** in more depressed market conditions. The new and more stringent environmental legislation will also impact on electricity costs (and those of coal based district heating). Continuing attention should be paid to the implications of this cost structure;

(v) there is a continuing need to exploit the scope for **reducing oil demand outside the electricity generating sector.** On some projections at least oil consumption shows an increase in volume terms over the period to 1990. These may be unrealistic, but the outlook needs to be kept under careful review and further opportunities for reducing oil dependence vigorously sought.

Table 1 SUMMARIZED ENERGY BALANCE - DEUTSCHLAND

in million toe	1973[a]	1979[a]	1982[a]	1985[b]	1990[b]
I. **Gross Energy Consumption**	265,79	284,68	250,95	288,9	300,6
- Bunkers	3,58	2,87	2,70	3,0	3,0
- Inland consumption	262,21	281,81	248,25	285,9	297,6
II. **Inland Energy Consumption**	262,21	281,81	248,25	285,9	297,6
- Solid fuels	83,16	80,20	81,37	81,8	88,4
- Oil	146,21	142,95	109,04	125,0	119,0
- Gas	26,99	45,36	38,31	50,0	51,0
- Primary electricity, etc.	5,85	13,30	19,53	29,1	39,2
III. **Indigenous Production**[1]	119,18	121,91	124,77	130,9	140,6
- Hard coal	69,13	61,75	63,15	83,8)	82,4)
- Lignite & peat	22,92	26,09	25,77	)	)
- Oil	7,14	5,14	4,42	4,0	5,0
- Natural gas	15,02	15,68	12,48	15,0	14,0
- Nuclear energy	3,05	10,73	16,52	(25,7)	(36,4)
- Hydro & geothermal[2]	1,20	1,46	1,54	(1,5)	(1,5)
- Others & renewables	0,72	1,06	0,89	(0,9)	(1,3)
IV. **Net Imports**[3]	147,41	163,23	130,12	158,0	160,0
- Solid fuels	-10,15	-12,15	-0,34	-2,0	+6,0
- Oil	144,65	144,87	104,05	124,0	117,0
- Natural gas	12,03	30,45	25,83	35,0	37,0
- Electricity[2]	0,88	0,06	0,58	1,0	-
V. **Stock changes**[4]	+0,81	+0,47	+3,93	..	..
- Solid fuels	-1,27	-4,51	+7,22	..	..
- Oil	+2,01	+4,19	-3,28	..	..
- Gas	+ 0,07	+ 0,79	-0,01	..	..
VI. **Electricity Generation Input**	69,50	85,71	85,88	97,1	113,2
- Solid fuels[5]	47,02	51,16	54,74	52,0	60,0
- Oil	9,75	6,46	3,94	4,0	3,0
- Natural gas	7,76	14,83	8,25	13,0	11,0
- Nuclear energy	3,05	10,73	16,52	(25,7)	(36,4)
- Hydro & geothermal[2]	1,20	1,46	1,54	(1,5)	(1,5)
- Others & renewables	0,72	1,07	0,89	(0,9)	(1,3)
VII. **Electricity Gross Production** (in TWh)	297,46	370,66	365,13	399,5	454,5
- Hydro & geothermal[6]	13,98	16,98	17,90	(17,5)	(17,5)
- Nuclear	11,76	42,29	63,58	99,0	140,0
- Conventional thermal	271,72	311,39	283,65	283,0	297,0
VIII. Electricity gross consumpt (in TWh)	309,29	372,81	373,67	(410,0)	454,5

Sources: a. Statistical Office of the European Communities.
b. Review of National Energy Programmes 1983.
Federal Republic of Germany - 1st August 1983.

Notes: 1. Production of primary sources, including recovered products.
2. The conversion of electricity, including hydro and geothermal, is based on its actual energy content: 3600 kjoules/kWh or 860 kcal/kWh
3. The (-) sign means net exports.
4. The (-) sign means a stock decrease.
5. Including coke oven gas and blast furnace gas (derived from coal).
6. Without pumped storage hydroelectricity.

General notes:
1° figures submitted by Member States have been adapted where necessary to ensure consistency with SOEC statistical definitions or conversion factors.
2° direct comparisons between 1982 and 1985 are not always possible, given that some forecasts use 1980 or 1981 as the basis for projection.

Table 2 MAIN ENERGY INDICATORS - DEUTSCHLAND

(related to 1990 Objectives)

	1973	1979	1982	1985	1990
I. Share of Oil in Gross Energy Consumption	56.4%	51.2%	44.5%	44.3%	41%
II. Fuel inputs to Electricity production(1): Shares taken by:					
- Solid fuels	67.6%	59.7%	63.8%	53.5%	53%
- Nuclear	4.4%	12.5%	19.2%	26.5%	32%
- Hydro and others	2.8%	3.0%	2.8%	2.5%	2%
- Natural Gas	11.2%	17.3%	9.6%	13.4%	10%
- Oil	14.0%	7.5%	4.6%	4.1%	3%
III. Supply dependence on:(2)					
- Imported oil	54.4%	50.9%	41.5%	42.9%	39%
- Imported solid fuels	-	-	-	-	2%
- Imported natural gas	4.5%	10.7%	10.3%	12.1%	12%
IV. Share of imports in (3) gross consumption of:					
- Energy	55.5%	57.3%	51.9%	54.7%	53%
- Oil	96.6%	96.5%	96.0%	96.9%	96%
- Solid fuels	-	-	-	-	7%
- Natural gas	44.6%	67.1%	67.4%	70.0%	73%

	1973/63	1975/73	1979/75	1982/79	1990/85
V. Average annual growth rates:					
G D P	+4.5%	-0.5%	+3.9%	+0.4%	+2.3%
Inland energy consumption	+4.3%	-4.3%	+4.1%	-4.1%	+0.8%
Final energy consumption(4)	+4.7%	-4.8%	+3.8%	-5.2%	+0.2%
VI. Energy coefficient(5)	0.96	-	1.05	-	0.35

	1973	1979	1982	1985	1990
VII. Energy ratio(6) (in kg oe per 10^3 DM)	253.1	235.4	205.1	223.9	208.1
VIII. Energy intensity(7) (in kg oe per 10^3 DM	174.1	160.2	135.6	145.7	131.5

Sources and General notes: see footnotes under Table 1

Notes:
1. Basic data expressed in oil equivalent terms.
2. Respective shares of imported oil, imported natural gas or imported solid fuels in gross energy consumption.
3. Share of each imported energy source, in gross consumption of that source.
4. Non energy use included.
5. Energy coefficient = ratio between growth rates of Inland Energy consumption and GDP.
6. Energy ratio = volume of inland energy consumption per unit of GDP, expressed in real terms, at 1975 prices. (in kg of oil equivalent per unit of national currency).
7. Energy intensity = final energy demand per unit of GDP expressed in real terms, at 1975 prices.

Table 3 TRENDS IN FINAL ENERGY CONSUMPTION - DEUTSCHLAND

	1973	1979	1982	1985	1990
INDUSTRY:					
Energy consumption (1) (in million toe)	68.56	66.45	53.90	66.0	64.0
Share in final consumption	38.0%	34.7%	32.8%	35.5%	34.1%
Energy consumption per unit of value-added(2) (in kg oe per 10^3 DM)	184.6	162.0	136.7	161.5	138.4
TRANSPORT:					
Energy consumption (1) (in million toe)	33.04	39.60	39.88	41.0	39.0
Share in final consumption	18.3%	20.6%	24.3%	22.0%	20.7%
Energy consumption per unit of GDP (3) (in kg oe per 10^3 DM)	31.89	33.08	32.95	32.12	27.27
HOUSEHOLDS, etc...					
Energy consumption (1) (in million toe)	78.84	85.72	70.37	79.0	85.0
Share in final consumption	43.7%	44.7%	42.9%	42.5%	45.2%
Energy consumption per unit of private consumption (4) (in kg oe per 10^3 DM)	132.0	118.1	97.8	107.0	104.1
FINAL ENERGY CONSUMPTION (in million toe) (1)	180.44	191.77	164.15	186.0	188.0
of which: Oil	59.8%	57.2%	51.7%	49.5%	46.8%
Final non-energy use (in million toe)	20.47	19.38	17.20	22.0	23.0

Sources and General Notes: see footnotes under Table 1

Notes: (1) non-energy use, not included.
(2) volume of energy consumed in the industrial sector, per unit of value-added produced by industry, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(3) volume of energy consumed in the transport sector, per unit of GDP, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(4) volume of energy consumed in the residential + tertiary sector, per unit of Private Consumption, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).

GREECE

ENERGY TRENDS

81. Greece has a lower GDP per capita and higher economic growth than any other Member State. Between 1963 and 1973 average annual GDP growth was of the order of 7.7% and energy demand grew even more quickly (13% p.a.), the bulk of it met by a rapid growth in oil imports. In 1973 imported oil provided nearly 90% of total primary energy supplies, the remainder made up by domestic **lignite** (nearly 8%) and **hydropower.**

82. During the past ten years the rate of GDP growth has fallen but the average for the latter half of the 1970s was still high (4.3% a year 1975-1980) and the growth in energy demand above that of GDP, producing an energy coefficient 1979-1975 of 1.4. In 1982 inland primary energy demand was around 30% (3.5 mtoe) above its 1973 level, with around 45% of the increase 1973-82 met by a further rise in oil demand (+1.6 mtoe) and a similar share by the production and use of **domestic** lignite (lignite production virtually doubled over the ten-year period). By 1982 oil dependence had fallen to 73% compared with nearly 81% in 1973, and because of the production of 1 mtoe of oil (nearly 10% of consumption) from the Prinos field dependence on **imported oil** was down to 64%.

THE EVOLUTION OF ENERGY POLICY

83. Policy in the last 10 years has concentrated on the exploitation of **indigenous resources for electricity-generation** (lignite and hydropower); to a more limited extent, on the use of **(imported) coal** in industry; the development of **renewables**; and, since 1975, on the exploration for **hydrocarbons.** The possibility of a **nuclear** contribution to electricity supply in the 1990s has been under examination for some time but there has been no positive decision. Only limited attention has been given to **conservation policy.**

84. Following the election of the new Government in 1981 there were a number of organisational changes in the energy policy field. In mid-1982 a new Ministry of Energy and Natural Resources was created to deal with all energy sectors and to supervise the main state agencies in the energy sectors, notably the Public Power Corporation (responsible for the construction and running of power-stations), IGME (responsible for exploration) and the Public Petroleum Corporation (responsible for hydrocarbon exploration and development). Together with the Ministry of the National Economy the new Ministry of Energy has been involved in the preparation of the important energy component of the new Five-Year Plan.

85. The main aims of policy are now to reduce the share of oil in primary energy to around 55% in 1987, essentially through the development of **indigenous resources.** To that end the Greek authorities give priority to:

- increased **exploration**, notably for **lignite**;
- maximum use of **lignite** not only in electricity-generation, but also through gasification and direct industrial use;
- accelerated development of **renewables**, including hydro-electricity, solar, geothermal and wind.

The authorities also insist on the scope for improved **energy conservation** (and apparently envisage some financial incentives for the industrial sector) and the desirability of more **rational energy pricing**; and are considering the need in the longer-term for a **natural gas network.**

Underlying all this is a **major investment programme.** The authorities wish to see a greater share for Greek industry, as against foreign companies, in business resulting from energy investment.

THE ENERGY OUTLOOK

86. There are as yet no officially endorsed projections of energy supply and demand for 1990. Those given in Tables 1 - 3 are independent projections submitted by the authorities for the review exercise, and must be regarded as provisional. These assume notably:

- a return to relatively high rates of economic growth in the second half of the 1980s (+4.0% p.a.);
- an improvement in the energy coefficient (1985-1990). Because this is still expected to be **positive**, however, both the energy ratio and energy intensity are projected to increase;
- a 250% increase in the consumption of solid fuels, essentially domestic lignite which is expected to meet over 35% of inland energy demand in 1990 and a very major share of electricity production.

SECTORAL AND HORIZONTAL DEVELOPMENTS

Energy pricing policy

87. Energy prices to consumers are set by a Committee of Economic Ministers (KYSYM) and/or a Ministerial Sub-Committee responsible for prices and income questions. The Ministry of Energy is responsible for making the relevant proposals to KYSYM, taking into account economic and social, as well as energy factors. In preparing its proposals the Ministry of Energy liaises with the Ministry of Finance (on tax levels) and the Ministry of Commerce (on retail and wholesale margins).

88. The starting point for oil price determination is a calculation of ex-refinery ratios on the basis of crude import prices and Platts quotations. The existence of a State monopoly of crude oil and oil produce imports results in uniformity in consumer prices (apart from minor regional variations), although some rebates are understood to be given by companies for larger bulk deliveries.

Oil taxes are levied for revenue rather than energy policy reasons. Gasoline taxes are high in relation to Greek income levels. Diesel fuel prices are much lower because the tax on diesel is the same for road use as for household consumption. Private cars are not, however, allowed to use diesel.

89. **Coal** prices are derived from import contracts and are not separately controlled.

90. **Electricity prices** in Greece were held down to generally very low levels until November 1980 when a major tariff increase took place (over 60% increase for a typical domestic consumer). Restraints on prices produced major losses for the Public Power Corporation (PPC) and low self-financing ratios. PPC's objective is to work to a 25% self-financing ratio during the period 1983-1992 to help meet its heavy investment programme (around 4 bn ECU over the period 1983-87). In 1982 and 1983 further moderate price increases did not however enable PPC to cover even its **operating expenses**: this is now the objective for 1984. It is clear that electricity prices still do not cover long-run marginal costs. Given the size of the projected investment programme (see below) and the cost of financing external borrowing, it is clearly essential that progress in rationalising electricity prices should be maintained and indeed accelerated.

Electricity prices in the industrial sector as a whole appear to be low compared with the Community average. Apart from implications for the financing of PPC, low electricity prices to industrial consumers provide no incentive to conservation.

Energy Efficiency

91. In the domestic sector energy consumption is the lowest in the Community and only a small proportion of energy is used for space heating. Building codes for new residential and public buildings (varying according to three climatic zones) have been in force since 1979 and operating standards for new domestic boilers since September 1982. There are no Government financial incentives to promote insulation or investment in more efficient boiler systems; but loan and tax relief arrangements have been available in some cases for the introduction of solar water heaters.

92. In the industrial sector consumption is high although energy intensity has fallen by 12.5% since 1973. The Greek authorities believe that the larger energy-intensive industries have already made a number of improvements in energy efficiency, but recognise that relatively little

progress has been made so far in medium-sized and smaller industries. Information campaigns do not appear to have received a good response. Within the framework of legislation on investment incentives in general, there is scope for promoting energy conservation investments by means of direct grants, interest rebates or tax reductions. But it is not clear how far this scope has been exploited. Attempts to encourage energy saving have been jeopardised to some extent by the lack of adequate and technically qualified staff in Government departments to ensure compliance with regulations.

93. Combined heat and power schemes are limited to a few cogeneration units in industrial plants, mainly in the food-processing and chemicals sectors. Present cogeneration capacity is about 120 Mw and might increase to 280 Mw by 1987.

94. In the transport sectors energy intensity is the third highest in the Community (after Luxembourg and Ireland) and progress in achieving savings has been made difficult by the rapid increase in private cars, the inadequacies of public transport facilities and the congested road network. There are now a differential road tax system in favour of small cars; speed limits; energy use is one element in the routine technical inspection of heavy goods vehicules; and in Athens itself there are restrictions on the use of private cars. But there are limits to the overall level of efficiency because of the age of much of the transport fleet.

Hydrocarbon Exploration

95. The Public Petroleum Corporation was established in 1975 to explore and develop Greece's hydrocarbon resources. The intention is that it should become a fully integrated oil company. It has sole rights to manage all exploration activities and to sign contracts with participating companies. Thirty exploration wells have already been drilled but only one small oil field has so far been found in the north of the Aegean Sea. The current plans of the Corporation are to drill a total of 80 exploration wells over the next five years, concentrated heavily in the most promising areas of Western Greece and the Ionian Sea at an expected cost of around 500 million ECU. It is recognised that the Corporation's technical know-how needs to be improved if it is to develop the programme successfully. So far involvement by foreign companies has been limited. Legislation is in preparation which will provide a new framework for oil exploration and for participation by foreign companies.

Solid Fuels

96. **Lignite** potential in Greece is estimated at 2.7 milliard tonnes exploitable output[6]. This is equivalent to 340 mtoe or to some 40 years of 1990 demand projected in Table 1. It is planned to boost production sharply, with output doubling by 1990 over its 1981 level. Government

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[6] COM(82)649 final

policy is focussed on development of the commercial (strip-mined) lignite reserves; an intensive programme to evaluate the scope for exploitation of the known **possible** reserves of lignite (put at a further 4 milliard tonnes); and exploration for new underground reserves. The extensive exploitation of strip-mined lignite will have an important environmental impact, and the Greek authorities have underlined the cost of land-reclamation after the exploitation of the resource.

Lignite mining is integrated with the other operations of the PPC. The prices at which lignite is transferred within PPC are not available to the Commission. The ability to finance large-scale investment in the lignite operations depends heavily on the overall financial situation of the PPC (see above).

97. Current non-electricity uses of lignite are limited but there are plans to intensify activity in the coming years, notably through the **gasification** of lignite. Specific projects in this field are apparently still in the early planning stages. It is intended that some of lignite for gasification should be derived from the development of dedicated small mines. Gasified lignite will be used as a substitute for fuel oil in industry and for naphtha in the production of ammonia; some will also be used in the domestic sector.

98. Proven reserves of **peat** are of the order of 4.3 bcm but technological constraints limit exploitable reserves to only 7% of this figure. There are, moreover, social problems associated with the exploitation of peat reserves, given the implications for the use of agricultural land.

Electricity

99. Some 98% of electric power is generated by the Government-owned PPC. The PPC's current ten-year investment programme (1983-1992) assumes a rate of growth of electricity demand of 5.7% p.a. 1983-87 and 6.5% p.a. 1988-92. This compares with a GDP growth rate of **4%** p.a. 1985-1990 assumed in Greek energy projections. The main objectives of the programme are:

- the virtual **elimination of oil** from the electricity sector by 1990;
- a corresponding substantial increase in **lignite** and **hydropower capacity**;
- a limited increase in the use of **imported coal** (especially for mixing with lignite);
- the use of **electricity imports** for emergencies or cost saving (connections already exist between the Greek system and those of Albania, Yugoslavia and Bulgaria).

For the period 1983-1992 4,750 Mw installed capacity will be put into operation (3,020 Mw lignite-fired and 1,730 hydroelectricity). The PPC's Plan also envisages the possible need for a unit operating on (imported) coal. A feasibility study is also underway of a possible under-sea cable between Italy and Greece.

100. **Nuclear power** is not included in the current PPC programme but it was envisaged until recently that there could be recourse to some nuclear power in the next PPC programme (i.e. from 1992). Now, no nuclear capacity is envisaged before 1996 at the earliest. If even this is to become a reality early decisions will have to be taken on reactor type and construction programmes.

101. The Greek authorities argue that lignite-fired electricity production is **currently** competitive with that of stations fired by imported coal. Evidence submitted by them points to a comparability in running costs between three lignite stations and a 350 Mw coal-fired station supplied with coal from a relatively small coal terminal. But it is recognised that the economics of lignite could worsen in the future as a result of deteriorating mining conditions (strip ratios).

Natural gas

102. A small and very old gas network in Athens is still in operation, using, until recently, town gas manufactured from imported coking coal, and for the future, gas from a naphtha refining plant. The running of this high-cost system, which is for domestic purposes only, is justified because of the pollution problems in the Athens area, which could be accentuated by oil-based electricity as an alternative. The authorities are examining the logic in the longer-term of more extensive recourse to natural gas which could be used as a direct source of heating on the mainland and a substitute for oil in industry. Any longer-term recourse to natural gas would clearly have to depend on imports but there are major geographical problems to be overcome. A direct pipeline from Algeria, perhaps via Italy, would probably not be economic because of the relatively small scale of likely future consumption in Greece, and because of the depth of the sea crossing. LNG would also be expensive at the level of foreseeable demand. An alternative would be connection to the main European natural gas networks via Italy, and some exploratory talks have already occurred. The other option is the purchase of Soviet gas through an extension of the pipeline from the Soviet Union to Bulgaria or Rumania. Exploratory discussions were held in 1983 and will resume in the second half of 1984. A study of supply options is underway.

New and Renewable Energies

103. On the basis of figures submitted to the Commission, the contribution (apart from hydro) is likely to be small even in 1990. Apart from hydro-electricity, Greece has large scope, however, for the exploitation of solar, geothermal, wind and biomass energy and a special geographical situation (large number of offshore islands) which make new

and renewable sources a more attractive option in terms of electricity supply than in other countries. In the past, electricity in many of the smaller islands has been produced essentially from small oil-fired generators. The provision of electricity supplies from large mainland generators by means of under-sea cable is expensive, and renewables offer a particularly interesting alternative. Extensive finds of high-temperature steam have already been made on some of the islands, and demonstration projects (with Community support) are already under way in Northern Greece to exploit lower calorific-value geothermal energy which could be used for agricultural purposes, district heating and, possibly, industry. There is already significant use of solar water heating and, as noted earlier, financial incentives to encourage further application.

104. The authorities now intend to give renewed emphasis to these activities, perhaps foreshadowing an attempt to **strengthen the financial incentives for the use of solar, biomass and wind energy** by domestic consumers and the encouragement of renewable-based electricity projects. But a specific programme of investments and financial inducements has yet to be formulated.

CONCLUSIONS

During the 1970s Greece made some useful progress in reducing dependence on oil for electricity-generation by conversion to solid fuels, but in other sectors oil use increased. Energy intensity in industry has fallen but is still high compared with the Community average.

In 1982 Greece depended on oil for 73% of her primary energy supplies. Current plans aim to ensure a major improvement in this situation during the remainder of this decade and beyond, bringing oil dependence down to 55%. This will involve, in particular, a very heavy capital expenditure programme to develop domestic lignite resources and lignite-based power generation capacity; attention to new and renewable energies; and hydrocarbon exploration.

Five major points need to be addressed:

- whether adequate financial resources and technical and managerial expertise can be brought to bear in implementing this programme. In this respect it is desirable that Greece should encourage more widespread recourse to external experience and resources;

- how far the burden of the investment programme and the long-term costs of the electricity system could be reduced by greater recourse to imports of hard coal than currently planned. The aim of the Greek authorities is to develop their indigenous resources in an optimal fashion. It is important in this context that costs are fully assessed;

- whether or not nuclear should play a rôle in the power station mix in the 1990s. Early decisions will be required if there is to be any reasonable expectation of a nuclear contribution by the mid-1990s;

- the adequacy of policies outside the electricity generating sector. Plans to improve oil substitution in industry and the domestic sector are limited and energy saving and pricing policies are relatively weak;

- the importance of adapting the Greek oil monopoly to Community rules as early as possible, and in any case before the end of 1985.

Table 1 SUMMARIZED ENERGY BALANCE - ELLAS

in million toe	1973[a]	1979[a]	1982[a]	1985[b]	1990[b]
I. **Gross Energy Consumption**	12,51	16,36	16,07	18,4	23,0
- Bunkers	0,83	0,99	0,82	1,0	1,0
- Inland consumption	11,68	15,37	15,25	17,4	22,0
II. **Inland Energy Consumption**	11,68	15,37	15,25	17,4	22,0
- Solid fuels	2,19	3,59	3,81	6,8	9,3
- Oil	9,28	11,43	10,95	10,2	12,2
- Gas	-	-	0,08	0,1	0,1
- Primary electricity, etc.	0,21	0,35	0,41	0,3	0,4
III. **Indigenous Production**[1]	1,97	3,45	4,88	7,6	9,0
- Hard coal	-	-	-	-	-
- Lignite & peat	1,77	3,12	3,43	5,9	8,2
- Oil	-	-	1,02	1,3	0,3
- Natural gas	-	-	0,08	0,1	0,1
- Nuclear energy	-	-	-	-	-
- Hydro & geothermal[2]	0,19	0,31	0,31	0,3	0,4
- Others & renewables	0,01	0,02	0,04	0,0	0,0
IV. **Net Imports**[3]	11,60	13,44	10,75	10,8	14,0
- Solid fuels	0,46	0,50	0,40	0,9	1,1
- Oil	11,13	12,93	10,29	9,9	12,9
- Natural gas[2]	-	-	-	-	-
- Electricity[4]	0,01	0,01	0,06	0,0	0,0
V. **Stock changes**	+1,07	+0,54	-0,45	..	..
- Solid fuels	+0,04	+0,03	+0,01	..	..
- Oil	+1,03	+0,51	-0,46	..	..
- Gas	-	-	-	-	-
VI. **Electricity Generation Input**	3,41	4,68	5,13	6,5	8,9
- Solid fuels[5]	1,47	2,50	3,22	5,6	7,9
- Oil	1,74	1,85	1,56	0,6	0,6
- Natural gas	-	-	-	-	-
- Nuclear energy	-	-	-	-	-
- Hydro & geothermal[2]	0,19	0,31	0,31	0,3	0,4
- Others & renewables	0,01	0,02	0,04	0,0	0,0
VII. **Electricity Gross Production** (in TWh)	14,82	22,10	23,27	26,1	35,8
- Hydro & geothermal[6]	2,22	3,57	3,56	3,9	5,0
- Nuclear	-	-	-	-	-
- Conventional thermal	12,60	18,53	19,71	22,2	30,8
VIII. **Electricity Gross Consumpt** (in TWh)	14,86	22,28	23,99	26,1	35,8

Sources: a. Statistical Office of the European Communities.
b. Review of National Energy Programmes 1983. Greece - January 1984.

Notes:
1. Production of primary sources, including recovered products.
2. The conversion of electricity, including hydro and geothermal, is based on its actual energy content: 3600 kjoules/kWh or 860 kcal/kWh.
3. The (-) sign means net exports.
4. The (-) sign means a stock decrease.
5. Including coke oven gas and blast furnace gas (derived from coal).
6. Without pumped storage hydroelectricity.

General notes:
1° figures submitted by Member States have been adapted where necessary to ensure consistency with SOEC statistical definitions or conversion factors.
2° direct comparisons between 1982 and 1985 are not always possible, given that some forecasts use 1980 or 1981 as the basis for projection.

Table 2 MAIN ENERGY INDICATORS - ELLAS

(related to 1990 Objectives)

	1973	1979	1982	1985	1990
I. Share of Oil in Gross Energy Consumption	80.8%	75.9%	73.2%	60.9%	57.4%
II. Fuel inputs to electricity production(1): Shares taken by:					
- Solid fuels	43.1%	53.4%	62.8%	86.2%	88.8%
- Nuclear	-	-	-	-	-
- Hydro and others	5.9%	7.1%	6.8%	4.6%	4.5%
- Natural Gas	-	-	-	-	-
- Oil	51.0%	39.5%	30.4%	9.2%	6.7%
III. Supply dependence on:(2)					
- Imported oil	89.0%	79.0%	64.0%	53.8%	56%
- Imported solid fuels	3.7%	3.1%	2.5%	4.9%	5%
- Imported natural gas	-	-	-	-	-
IV. Share of imports in (3) gross consumption of:					
- Energy	92.7%	82.1%	66.9%	58.7%	61%
- Oil	100%	100%	87.4%	88.4%	98%
- Solid fuels	21.0%	13.9%	10.5%	13.2%	12%
- Natural gas	-	-	-	-	-

	1973/63	1975/73	1979/75	1982/79	1990/85
V. Average annual growth rates:					
G D P	+7.7%	+1.1%	+5.0%	+0.3%	+4.0%
Inland energy consumption	+13.0%	+0.4%	+7.0%	-0.3%	+4.8%
Final energy consumption(4)	+11.9%	-2.1%	+7.3%	-0.0%	+4.2%
VI. Energy coefficient(5)	1.69	-	1.40	-	1.20

	1973	1979	1982	1985	1990
VII. Energy ratio (6) (in kg oe per 10^4 DRA)	177.6	187.8	184.8	197.0	204.7
VIII. Energy intensity(7) (in kg oe per 10^4 DRA)	126.5	132.6	129.8	138.7	134.9

Sources and General notes: see footnotes under Table 1

Notes:
1. Basic data expressed in oil equivalent terms.
2. Respective shares of imported oil, imported natural gas or imported solid fuels in gross energy consumption.
3. Share of each imported energy source, in gross consumption of that source.
4. Non energy use included.
5. Energy coefficient = ratio between growth rates of Inland Energy consumption and GDP.
6. Energy ratio = volume of inland energy consumption per unit of GDP, expressed in real terms, at 1975 prices. (in kg of oil equivalent per unit of national currency).
7. Energy intensity = final energy demand per unit of GDP expressed in real terms at 1975 prices.

Table 3 TRENDS IN FINAL ENERGY CONSUMPTION - ELLAS

	1973	1979	1982	1985	1990
INDUSTRY:					
Energy consumption (1) (in million toe)	3.15	4.21	3.57	3.9	4.6
Share in final consumption	37.8%	38.8%	33.3%	33.0%	31.7%
Energy consumption per unit of value-added(2) (in kg oe per 10^4 DRA)	267.4	272.1	240.1	242.4	179.4
TRANSPORT:					
Energy consumption (1) (in million toe)	2.76	3.69	4.10	4.6	5.9
Share in final consumption	33.2%	34.0%	38.3%	39.0%	40.7%
Energy consumption per unit of GDP (3) (in kg oe per 10^4 DRA)	41.96	45.10	49.68	52.09	54.91
HOUSEHOLDS, etc...					
Energy consumption (1) (in million toe)	2.41	2.95	3.04	3.3	4.0
Share in final consumption	29.0%	27.2%	28.4%	28.0%	27.6%
Energy consumption per unit of private consumption (4) (in kg oe per 10^4 DRA)	54.35	52.06	52.86	53.84	52.65
FINAL ENERGY CONSUMPTION (in million toe) (1)	8.32	10.85	10.71	11.8	14.5
of which: Oil	79.1%	78.8%	78.2%	74.5%	72.8%
Final non-energy use (in million toe)	0.48	0.49	0.46	0.5	0.6

Sources and General Notes: see footnotes under Table 1

Notes: (1) non-energy use, not included.
(2) volume of energy consumed in the industrial sector, per unit of value-added produced by industry, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(3) volume of energy consumed in the transport sector, per unit of GDP, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(4) volume of energy consumed in the residential + tertiary sector, per unit of Private Consumption, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).

FRANCE

ENERGY TRENDS

105. With very limited and declining fossil fuel resources France experienced one of the highest rates of growth in oil consumption in the Community during the 1960s. Between 1958 and 1973 oil demand rose fivefold to reach nearly 72% of total energy demand. Practically all that oil was imported (98% of available oil supplies). The only significant indigenous resources were (and are) uranium and coal.

106. When the second "oil shock" occurred in 1979/80 significant changes had taken place, principally as a result of the acceleration of the **nuclear power** programme (begun in 1970), **energy conservation**, as well as efforts to **diversify** sources of oil (and coal) supplies and to establish new relations with importing countries (especially oil importers). In 1979 dependence on oil was down to less than 63%; nuclear energy accounted for nearly 24% of inputs to electricity generation; and there had been a significant reduction in the intensity of final energy demand.

107. In the past four years the rate of change has accelerated sharply. Oil demand in 1982 was down in volume terms to less than three-quarters of its 1973 level and to less than four-fifths of the level of 1979; dependence on oil had fallen to less than 53%; with the coming into service of a number of nuclear stations, nuclear electricity output had increased by 270% in three years, nuclear becoming the single most important source of inputs (over 50%) to electricity generation; the intensity of final energy demand had fallen still further, with particular sharp falls in industry and the household sector (each -16% over the period (1979-82).

108. Other important features of the changing energy balance have been a growth of some 56% in natural gas use between 1973 and 1979, which has since stabilised; a reversal during the past few years in the upward trends in the use of solid fuels of the mid-late 1970s; and a 50% increase since 1973 in the output of hydro-electricity which currently accounts for nearly 11% of total electricity generation.

THE EVOLUTION OF ENERGY POLICY

109. Apart from the commitment to nuclear power, backed up by the accelerated nuclear ordering programme, the 1970s were marked by the creation of new energy bodies to help manage the transition to a more

secure and more efficient energy economy, and notably the "Agence pour les Economies d'Energie" in 1974 and "Commissariat à l'Energie Solaire" in 1978.

110. In 1980 the Government approved a new long-term energy programme with a central objective of reducing oil use to one-third of total energy demand by 1990.

This was to be achieved essentially by:

- raising further the targets for **nuclear power** (nuclear was expected to supply 80 mtoe in 1990 compared with 16 mtoe in 1980);

- launching a new **energy saving drive**, including a significant increase in the rôle of district heating, which was expected to reduce the energy coefficient 1990/1985 to under 0.6% against a background of average annual GDP growth of 3.5%;

The programme also:

- foresaw a substantial and steady decline in **coal use** for electricity generation as thermal stations were replaced by nuclear. This was expected to be offset, however, by a very large rise in **coal use in industry** (up from 2.5 mtoe to 16 mtoe in 1990). On the supply side there would be a steady shift to coal imports and some **decline in domestic production**; and

- indicated a substantial increase in **natural gas use and imports.**

111. In June 1981 the new Government announced the completion of a revised long-term programme of energy independence. This was approved by the French Parliament in October 1981. The essential aim was seen as ensuring that energy should cease to be a potential constraint on economic growth. Using two scenarios for GDP growth 1985-1990 (2.5% and 5%) the Plan confirmed the objective of reducing oil's share in energy demand to 30-32% and foresaw, notably:

- investment of 40 bn FF a year during the 1980s on **energy savings investments**;

- an initial halt to the downward trend in **domestic coal production** and, in the longer-term, an increase in production. The aim was to increase coal consumption and to cover 50% of coal needs in 1990 from domestic sources (compared with 25% under the 1980 plan);

- **a downward revision of the projected level of nuclear output** in 1990, to reflect reduced electricity projections. Nuclear output was nevertheless expected to rise from 11 mtoe in 1979 to 72 mtoe in 1990 (compared with 80 mtoe forecast previously);

- ambitious targets for **new and renewable energies** (up to +/- 15 mtoe), the major part to be provided by biomass on the basis of wood and waste; and

- continuing efforts to **diversify sources of hydrocarbon imports;**

112. The quantitative aspects of these objectives are now once again under review. In the context of the preparation of France's ninth national plan the Long-Term Energy Group (GLTE) (a group of experts) completed, in 1983, new scenarios for energy supply and demand to 1990 and 2000 that take into account developments on the energy markets since 1979. These scenarios, if endorsed by the Government, could have important implications for policies in a number of fields, notably **coal, electricity,** and perhaps **natural gas.**

THE ENERGY OUTLOOK

113. The main scenarios used by the GLTE are based on GDP growth rates of 1.4% and 3.1% respectively for the period 1985-1990. On the basis of these new and more conservative scenarios, oil use is expected to fall by 1990 to around 36% of gross primary energy demand. On both growth rate assumptions oil demand is expected to fall significantly in volume terms and nuclear to increase its contribution substantially. On the higher growth rate scenario, nuclear could provide the equivalent of up to 81 mtoe (88%) to electricity generation or three-quarters of electricity output; and even on the low growth assumption, nuclear is expected to provide at the least the equivalent of 67.5 mtoe (83%) to electricity generation or two-thirds of electricity supply by 1990. On both scenarios solid fuels use is now projected to fall significantly from its 1982 level (on the less optimistic scenario, demand for solid fuels could be down to 18 mtoe or 64% of its 1982 level): the implication is a fall of nearly 2 mtoe or 17.5% in domestic coal production, compared with 1982. Similarly, there is an important downward revision to projected natural gas consumption compared with previous plans: on present assumptions, natural gas demand is expected to grow by 4-6 mtoe up to 25-27 mtoe by 1990, compared with nearly 31 mtoe projected in 1981.

Finally, there are now somewhat more conservative projections for the contributions of renewable energy sources. Hydro, geothermal and other sources are now expected to supply some 12-15 mtoe in 1990 compared with the maximum figure of 15.6 mtoe projected earlier.

114. On these assumptions, final energy demand is projected to increase by 5-11% 1982-1990 and oil's share in final energy demand to fall from around 58% in 1982 to 45% in 1990. Oil use as a share of primary energy demand will fall from 53% in 1982 to around 36% in 1990.

Detailed projections are not available from the French authorities in relation to energy intensity in specific sectors. The figures shown in Table 3 are estimates made by the Commission services on the basis of the information currently available. The figures suggest continuing improvements in energy intensity in the transport and domestic sectors, but less progress in the industrial field. As noted below, however, the French Government attaches considerable importance to continuing improvements in all three sectors.

SECTORAL AND HORIZONTAL DEVELOPMENTS

Energy Pricing

115. Energy prices to domestic and small industrial consumers have tended generally to be above average for the Community, providing a helpful stimulus to energy savings efforts. Electricity prices to small and medium-sized industrial consumers are now, however, low in relation to many Community countries. Comparatively low electricity prices should be a natural function of the high share of nuclear energy in the electricity generation picture. But the recent stagnation of electricity demand and the inevitably high financial costs of the nuclear investment programme have impacted on the costs of electricity output. The French Government is currently considering changes to the electricity tariff structure to make electricity relatively more attractive to industrial consumers. The Commission will be examining further in its separate report on pricing whether existing levels of electricity prices are realistic in relation to costs, as well as the implications of planned tariff changes.

116. There are separate pricing systems applicable to different oil products:

- motor fuels and domestic heating oil are subject to a specific price regime which effectively fixes maximum and in principle automatic ex-refinery prices and minimum consumer prices for motor gasoline;

- the prices of other oil products are not subject to control in normal circumstances, but reserve powers exist for the application of controls in crisis situation.

Energy Efficiency

117. Improvements in energy efficiency remain a key objective of French energy policy and investments in energy efficiency are seen as important in the context of employment, balance-of-payments and economic policy more generally. Specific aims are:

- in the **domestic and tertiary sectors**, to save 16-20 mtoe by 1990 (by retrofitting, better application of existing norms and standards, improvements in efficiency of electrical applicances); and to halve oil consumption (by increased electricity penetration, the promotion of heat pumps, solar heating, etc);

- in **industry**, to save 10 mtoe by 1990 and also to halve oil demand, notably by increased coal and electricity penetration;

- in **transport**, to save 8-10 mtoe, especially by improvements in vehicle design.

118. The Government estimates that meeting these objectives will mean raising the level of investment in rational energy use to 1% of GDP by 1985, compared with 0.6% 1980-81. This is intended to be achieved by:

(i) **financial and fiscal incentives,** including tax credits for energy saving investment by individuals, new criteria for investment aids to industry;

(ii) the creation in 1982 of the **Agence Française pour la Maîtrise de l'Energie** (AFME) to take over the work of the former Agence pour les Economies d'Energie, the Commissariat à l'Agence Solaire and separate agencies dealing with geothermal energy and heat;

(iii) the **Fonds Spécial des Grands Travaux** (FSGT), established in July 1982, financed by a special tax on motor fuel. Already FSGT has committed some 2 bn FF to RUE investment (compared with total investment in this sector estimated at 15 bn FF in 1982) in the public sector (schools, hospitals, local authority housing, district heating networks). The allocation of a further 2 bn FF to FSGT was decided by the French Government at the end of 1983.

French objectives are ambitious. It is important that progress towards them should be carefully monitored and the effectiveness of specific measures carefully assessed.

Solid Fuels

Demand

119. All the current projections point to a fall in solid fuel use by 1990 compared with the 1982 level. The main reason is a severe reduction in expected coal use in the electricity generating field. On the 'low' GDP growth scenario solid fuel use as a whole falls by 10 mtoe from 28 mtoe in 1982 to 18 mtoe in 1990, almost all of which is accounted for by the electricity sector. On the 'high' growth scenario, the fall is around 5 mtoe, with a reduction of over **7 mtoe** in the electricity sector. There is also expected to be a fall in coal use in the steel industry. Expected growth in other industrial sectors will only partially offset the decline in these two principal consumers of solid fuels.

120. The French authorities underline the importance of efforts to promote coal use in general industry as well as the domestic and tertiary sectors; but emphasise that investment costs in industry are relatively high despite the competitivity of coal as a source of steam-raising. A system of grant aids has been in operation to encourage solid fuel use in industry.

Domestic Production

121. The downward revision to demand forecasts has major implications for the future level of domestic coal output. The authorities have made it clear that the maintenance of existing levels of French coal production through the 1980s is no longer sustainable. Contrary to earlier expectations, total coal output is now expected to fall. No production targets have been fixed for 1990 but subsidy levels are expected to decline in real terms. A specific budgetary ceiling has been fixed for the coming year which will not permit the Charbonnages de France (CdF) to subsidise as high a tonnage of output in 1984 as in 1983. CdF are about to submit to the French Government a "Company project" which seems likely to set a framework for a reduction in output over the coming years.

Electricity/Nuclear

122. The growth of electricity demand has slowed down abruptly in the past few years and demand forecasts for 1990 are increasingly conservative. On the 'low' growth scenario, projected domestic electricity requirements in 1990 will be some 23% above their (low) 1982 level and on the 'high' growth scenario only 30%. Total domestic electricity consumption is therefore forecast to be in the range 330-360 Twh compared with a capacity able to meet 400 Twh or more. The Government emphasises that likely overcapacity could be only a temporary phenomenon, although some 7-10 nuclear stations could be surplus to domestic requirements in 1990. Against that background, the Government is now developing a new policy on electricity which will be formalised by a planning contract (**contrat de plan**) between EdF and the Government.

The new policy will be directed largely at:

(i) **the rate of ordering of new plant.** Capacity in 1990 is determined by orders already made. The forecasts by GLTE suggest, however, that even to meet foreseeable domestic demand in the 1990s no additional nuclear plant need be ordered until at least the late 1980s. Given the need for a smooth ordering programme for the nuclear industry and possible market developments the Government has already decided, however, to order two new nuclear sets in 1984 and at least one in 1985;

(ii) **increased electricity penetration.** The authorities estimate that by 1990 it should be possible to increase electricity consumption by 30-50 Twh more than the projections described above (330-360 Twh) by developing new outlets. In the meantime, **attention is to be paid to the structure of tariffs and long-term contract prices for industrial electricity use,** so as to make industrial electricity prices relatively more attractive than in the past;

(iii) **electricity exports.** For the next 4-5 years the scope for electricity exports is expected to be limited. In the longer-term the Government envisages sizeable contracts (long-, medium- and short-term) for sales to neighbouring countries and also participation by them in French power stations, estimating that

exports of 30-50 Twh a year in the 1990s are a realistic possibility. Current projections already imply net exports of 30-40 Twh in 1990;

(iv) renewed attention to **production costs** in the nuclear field, which are said to be twice as high for stations committed in 1982 as for those in 1972, so as to help keep down the real costs of electricity and to encourage electricity penetration.

It is clear that major uncertainties attach to the projections of net electricity exports. There are obvious potential markets (notably Italy), but the signature of long-term contracts for sizeable net electricity exports will require the resolution of difficult questions in relation to price, back-up capacity and use of transmission systems.

Natural Gas

123. On all the projections, natural gas demand is expected to grow during the rest of the decade but at slower rates than envisaged 2-3 years ago. On the 'low' growth scenario, natural gas demand could rise from 21 mtoe now to 25 mtoe in 1990; on the 'high' growth scenario to 27 mtoe. On the figures available to the Commission it would appear that **only the high demand figures correspond to projected levels of supply under existing contracts** unless there are to be very high levels of stocking.

Gaz de France is in the process of developing a '**contrat de plan**' with the Government which should resolve these uncertainties. In present circumstances, it is not yet absolutely clear where gas is to be absorbed, at what price, and with what effect on other competing alternatives, notably the direct use of electricity. At the same time, the Government makes clear its view that gas should not be used in an energy-inefficient manner and projects a decline in the already low gas use in power stations.

New and Renewables/New Technologies

124. As noted earlier, there has been some reduction since 1981 in the expected contribution of new and renewable energies in 1990, but the expectations are still the highest in any Member State. There are six main elements in addition to normal hydro:

- geothermal energy (expected to be up from 0.06 mtoe in 1982 to 0.6-0.8 mtoe in 1990);

- biomass (up from 0.5 mtoe in 1982 to around 1 mtoe in 1990);

- industrial and urban waste (up from 0.9 mtoe to around 2 mtoe);

- mini-hydro (up to 0.3 mtoe);

- low-temperature solar heating (as much as 0.2 mtoe);

- substitute fuels in petrol (up to 0.6 mtoe).

125. The AFME is responsible for managing programmes in this area, together with other smaller technical units and Regional Delegations responsible for the implementation of regional plans for rationalising energy use (maîtrise de l'énergie). Considerable sums of money have been committed and are planned over the coming years.

CONCLUSIONS

There have been very radical changes in the French energy economy since 1973 as a result of the very clear commitment to nuclear power and vigorous efforts in the field of energy saving. The process of substitution for oil is likely to continue and indeed to accelerate during the rest of this decade as available nuclear capacity doubles.

French energy planning can justifiably claim major success. But the changes in the energy situation of the past few years and in the outlook for economic growth are posing some difficult questions, notably in the electricity sector and in the coal industry, and some uncertainty about the future rôle of natural gas. Important decisions will be required in each of these areas in the short- and medium-term. Of particular interest in a Community context is the possible availability for export of relatively large amounts of cheap French nuclear electricity.

Table 1 SUMMARIZED ENERGY BALANCE - FRANCE

in million toe	1973[a]	1979[a]	1982[a]	1985[c]	1990[b]
I. **Gross Energy Consumption**	180,04	190,02	178,16	186,5	189,7/221,5
- Bunkers	5,32	4,72	2,87	3,0	3,0
- Inland consumption	174,72	185,30	175,29	183,5	186,7/218,5
II. **Inland Energy Consumption**	174,72	185,30	175,29	183,5	186,7/218,5
- Solid fuels	28,73	31,81	28,21	26,0	18,0/23,0
- Oil	123,85	114,89	91,43	82,4	67,0/77,0
- Gas	13,59	21,24	21,10	24,0	25,0/27,0
- Primary electricity, etc.	8,55	17,36	34,55	51,1	76,7/91,5
III. **Indigenous Production**[1]	34,31	38,45	54,77	69,5	92,9/109,4
- Hard coal	16,35	12,04	10,90	10,0	9,0
- Lignite & peat	0,85	0,82	0,88	1,0	1,0
- Oil	1,98	2,19	2,59	2,2	1,2
- Natural gas	6,32	6,52	5,52	5,2	2,4
- Nuclear energy	4,54	10,96	28,64	45,0	(67,5/81,0)
- Hydro & geothermal[2]	4,14	5,79	6,14	5,8	(5,8)
- Others & renewables	0,13	0,13	0,10	0,3	6,0/9,0
IV. **Net Imports**[3]	145,93	154,59	119,19	117,0	96,8/112,1
- Solid fuels	9,90	17,98	14,93	15,0	8,0/13,0
- Oil	128,73	121,41	88,34	83,2	68,8/78,8
- Natural gas	7,56	14,71	16,25	18,8	22,6/24,6
- Electricity[2]	-0,26	0,49	0,33	-	-2,6/-4,3
V. **Stock changes**[4]	+0,20	+3,02	-4,21	..	..
- Solid fuels	-1,63	-0,96	-1,50	..	..
- Oil	+1,54	+3,99	-3,38	..	..
- Gas	+0,29	-0,01	+0,67	..	..
VI. **Electricity Generation**	34,87	46,40	56,75	66,0	81,1/91,8
- Solid fuels[5]	8,60	15,94	14,97	12,5	5,0/2,2
- Oil	15,37	11,82	5,90	2,0	2,0
- Natural gas	2,09	1,76	1,00	0,5	0,5
- Nuclear energy	4,54	10,96	28,64	45,0	67,5/81,0
- Hydro & geothermal[2]	4,14	5,79	6,14	5,8	5,8
- Others & renewables	0,13	0,13	0,10	0,2	0,3
VII. **Electricity Gross Production** (in TWh)	182,38	240,70	278,53	310,0	370,0/407,5
- Hydro & geothermal[6]	48,12	67,28	71,37	67,5	67,5
- Nuclear	14,74	39,95	108,96	170,0	250,0/300,0
- Conventional thermal	119,52	133,47	98,20	72,5	52,5/40,0
VIII. Electricity Gross Consumpt (in TWh)	179,56	247,09	275,45	310,0	340,0/357,5

Sources: a. Statistical Office of the European Communities.
b. Review of National Energy Programmes 1983. France - 21 October 1983.
c. Commission's estimates.

Notes:
1. Production of primary sources, including recovered products.
2. The conversion of electricity, including hydro and geothermal, is based on its actual energy content: 3600 kjoules/kWh or 860 kcal/kWh.
3. The (-) sign means net exports.
4. The (-) sign means a stock decrease.
5. Including coke oven gas and blast furnace gas (derived from coal).
6. Without pumped storage hydroelectricity.

General notes:
1° figures submitted by Member States have been adapted where necessary to ensure consistency with SOEC statistical definitions or conversion factors.
2° direct comparisons between 1982 and 1985 are not always possible, given that some forecasts use 1980 or 1981 as the basis for projection.

Table 2 MAIN ENERGY INDICATORS - FRANCE

(related to 1990 Objectives)

	1973	1979	1982	1985	1990
I. Share of Oil in Gross Energy Consumption	71.7%	62.9%	52.9%	45.8%	37%/36%
II. Fuel inputs to Electricity production(1): Shares taken by:					
- Solid fuels	24.7%	34.3%	26.4%	18.9%	6%/2%
- Nuclear	13.0%	23.6%	50.4%	68.2%	83%/88%
- Hydro and others	12.2%	12.8%	11.0%	9.1%	7%
- Natural Gas	6.0%	3.8%	1.8%	0.8%	1%
- Oil	44.1%	25.5%	10.4%	3.0%	3%/2%
III.Supply dependence on:(2)					
- Imported oil	71.5%	63.9%	49.6%	44.6%	36%
- Imported solid fuels	5.5%	9.5%	8.4%	8.0%	4%/6%
- Imported natural gas	4.2%	7.7%	9.1%	10.1%	12%/11%
IV. Share of imports in (3) gross consumption of:					
- Energy	81.1%	81.4%	66.9%	62.7%	51%
- Oil	98.5%	98.2%	97.3%	97.4%	98%
- Solid fuels	34.5%	56.5%	52.9%	57.7%	44%/57%
- Natural gas	55.6%	69.3%	77.0%	78.3%	91%

	1973/63	1975/73	1979/75	1982/79	1990/85
V. Average annual growth rates:					
G D P	+5.5%	+1.7%	+3.7%	+1.1%	1.4%/3.1%
Inland energy consumption	+5.6%	-4.9%	+4.1%	-1.9%	1.4%/3.5%
Final energy consumption(4)	+5.6%	-4.2%	+3.3%	-3.3%	0.5%/1.7%
VI. Energy coefficient(5)	1.02	-	1.11	-	1.0/1.13

	1973	1979	1982	1985	1990
VII.Energy ratio(6) (in kg oe per 10^3 FF)	124.4	110.5	101.1	103.4	98.1/105.7
VIII.Energy intensity(7) (in kg oe per 10^3 FF)	90.0	78.34	67.9	68.2	65.4/63.7

Sources and General notes: see footnotes under Table 1.

Notes:
1. Basic data expressed in oil equivalent terms.
2. Respective shares of imported oil, imported natural gas or imported solid fuels in gross energy consumption.
3. Share of each imported energy source, in gross consumption of that source.
4. Non energy use included.
5. Energy coefficient = ratio between growth rates of inland energy consumption and GDP.
6. Energy ratio = volume of inland energy consumption per unit of GDP, expressed in real terms, at 1975 prices. (in kg of oil equivalent per unit of national currency).
7. Energy intensity = final energy demand per unit of GDP expressed in real terms at 1975 prices.

Table 3 TRENDS IN FINAL ENERGY CONSUMPTION - FRANCE

	1973	1979	1982	1985	1990
INDUSTRY:					
Energy consumption (1) (in million toe)	46.14	46.12	36.81	(38.0)	36.8/42.5
Share in final consumption	36.5%	35.1%	31.3%	31.4%	29.7%/32.3%
Energy consumption per unit of value-added(2) (in kg oe per 10^3 FF)	123.8	104.1	87.4	96.3	93.1/98.9
TRANSPORT:					
Energy consumption (1) (in million toe)	25.94	31.18	32.41	(33.0)	34.8/36.2
Share in final consumption	20.5%	23.7%	27.5%	27.3%	28.0%/27.5%
Energy consumption per unit of GDP (3) (in kg oe per 10^3 FF)	18.47	18.60	18.69	18.59	18.29/17.50
HOUSEHOLDS, etc...					
Energy consumption (1) (in million toe)	54.31	54.08	48.47	(50.0)	52.5/53.1
Share in final consumption	43.0%	41.2%	41.2%	41.3%	42.3%/40.2%
Energy consumption per unit of private consumption (4) (in kg oe per 10^3 FF)	64.64	51.49	43.08	43.44	42.13/38.84
FINAL ENERGY CONSUMPTION (in million toe) (1)	126.39	131.38	117.69	121.0	124.1/131.8
of which: Oil	67.6%	62.8%	57.9%	(53%)	45%
Final non-energy use (in million toe)	11.27	12.31	10.19	(10.0)	8.5/10.0

Sources and General Notes: see footnotes under Table 1.

Notes: (1) non-energy use, not included.
(2) volume of energy consumed in the industrial sector, per unit of value-added produced by industry, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(3) volume of energy consumed in the transport sector, per unit of GDP, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(4) volume of energy consumed in the residential + tertiary sector, per unit of Private Consumption, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).

IRELAND

ENERGY TRENDS

126. The sustained economic growth experienced by Ireland in the 1960s and early 1970s produced a major increase in imported oil. By 1973 oil imports provided almost 80% of Ireland's primary energy requirements.

127. Since 1973, there have been major changes. Between 1973 and 1979 primary energy demand in Ireland rose by 21.3% from 6.9 mtoe to 8.4 mtoe, while during the same period oil, as a percentage of Ireland's energy consumption, fell from 79.1% to 73.7%. Following the second oil shock total energy demand fell by 4.7% to 8 mtoe between 1979 and 1982, while oil usage declined dramatically in the three-year period, accounting for only 55.7% of primary energy demand by 1982. The decline in oil consumption of 28% between 1979 and 1982 was matched by a corresponding rise (in volume terms) in natural gas production and use, of which the bulk is currently being used to displace oil in electricity generation.

128. In 1973 peat was the only significant indigenous energy source, accounting for 9.4% of energy consumption. Peat production has increased significantly since 1973, as a result of the implementation of development plans for the industry, and its share of energy consumption has risen to 12.3%. The discovery of natural gas in 1973 has been more significant, however, in reducing Ireland's dependence on imported oil. In 1982 natural gas production accounted for 20.7% of inland energy consumption. The changing pattern of energy consumption in Ireland is set out in the table below:

SECTORAL CONTRIBUTION TO INLAND PRIMARY ENERGY CONSUMPTION (%)

	1973	1979	1982	1990[7]
Oil	79.1	73.7	55.7	49.1
Hard Coal (largely imported)	7.2	9.4	11.0	27.4
Peat	9.4	7.5	12.3	11.4
Natural gas	-	5.4	20.7	10.6

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[7] Projected

THE EVOLUTION OF ENERGY POLICY

129. Since 1970, there have been four major elements in policy:

(i) the bringing on stream of natural gas from the Kinsale field; its substitution for oil in electricity generation; and efforts to develop a natural gas network so as to be able to exploit premium markets;

(ii) the implementation of the peat development plan;

(iii) encouragement of a switch to solid fuels in domestic heating;

(iv) the development of coal-fired electricity capacity, notably through the commitment to a new coal-fired power station at Moneypoint due to come on stream in 1986.

Less emphasis has been given to energy conservation policy.

THE ENERGY OUTLOOK

130. The use of natural gas for electricity generation is expected to fall in 1986 as the new coal-fired station at Moneypoint begins to come on stream. Coal imports from the US and Colombia for electricity generation account for the large increase projected in the use of solid fuels between 1982 and 1990 (Table 1). By then solid fuels are expected to provide 58.5% of electricity generation inputs. Indigenous fuel supplies will be greatly enhanced if the Gulf oil find off the south coast of Ireland proves to be commercial. By 1990 natural gas is expected to be in use in only the premium energy market.

131. While primary energy demand will continue to rise to 1990, the share of oil is expected to fall further to under 50% of total primary energy demand. This would, however, be above the projected average level of 43% for EUR-10 and would mean a slowdown in the rate of progress away from oil compared with the past few years.

SECTORAL AND HORIZONTAL DEVELOPMENTS

Energy Pricing

132. Apart from the price of peat, the Minister for Industry, Commerce and Tourism on the advice of the National Prices Commission controls the retail price of all energy products. Petroleum prices are administered to reflect world market price changes. Although oil product taxes are levied principally for fiscal reasons, the balance of payments and energy considerations are said also to figure largely in their rationale.

133. The decision of the Irish Government to compel oil companies to purchase one third of their requirements from the state-owned Whitegate oil refinery is currently the subject of a reference to the Court of Justice.

134. The Minister for Industry, Commerce and Tourism on the advice of the National Prices Commission also controls prices of the Electricity Supply Board (ESB) and there is a legislative requirement on the ESB to break even, taking one year with the next. Government delays in sanctioning increases in electricity prices are one of the reasons for the financial deficits returned by the ESB in recent years.

135. In line with the development plan for peat, the price of this product has recently been allowed to rise to enable the financing of large-scale peat extraction (see paragraph 16 below).

136. Natural gas pricing policy is still developing, with charges varying between types of customer. As premium markets develop the Irish Government envisage natural gas prices tending towards gasoil prices but with some margin for competition with rival fuels. For industry, however pricing reflects heavy fuel oil import prices together with a premium for connection and transmission. The pricing policy for gas supplied to industry is being reviewed by the Irish Government.

Energy Efficiency

137. Energy saving programmes were initiated in 1974 with the emphasis on **voluntary cooperation** rather than mandatory measures. Governmental energy saving activities have been concerned mainly with **information and advice** (e.g. publicity campaigns, booklets, seminars, etc) as well as some financial support schemes (insulation grants (now discontinued), fuel efficiency surveys, free boiler testing service now replaced by steam plant audit). In the public sector conservation measures are being taken in Government buildings, Health Board buildings, schools and by local authorities. Energy saving activities in the transport area have been rather limited (speed limits, bus lanes). In the domestic sector, while there has been a dramatic switch from oil to solid fuels, **many dwellings are still heated by an open fire system** which is a relatively inefficient heating method compared to closed solid fuel burners. Budgetary considerations have led to a reduction in the amount of financial assistance being provided for energy conservation and as a result some schemes have had to be discontinued.

Combined Heat and Power/District Heating

138. Despite some studies in this area the use of CHP or District Heating is not seen as a commercial proposition for large-scale use in the short term. Feasibility projects have been assisted by grant aids from the Government.

Oil

139. The legislative framework for hydrocarbon exploration is the Petroleum and Other Minerals Development Act 1960 and the Continental Shelf Act 1968. Under an agreement signed in 1954 and amended in 1969, Marathon Petroleum held 37 offshore blocks under 21-year leases, the first of which was granted in 1970. Offshore exploration licences were granted in 1976, to a number of consortia, in accordance with specific provisions announced at that time. Awards under a second licensing round were announced in June 1982. In 1983 Gulf Oil, in conjunction with its partners, announced an oil find off the south coast of Ireland. While tests continue to ascertain its commercial potential, the indications for its success are promising, not the least being the relative shallow water and closeness of the find to the shore. In 1973 indigenous sources accounted for only 10.6% of gross energy consumption. In 1982 the percentage of gross energy consumption supplied by indigenous sources had risen to 34.2% due mainly to the production of the Kinsale Head gas field which was discovered in 1973. The addition of an oil find could considerably alter the projected energy balance in Ireland for 1990.

140. As already referred to, Ireland's dependence on imported oil has declined dramatically mainly as a result of the use of natural gas as an input to electricity generation. This decline is expected to continue until 1985 when the pace of the economic recovery is expected to raise oil demand again. The expectation of availability of indigenous supplies could still encourage an increase in oil demand particularly if conversion programmes are cancelled or postponed in anticipation of improved supply security.

Solid Fuels

141. Apart from some anthracite deposits coal reserves are small in quantity and low in quality. The Electricity Supply Board plans to increase its coal-fired capacity to 900 Mw by 1990. This means that solid fuel-fired capacity will account for 58% of generation capacity by 1990 compared to 23% at present. As a result coal imports are expected to rise from 0.8 mtoe to 2.4 mtoe by 1990.

142. As part of the Government's policy to reduce dependence on imported oil, greater emphasis has been placed on the need for investment and development in the turf sector. Development plans for the industry are expected to raise peat production from its 1973 level of about 0.7 mtoe to about 1.4 mtoe by 1990[8]. Most of the extra peat produced will be used for electricity generation but it is also planned to build new peat briquetting capacity, a fuel which is used almost exclusively in households. Until recently, peat pricing had been on a cost plus basis and this had not provided the revenue necessary for investment in future development. However, since 1982 there has been a move to a more energy-related pricing system which will assist the longer-term

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[8] Figures based on SOEC conventions

development of bogland. The increase in peat prices has reduced the viability of some of the older, less efficient electricity generating stations.

143. The future development of solid fuel usage in Ireland will be hindered by the lack of coal handling facilities in the main ports. While the new jetty at Moneypoint can handle large volumes, its distance from the largest urban areas in Ireland restricts its wider use.

Nuclear

144. Proposals for a nuclear powered electricity generation station have been dormant for some years.

Electricity

145. After achieving growth rates of 6% a year on average during the late 1960s and 70s, electricity demand has been stagnant and even falling in recent years. As the largest users of energy, the Electricity Supply Board (ESB) have had to rethink their long term strategy. Their future development plans now centre around coal-fired, and to a lesser extent, peat-fired, generating capacity. Solid fuel-fired electricity generation provides 23% of supply. This is not likely to change significantly until the new 900 Mw power station at Moneypoint begins to come on stream in 1986. There has been a marked switch from oil to natural gas as an input to electricity generation. In 1979 oil accounted for 63% of fuel inputs in electricity generation. By 1982 it had fallen to 27% as natural gas supplies were used to replace it. By 1982 48% of fuel inputs to electricity generation were accounted for by natural gas. The use of natural gas in this way is seen primarily as a holding operation until the new coal-fired station is operational, while at the same time demand for natural gas from alternative customers will be building up. The revenue provided by sales to the ESB can be used for investing in the development of a market and distribution system for natural gas.

146. The economics of electricity generation in the Republic suffer from the lack of any interconnection either with Northern Ireland or the UK mainland. Ireland is the only EEC Member State that does not enjoy the advantages of transnational electricity interconnections.

Natural Gas

147. The only commercial gas find so far announced was made by Marathon in 1973 (Kinsale). The field was originally estimated to have reserves of 1 trillion cubic feet. This has since been revised substantially upwards. In 1982 the output of natural gas accounted for almost 21% of Ireland's energy consumption. Although gas initially was only used locally in the Cork area for electricity generation, and as a feedstock in fertiliser production (with a small amount being made available to

local consumers) a **Cork-Dublin gas pipeline** was built in 1982. Conversion of consumers to the direct burning of gas is underway in Dublin. The Electricity Supply Board is, however, still the largest customer for the gas - taking the bulk of the daily output.

148. Agreement between the Irish and British Governments was reached recently on the extension of the gas supply grid to Northern Ireland. Deliveries of gas are expected to commence in 1985. The building up of a premium market for natural gas is important to the maximisation of the fuel's potential. Short run advantages of displacing the use of oil for electricity generation must not be allowed to obscure the longer-term benefits of developing a more diversified energy supply and demand structure.

New and Renewable Energies and New Technologies

149. The contribution from renewables is small in Ireland. They represent only 2.5% of indigenous production and nearly all of this is accounted for by hydro electricity generation. The Government is trying to encourage more research into renewable sources through the support of demonstration projects.

CONCLUSIONS

Ireland has succeeded in significantly reducing its dependence on imported oil mainly through the discovery of natural gas as well as greater use of solid fuels. In order to ensure long-term diversification of energy supply and demand it is important that a premium market for natural gas be developed and that its use as an input to electricity generation should begin to phase down once the coal-fired electricity power station at Moneypoint is brought into service. Transnational gas and electricity interconnections make an important contribution to the economics of operation and the security of supply in other Member States. The possible benefits of interconnections for Ireland should be examined further. The discovery of a commercial oil find could have a major impact on Ireland's energy supply position but sight should not be lost of the large savings in energy use that can still be achieved through a more vigorous effective conservation programme, development of solid fuels and due attention to the rôle of energy pricing policy.

Table 1 SUMMARIZED ENERGY BALANCE - IRELAND

in million toe	1973[a]	1979[a]	1982[a]	1985[b]	1990[b]
I. **Gross Energy Consumption**	7,02	8,48	8,07	8,18	8,79
- Bunkers	0,07	0,05	0,04	0,04	0,04
- Inland consumption	6,95	8,43	8,03	8,14	8,75
II. **Inland Energy Consumption**	6,95	8,43	8,03	8,14	8,75
- Solid fuels	1,39	1,70	1,83	2,31	3,43
- Oil	5,50	6,21	4,47	3,96	4,30
- Gas	-	0,45	1,66	1,78	0,93
- Primary electricity, etc.	0,06	0,07	0,07	0,09	0,09
III. **Indigenous Production**[1]	0,74	1,18	2,75	2,99	2,25
- Hard coal	0,03	0,03	0,03	0,05	0,05
- Lignite & peat	0,65	0,63	0,99	(1,0)	(1,0)
- Oil	-	-	-	-	-
- Natural gas	-	0,45	1,66	(1,85)	(1,11)
- Nuclear energy	-	-	-	-	-
- Hydro & geothermal[2]	0,06	0,07	0,07	(0,09)	(0,09)
- Others & renewables	-	-	-	-	-
IV. **Net Imports**[3]	6,02	7,08	5,29	5,19	6,54
- Solid fuels	0,49	0,79	0,85	1,26	2,38
- Oil	5,52	6,29	4,44	4,0	4,34
- Natural gas	-	-	-	(-0,07)	(-0,18)
- Electricity[2]	0,01	-	-	-	-
V. **Stock changes**[4]	-0,27	-0,21	-0,03	..	..
- Solid fuels	-0,22	-0,24	+0,05	..	..
- Oil	-0,05	+0,03	-0,08	..	..
- Gas	-	-	-	..	..
VI. **Electricity Generation Input**	1,84	2,55	2,74	2,67	3,25
- Solid fuels[5]	0,63	0,65	0,62	0,81	1,90
- Oil	1,15	1,64	0,73	0,51	1,17
- Natural gas	-	0,19	1,32	1,26	0,09
- Nuclear energy	-	-	-	-	-
- Hydro & geothermal[2]	0,06	0,07	0,07	0,09	0,09
- Others & renewables	-	-	-	-	-
VII. **Electricity Gross Production** (in TWh)	7,35	10,64	10,53	12,09	14,72
- Hydro & geothermal[6]	0,64	0,82	0,80	1,01	1,01
- Nuclear	-	-	-	-	-
- Conventional thermal	6,71	9,82	9,73	11,08	13,71
VIII. **Electricity Gross Consumpt** (in TWh)	7,39	11,02	10,93	12,09	14,72

Sources: a. Statistical Office of the European Communities.
b. Review of National Energy Programmes 1983 Ireland - 17 October 1983.

Notes:
1. Production of primary sources, including recovered products.
2. The conversion of electricity, including hydro and geothermal, is based on its actual energy content: 3600 kjoules/kWh or 860 kcal/kWh.
3. The (-) sign means net exports.
4. The (-) sign means a stock decrease.
5. Including coke oven gas and blast furnace gas (derived from coal).
6. Without pumped storage hydroelectricity.

General notes:
1° figures submitted by Member States have been adapted where necessary tc ensure consistency with SOEC statistical definitions or conversion factors.
2° direct comparisons between 1982 and 1985 are not always possible, given that some forecasts use 1980 or 1981 as the basis for pro-

Table 2 MAIN ENERGY INDICATORS - IRELAND

(related to 1990 Objectives)

	1973	1979	1982	1985	1990
I. Share of Oil in Gross Energy Consumption	79.3%	73.8%	55.9%	48.9%	49%
II. Fuel inputs to Electricity production(1): Shares taken by:					
- Solid fuels	34.2%	25.5%	22.6%	30.3%	58.4%
- Nuclear	-	-	-	-	-
- Hydro and others	3.3%	2.7%	2.6%	3.4%	2.8%
- Natural Gas	-	7.5%	48.2%	47.2%	2.8%
- Oil	62.5%	64.3%	26.6%	19.1%	36.0%
III. Supply dependence on:(2)					
- Imported oil	78.6%	74.2%	55.0%	48.9%	49%
- Imported solid fuels	7.0%	9.3%	10.5%	15.4%	27%
- Imported natural gas	-	-	-	-	-
IV. Share of imports in (3) gross consumption of:					
- Energy	85.8%	83.5%	65.6%	63.5%	74.4%
- Oil	100%	100%	100%	100%	100%
- Solid fuels	35.3%	46.5%	46.5%	54.6%	69.4%
- Natural gas	-	-	-	-	-

	1973/63	1975/73	1979/75	1982/79	1990/85
V. Average annual growth rates:					
G D P	+4.4%	+3.1%	+4.2%	+1.7%	+1.5%
Inland energy consumption	+6.5%	-4.3%	+7.3%	-1.6%	+1.5%
Final energy consumption(4)	+7.0%	-6.0%	+7.6%	-2.8%	+0.5%
VI. Energy coefficient(5)	1.48	-	1.74	-	1.0

	1973	1979	1982	1985	1990
VII. Energy ratio(6) (in kg oe per 10^2 IRL)	198.3	191.5	173.4	165.5	165.2
VIII. Energy intensity(7) (in kg oe per 10^2 IRL)	148.4	142.7	125.0	122.0	117.1

Sources and General notes: see footnotes under Table 1.

Notes:
1. Basic data expressed in oil equivalent terms.
2. Respective shares of imported oil, imported natural gas or imported solid fuels in gross energy consumption.
3. Share of each imported energy source, in gross consumption of that source.
4. Non energy use included.
5. Energy coefficient = ratio between growth rates of inland energy consumption and GDP.
6. Energy ratio = volume of inland energy consumption per unit of GDP, expressed in real terms, at 1975 prices. (in kg of oil equivalent per unit of national currency).
7. Energy intensity = final energy demand per unity of GDP expressed in real terms at 1975 prices.

Table 3 TRENDS IN FINAL ENERGY CONSUMPTION - IRELAND

	1973	1979	1982	1985	1990
INDUSTRY:					
Energy consumption (1) (in million toe)	1.80	1.98	1.76	(1.6)	(1.65)
Share in final consumption	34.6%	31.5%	30.4%	26.7%	26.6%
Energy consumption per unit of value-added(2) (in kg oe per 10^2 IRL)	206.5	173.8	154.5	127.9	108.6
TRANSPORT:					
Energy consumption (1) (in million toe)	1.59	1.77	1.65	1.80	1.9
Share in final consumption	30.6%	28.2%	28.5%	30.0%	30.7%
Energy consumption per unit of GDP (3) (in kg oe per 10^2 IRL)	45.36	40.20	35.62	36.59	35.86
HOUSEHOLDS, etc...					
Energy consumption (1) (in million toe)	1.81	2.53	2.38	(2.6)	(2.65)
Share in final consumption	34.8%	40.3%	41.1.%	43.3%	42.7%
Energy consumption per unit of private consumption (4) (in kg oe per 10^2 IRL)	72.54	88.21	88.34	98.25	93.87
FINAL ENERGY CONSUMPTION (in million toe) (1)	5.20	6.28	5.79	6.0	6.2
of which: Oil	73.4%	65.8%	59.9%	56.7%	50%
Final non-energy use (in million toe)	(0.25)	(0.18)	0.50	0.6	0.6

Sources and General Notes: see footnotes under Table 1.

Notes: (1) non-energy use, not included.
(2) volume of energy consumed in the industrial sector, per unit of value-added produced by industry, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(3) volume of energy consumed in the transport sector, per unit of GDP, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(4) volume of energy consumed in the residential + tertiary sector, per unit of Private Consumption, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).

ITALY

ENERGY TRENDS

150. High rates of economic growth in Italy in the 1950s and 1960s (nearly 5% a year 1963-73) were fuelled essentially by imported oil. In 1973 oil met 79% of total primary energy demand and net oil imports 98% of available oil supplies.

A return to relatively high rates of economic growth in the second half of the 1970s brought correspondingly high levels of oil consumption and imports. At the time of the second oil shock of 1979/80, both oil demand levels and net oil imports were at much the same levels as in 1973.

Between 1979-82, the Italian economy grew by only 3.6% (with an actual decline in output in 1982), energy demand held around its 1979 level and inland oil demand fell much **less steeply than in all other Community countries**, apart from Greece and Ireland (-12.5% over the three-year period, compared with the Community average of over -19%). In 1982, oil consumption still accounted for nearly 68% of total energy demand, with practically all the oil imported.

151. Recourse to high levels of imported oil during the post-war industrialisation drive was a function of the limited availability of indigenous energy resources. Oil and solid fuels production was small and reserves limited. The only significant exploitable resources in the 1970s were:

(i) natural gas (domestic resources met 89% of natural gas consumption and 10% of total inland energy demand in 1973), and

(ii) hydropower (which made up 13% of the inputs to electricity supply and around one-quarter of electricity output in 1973).

Moves away from oil would therefore depend on the rate of introduction of nuclear power as an additional indigenous source of energy; the expansion of coal and natural gas imports; the further exploitation, where possible, of hydropower; improved energy efficiency; and, in the longer term, the development of alternative sources of supply (geothermal, solar).

152. The energy plans prepared by the Italian Government in the 1970s in practice gave particular attention, on the supply side, to the development of nuclear power. The difficulties in implementing these

plans were reflected, in particular, in the problems encountered at local and regional level in reaching agreement on sites for nuclear stations.Between 1973 and 1980, the small contribution of nuclear power to electricity supply actually **declined** while oil use in the electricity sector **increased.**

To the extent that oil was displaced during the 1970s, the main reason was the growing contribution of **natural gas** which increased significantly in importance to meet over 17% of inland energy demand in 1979 (mainly in the residential-commercial sectors). Imports accounted for the whole of this increase. Over the same period, there was a modest increase in coal imports (+13%) as coal began to play a more important, though still modest (10% of total inputs), rôle in electricity generation, and to meet an expansion in coking coal use for the steel industry.

The increase in solid fuel use accelerated after the second oil shock but the total volumes consumed remain relatively small. In 1982, solid fuels met only 10% of total energy demand and provided 16% of inputs to electricity generation. The power station sector remained (1982) dominated by oil (59%), only a little less so than the rest of the energy economy.

153. The intensity of final energy demand has fallen since 1973 (-12%), but less rapidly than in most other Community countries. In industry, the performance has been much better than in other sectors; in the residential-tertiary sector the improvement has been more limited but energy intensity in this sector is below the Communty average. In the transport sector energy intensity increased. Oil use in all three main sectors is high.

THE EVOLUTION OF ENERGY POLICY

154. There were two national Energy Plans in the 1970s (1975 and 1977), but these were only partially implemented. In 1981, the Government adopted, and both Houses of Parliament subsequently approved, a new National Energy Plan (NEP) which remains the main point of reference for Italian energy policy. The main points in the Plan were:

(i) a basic aim of reducing oil demand to 50% of total primary energy demand in 1990;

(ii) a 50% increase in the use of electricity by 1990, with power-station oil-burn rising only slightly from its 1980 level and the remaining demand to be met by:

- a very substantial increase in coal-burn (up from 3.3 mtoe in 1980 to 21.6 mtoe in 1990);

- more modest yet significant expansion of nuclear power (up from 0.7 mtoe in 1980 to 8 mtoe in 1990), and

- some limited expansion of hydropower.

(iii) a substantial increase in the use of natural gas (from 22.7 mtoe to 35 mtoe or 20% of inland energy demand), divided equally between industry and other sectors and including **a modest increase in power-station use**;

(iv) consequent substantial increases in imports of natural gas and coal (both of which were expected almost to triple);

(v) a series of measures in the energy savings field, later set out in a separate Law N° 308 of 1982;

(vi) efforts to increase the availability of domestic energy supplies (notably hydrocarbons).

The Plan recognised the problems posed by conflicts in the past over sites for nuclear power. It laid down that, in the case of disagreement between national and regional authorities, the Government would act as final arbiter. It also laid down a clearer demarcation of functions than in the past between ENEL (the electricity supply company), ENEA (responsible for nuclear licences) and AGIP (responsible for supplies of nuclear materials).

155. It was recognised that the structural changes implied in this Plan would require a very substantial investment programme (some 85 billion lire at 1980 prices over the period 1981-1990). The largest share of this expenditure would be in the electricity sector:

	Bn 1980 Lire
nuclear power station construction (4 GW of new capacity over and above the 2 GW already under construction)	10.3
coal-fired plant construction and conversion (17 GW new capacity and 3.7 GW conversion)	7.8
hydro-electric power	5.1
transmission and distribution	12.5
Total electricity	35.7

Other key features were planned expenditure on **exploration and development of hydrocarbons** of 17 bn lire; expenditure of nearly 4 bn lire on **coal**, both mining at home and abroad and **infrastructure for handling imports** of coal (including construction of three major coal-handling ports); and expenditure of 2.5 bn lire on **natural gas** (essentially the distribution network).

156. Only the energy conservation element (nearly 8 bn lire) would be met directly by Government funding; the remaining investment would be financed by the State energy enterprises (notably ENEL), although the

financing of the gas distribution network would fall partly on municipal authorities and partly on the Italian Government (with substantial aid from the European Community). In practice, however, it was inevitable that the ability to find the necessary resources would be closely tied up with Government willingness to provide indirect funding for the massive power station programme. This is discussed further below.

157. In its last review of Member States' energy programmes, the Commission heralded the 1981 programme and the parliamentary reaction to it as offering the prospect of major progress during the 1980s in reducing dependence on imported oil. Since then, energy projections to 1990 have been significantly altered and there have been a number of important developments at sectoral level, notably in the electricity field.

THE ENERGY OUTLOOK

158. The Italian authorities no longer expect to bring the share of oil in energy demand down to 50% by 1990. The latest revised projections submitted for the review exercise imply a fall to only 57%, the highest projected level of dependence of any Member State in the Community. All the other key objectives of the Plan have now also been scaled down. The summary picture is as follows:

	1990	
	1981 NEP Projections	1983 Projections
	(MTOE)	
Total primary energy demand		
Oil demand	94	88
Natural gas	35	32.3
Solid fuels	34	22.8
Electricity generation (fuel inputs)	62	46.5
of which:		
Nuclear	8	4.65
Solid fuels	21.6	12.5
Oil	not available	21.6
Natural gas	not available	3.5

Particularly striking are the revised projections for nuclear and solid fuel use.

These new projections have been made in the light of energy market developments since 1981 and reflect, inter alia, more modest expectations about GDP growth (2.6% p.a. in the period 1982-1990). They are considered by the authorities to be only a **first preliminary re-assessment** of the implications of the new situation. In some other countries such preliminary re-assessments have brought downward adjustments to the projected overall demand and oil demand levels in 1990 but the effects on future supply and demand for alternatives have

generally been considered to be more limited. In the case of Italy, however, the opposite is the case. Oil demand projections have been revised downwards **more modestly** than projected supply and use of alternatives.

159. Even if the projections are realised, Italy will have in 1990 the lowest level of recourse to nuclear, solid fuels and hydro for electricity generation of any Community country and the highest dependence on oil for electricity.

160. Current projections assume a further fall in the intensity of final energy demand by some 3% between 1982 and 1990. Energy/output ratios in the energy-intensive industries are expected to fall but at generally slower rates than in the period 1973-82. In the residential sector, energy consumption **per dwelling** is expected to fall by over 3% over the period, but this probably understates the likely real efficiency gains because of the growing penetration of central heating over the same period. The main development in the residential sector, however, is expected to be the deeper penetration of natural gas. In 1982, nearly 10 mtoe of oil were consumed in space heating (nearly 60% of total final energy demand in this sector), less than 6 mtoe of natural gas. By 1990 natural gas is expected to supply 9 mtoe and oil only 7.4 mtoe. Electricity use for heating purposes should remain limited.

SECTORAL AND HORIZONTAL DEVELOPMENTS

Energy Pricing

161. Energy prices have generally been closely controlled by the Italian Government and for much of the 1970s price increases were restrained for counter-inflationary reasons. But there have been recent changes of some importance:

- since July 1982 the Italian oil product price regime has been liberalised in certain respects. Now only the prices of gasoline and LPG are fixed by the Government; other prices are subjct to monitoring via the communication of price lists;

- in December 1981 the CIP (Inter-Ministerial Committee on Prices) approved bi-monthly electricity tariff increases of 2% for 1982 (producing a cumulative increase of 12.6% by the end of the year). A similar further set of increases was approved for 1983. These increases were considerably greater than in previous years and produced a better relation between revenues and costs for ENEL. But for 1984 a rise of only 7% is approved which is likely to produce a reduction in **real** electricity prices. In the domestic sector prices are recognised to be particularly low in relation to

costs. The relationship of pricing policy to the financing of ENEL's large investment programme is considered further below.

- natural gas tariffs continue to be subject to administrative control. Increases in tariff levels in the domestic sector were between 25 and 40% between February 1982 and May 1983 and in industry 14-15%.

Energy Efficiency

162. In the 1970s energy saving policy was restricted largely to limited information campaigns, essentially by the energy industries and companies themselves (ENEL, ENI, AGIP); speed limits; insulation standards for new and modernised residential or office buildings (since 1979); temperature limits in new buildings; and standards for heating boilers. The Law N° 308 of 29 May 1982 was intended to strengthen policy significantly by introducing a series of financial incentives for investment in energy saving in industry, transport and the residential/commercial sector. The Law also encouraged combined heat and power/district heating by reducing the regulatory constraints and providing subsidies for feasibility studies into heat distribution networks connected to CHP plants or power plants using renewable sources.

The 1982 law allocated 1568 bn lire for these purposes over the period 1982-84: 552 bn to be disbursed by the central Government and 1016 bn by the regions.

163. The implementation of this Law, however, does not appear to have proceeded as smoothly as expected, notably **at regional level.** A number of implementing Decrees are still outstanding at regional level. Some projects have apparently been approved; others are being studied. But so far little of the allocated finance has been committed. The Italian authorities believe that the Law should get off the ground during 1984 when new financial provisions will be required. It is clearly very important that further delays do not occur.

Hydrocarbon Exploration and Development

164. There has also been some difficulty in getting the planned hydrocarbon exploration and development programme off the ground. To date expenditure has been small.

Solid Fuels

165. The provisional update of the 1981 NEP envisages an increase in solid fuel demand of 9.5 mtoe 1982-1990. Electricity generation accounts for 7 mtoe of this total. By 1995, solid fuels use is expected to rise by a further 14 mtoe, 12 mtoe of this in electricity

generation. The pace of power station construction and conversion is therefore of crucial importance to the prospects for increased coal penetration.

At present, operating capacity is around 5.2 GW. New coal-fired plants (3.8 GW in total) are already authorised at Brindisi Sud, Sulcis 3, Tavassano and Fiume Santo 3 + 4 and conversions of a further 1.4 GW are underway. Authorisation procedures on other plants must be completed soon if the capacity now projected for 1990 (12.8 GW) is to be available in time. If the rather larger 1995 target is to be met, there must be a steady process of site authorisation and project approval. A key element here will be the progress on the largest new coal-fired plant, the 4 x 640 GW Gioia Tauro plant in Calabria, for which ENEL have recently indicated a completion date of 1994 compared with the NEP schedule of 1990.

166. The NEP foresaw the construction of three new coal-handling ports to deal with the long-term increase in coal use in the power generating sector: Trieste, Vado Ligure and Gioia Tauro. Only limited progress has been made so far in implementing these plans which are tied to final approvals for the construction of the associated coal-fired stations.

167. It should be noted in the context of solid fuel use that Italian legislation currently prohibits the use of power stations of coal with a sulphur content of more than 1% while fuel oil with a sulphur content of 3.5% is permitted.

168. The Italian authorities are considering whether or not to bring back into production the Sulcis coal mine in Sardinia for use in power stations in Sardinia. The production level could be 1.7 m tonnes (coal tonnes) of washed coal a year (compared with Italian consumption of around 16 m tonnes). It is envisaged that the coal from Sulcis could be in use in power stations by 1988 (despite its high sulphur content).

Nuclear

169. The updated NEP envisages a contribution of around 4.5 mtoe from nuclear power in 1990 and 15.5 mtoe in 1995. This may be optimistic given the outlook for capacity.

Besides the 1.3 GW currently in operation, there are 2 GW under construction at Montalto di Castro which are expected to come on stream by 1990. A further 10 GW is planned to be commissioned by 1995, but no **definite** decisions have yet been taken on sites for any of this additional capacity. In the case of 6 GW (originally envisaged as three separate plants in Piedmont, Lombardy and Puglia), there have been consultations with the regional authorities resulting in further investigations on the choice of **two** potential sites, in Piedmont and Lombardy respectively. With respect to the remaining 4 GW, the process of site selection is at a very preliminary stage.

It is important that progress in these areas is not further delayed. If all this capacity is to be in operation by 1990, construction ought to begin in the next 2-3 years.

Electricity

170. According to its latest investment programme, published in autumn 1983, ENEL envisages expenditure of some 45,800 bn lire up to 1995 on investment. The programme envisages the maintenance of the former programme and timescale for conversion of oil-fired stations to coal, but a retiming of the programme for new power station construction. The realism of this plan will depend on final decisions on site location for coal-fired and nuclear plant (it is noteworthy that 31,000 bn or two-thirds of the projected investment is on power stations for which no authorisations have yet been given) and on the success of measures to improve ENEL's financial position.

171. In order to encourage regional and local co-operation in the introduction of coal and nuclear plant, Law 8-83 provided for financial compensation for local authorities through a levy on the quantity of electricity produced and payments related to the installed capacity of plants converted to coal or new building of nuclear or coal-fired plant. ENEL is confident that this legislation and the new Government powers of arbitration should help to speed up the process of site determination.

172. Some measures have been taken, however, to help improve ENEL's financial position, which made large operating losses in 1981 and 1982. In addition to the tariff increases referred to above:

- Law 231 of May 1982 committed to the ENEL Endowment Fund some 5,890 bn lire over 10 years, around half of which is to help offset the costs of rising fuel inputs (the 'thermal surcharge') which ENEL was not allowed to cover by means of tariff increases 1979-81;

- Law 526 of August 1982 assigned a further 1,000 bn to the Fund; and

- Law 130 of April 1983 some 850 bn.

The Italian authorities recognise that even these payments will not have been sufficient to allow ENEL to break even in 1983 but hope that this will be achieved in 1984 by a further grant of 1,000 bn lire and an increase in non-household electricity tariffs **less** than the expected inflation rate.

173. A further complication in the electricity outlook is the possible longer-term impact of the recent agreement between ENEL and SNAM (the gas supply company) to replace some 2.5 mtoe of fuel oil with natural gas up to 1987 on an interruptible basis in dual oil-gas fired stations. It may prove attractive to both sides to extend this contract, with a possible consequence that the transition to coal-fired or nuclear stations will be delayed further (see below).

Natural Gas

174. Natural gas use increased by over 8% a year in Italy during the period 1973-81, the largest share going into the residential and commercial heating market. Until recently, the plans of the gas industry, within the framework of the NEP, have been to increase gas use by 50% up to 1990, with nearly half of this increment going to the residential/commercial sector and half to industry. The current revised energy projections continue to assume broadly the same overall rate of growth. Since 1979, however, there has been a reversal of the trend in gas consumption. At the same time, only limited progress appears to have been made in improving the gas transmission and distribution system on which high rates of gas penetration will depend (some 500m km of gas pipeline were constructed by SNAM in 1981, compared with already existing transmission capacity of nearly 16,000 km). SNAM recognises the constraints imposed by this factor in developing the household market in particular. In the industrial sector a special arrangement has been concluded between SNAM and CONFINDUSTRIA to encourage conversion to gas (including preferential tariffs).

175. This picture and its possible implications for the longer-term must be set against the gas supply position.

In 1977, an agreement was signed between Italy and Algeria to import 12.3 bcm annually through the Trans-Mediterranean pipeline, the contract for the construction of which was signed at the same time. The pipeline has been idle since late 1981 because of the pricing dispute. The deadlock was finally broken in April 1983 and deliveries of gas through the completed Trans-Mediterranean pipeline was expected to begin at end-1983. This gas will be in addition to existing supplies of Dutch and Soviet gas, and domestic Po Valley gas. In addition, SNAM has signed an agreement for new deliveries of Soviet gas (8 bcm) which is subject to Government approval. No final decision has yet been taken.

It is no longer self-evident that these contracted levels of supply are compatible with the realistic outlook for demand in the industrial and domestic sectors, taking into account the rate of progress in improving

the gas transmission system to cope with increased demand and the possible continuing price competition with oil. It is apparently against that background that the SNAM has recently signed new contracts for gas supplies to ENEL for electricity generation.

This gas will be priced marginally below heavy fuel oil equivalent, which is said currently to cover the costs. The financial situation of SNAM depends however on Government policy.

New and Renewables and New Energy Technology

176. Hydropower is expected to continue to play an important rôle in the electricity generating field. Together with geothermal energy, it is expected to be supplying over 9% of the primary energy inputs to electricity generation in 1990 and to account for nearly 20% of electricity output (two and a half times as much as nuclear energy).

177. Considerable efforts are underway to develop geothermal energy further. Already one 8 MW geothermal power plant is in operation and a second 8 MW plant is almost completed. Both ENEL and AGIP are engaged on large programmes of exploration drilling.

178. ENEL has been conducting a promotion campaign since 1982 on solar water heaters which, it is estimated, could save the equivalent of around 12,000 toe per year. Under Law 308, capital grants are available to consumers and there are special arrangements for delayed payment of the remainder with electricity bills.

179. Other developments include the continuing operation of the first prototype solar power plant (1MW) in Sicily; a wind power station in Sardinia; coal-water combustion projects by ENEL.

CONCLUSIONS

Progress is developing and implementing a comprehensive energy policy in Italy has been slower than expected in the Government's plans. Conservation, pricing and electricity policies in particular have not yet achieved fully satisfactory results. Oil dependence has been reduced more slowly than in all other Member States apart from Greece and Luxembourg. Oil still accounted for over two-thirds of energy supplies in 1982 and for nearly 60% of the inputs to electricity generation.

The New Energy Plan of 1981 was an important step forward, offering the prospect of a radical improvement in the situation over the coming years. Recent progress has been made in putting oil product and eletricity pricing on a sounder footing, although much remains to be done. But generally progress in implementing the Plan has been slower than expected and some of its objectives have been scaled down or re-timed in the light of developments to date and the new economic and energy situation since the second "oil shock".

Even if current energy projections are realised, nearly half of Italian electricity will be produced from oil in 1990 and Italy will remain dependent on oil for 57% of her energy supplies. It is essential that the planned switch to nuclear and coal in the power generating sector should not be further delayed by continued problems over siting or the interim use of natural gas in power stations; and that the provisions of the 1982 Energy Conservation Law should be fully enacted. There is a serious risk otherwise that Italy's position vis-à-vis other Member States will further deteriorate between now and 1990.

Table 1 SUMMARIZED ENERGY BALANCE - ITALIA

in million toe	1973[a]	1979[a]	1982[a]	1985[c]	1990[b]
I. **Gross Energy Consumption**	129,24	139,14	129,19	135,0	153,1
- Bunkers	7,03	5,00	4,02	4,0	4,0
- Inland consumption	122,21	134,14	125,17	131,0	149,1
II. **Inland Energy Consumption**	122,21	134,14	125,17	131,0	149,1
- Solid fuels	8,08	10,15	13,28	16,7	22,8
- Oil	95,20	95,58	83,57	82,1	84,0
- Gas	14,23	22,79	21,89	25,2	32,3
- Primary electricity, etc.	4,70	5,62	6,43	7,0	10,0
III. **Indigenous Production**[1]	19,33	18,28	19,87	19,6	24,7
- Hard coal	0,00	-	-	-	1,2
- Lignite & peat	0,31	0,33	0,32	0,3	0,3
- Oil	1,77	1,71	1,79	2,5	4,0
- Natural gas	12,62	11,09	11,94	10,2	9,6
- Nuclear energy	0,93	0,79	1,86	2,0	4,65
- Hydro & geothermal[2]	3,44	4,17	3,80	4,25	4,25
- Others & renewables	0,26	0,19	0,16	0,35	0,70
IV. **Net Imports**[3]	112,09	120,07	112,15	115,4	128,4
- Solid fuels	7,71	8,74	13,18	16,4	21,3
- Oil	102,65	98,77	87,30	83,6	(84,0)
- Natural gas	1,65	12,10	11,06	15,0	22,7
- Electricity[2]	0,08	0,46	0,61	0,4	0,4
V. **Stock changes**[4]	+2,18	-0,78	+2,83	..	..
- Solid fuels	-0,06	-1,07	+0,21	..	..
- Oil	+2,20	-0,11	+1,50	..	..
- Gas	+ 0,04	+ 0,40	+1,12	..	..
VI. **Electricity Generation Input**	26,07	32,74	34,22	38,6	46,5
- Solid fuels[5]	1,29	3,32	5,47	8,0	12,5
- Oil	19,13	21,88	20,29	20,8	21,6
- Natural gas	1,02	2,39	2,64	3,2	3,5
- Nuclear energy	0,93	0,79	1,86	2,0	4,65
- Hydro & geothermal[2]	3,44	4,17	3,80	4,25	4,25
- Others & renewables	0,26	0,19	0,16	0,35	-
VII. **Electricity Gross Production** (in TWh)	143,92	179,00	181,83	204,0	247,0
- Hydro & geothermal[6]	40,00	48,45	44,20	49,3	49,3
- Nuclear	3,14	2,63	6,80	7,3	(20,2)
- Conventional thermal	100,78	127,92	130,83	147,4	(177,5)
VIII. Electricity Gross consumpt (in TWh)	146,40	186,66	191,60	208,5	251,5

Sources: a. Statistical Office of the European Communities.
b. Review of National Energy Programmes 1983 Italy - October 1983.
c. Commission's estimates.

Notes:
1. Production of primary sources, including recovered products.
2. The conversion of electricity, including hydro and geothermal, is based on its actual energy content: 3600 kjoules/kWh or 860 kcal/kWh.
3. The (-) sign means net exports.
4. The (-) sign means a stock decrease.
5. Including coke oven gas and blast furnace gas (derived from coal)
6. Without pumped storage hydroelectricity.

General notes:
1° figures submitted by Member States have been adapted where necessary to ensure consistency with SOEC statistical definitions or conversion factors.
2° direct comparisons between 1982 and 1985 are not always possible, given that some forecasts use 1980 or 1981 as the basis for projection.

Table 2 MAIN ENERGY INDICATORS - ITALIA

(related to 1990 Objectives)

	1973	1979	1982	1985	1990
I. Share of Oil in Gross Energy Consumption	79.1%	72.3%	67.8%	63.8%	57%
II. Fuel inputs to Electricity production(1): Shares taken by:					
- Solid fuels	4.9%	10.2%	16.0%	20.7%	27%
- Nuclear	3.6%	2.4%	5.4%	5.2%	10%
- Hydro and others	14.2%	13.3%	11.6%	11.9%	9%
- Natural Gas	3.9%	7.3%	7.7%	8.3%	8%
- Oil	73.4%	66.8%	59.3%	53.9%	46%
III. Supply dependence on:(2)					
- Imported oil	79.4%	71.0%	67.8%	61.9%	55%
- Imported solid fuels	6.0%	6.3%	10.2%	12.2%	14%
- Imported natural gas	1.3%	8.7%	8.6%	11.1%	15%
IV. Share of imports in (3) gross consumption of:					
- Energy	86.7%	86.3%	86.8%	85.5%	84%
- Oil	98.3%	98.3%	98.0%	97.1%	95%
- Solid fuels	95.4%	86.1%	99.3%	98.2%	93%
- Natural gas	11.6%	53.1%	50.5%	59.5%	70%

	1973/63	1975/73	1979/75	1982/79	1990/85
V. Average annual growth rates:					
G D P	+4.9%	+0.2%	+3.8%	+1.1%	(+3.5%)
Inland energy consumption	+7.2%	-0.8%	+2.8%	-2.3%	+2.6%
Final energy consumption(4)	+7.4%	-1.1%	+2.5%	-2.3%	+1.6%
VI. Energy coefficient(5)	1.47	-	0.74	-	0.74

	1973	1979	1982	1985	1990
VII. Energy ratio (6) (10^6 LIT) (in kg oe per 10^6 LIT)	978.2	920.6	830.3	843.6	805.5
VIII. Energy intensity(7) (in kg oe per 10^6 LIT	688.4	661.2	604.2	634.3	574.8

Sources and General notes: see footnotes under Table 1.

Notes:
1. Basic data expressed in oil equivalent terms.
2. Respective shares of imported oil, imported natural gas or imported solid fuels in gross energy consumption.
3. Share of each imported energy source, in gross consumption of that source.
4. Non energy use included.
5. Energy coefficient = ratio between growth rates of inland energy consumption and GDP.
6. Energy ratio = volume of inland energy consumption per unit of GDP, expressed in real terms, at 1975 prices. (in kg of oil equivalent per unit of national currency).
7. Energy intensity = final energy demand per unit of GDP expressed in real terms at 1975 prices.

Table 3 TRENDS IN FINAL ENERGY CONSUMPTION - ITALIA

	1973	1979	1982	1985	1990
INDUSTRY:					
Energy consumption (1) (in million toe)	35.74	36.79	31.72	(35.5)	38.3
Share in final consumption	41.6%	38.2%	34.8%	36.1%	36.0%
Energy consumption per unit of value-added(2) (in kg oe per 10^6 LIT)	922.0	791.0	668.9	682.7	626.0
TRANSPORT:					
Energy consumption (1) (in million toe)	19.43	24.85	27.84	(28.5)	(30.5)
Share in final consumption	22.6%	25.8%	30.6%	28.9%	28.7%
Energy consumption per unit of GDP (3) (in kg oe per 10^6 LIT)	155.5	170.6	184.7	183.5	164.8
HOUSEHOLDS, etc...					
Energy consumption (1) (in million toe)	30.83	34.71	31.52	(34.5)	(37.6)
Share in final consumption	35.8%	36.0%	34.6%	35.0%	35.3%
Energy consumption per unit of private consumption (4) (in kg oe per 10^6 LIT)	383.1	371.1	321.5	354.4	326.8
FINAL ENERGY CONSUMPTION (in million toe) (1)	86.00	96.35	91.08	98.5	106.4
of which: Oil	68.4%	62.2%	59.1%	(55%)	50%
Final non-energy use (in million toe)	12.12	9.71	7.64	(8.0)	8.6

Sources and General Notes: see footnotes under Table 1.

Notes: (1) non-energy use, not included.
(2) volume of energy consumed in the industrial sector, per unit of value-added produced by industry, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(3) volume of energy consumed in the transport sector, per unit of GDP, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(4) volume of energy consumed in the residential + tertiary sector, per unit of Private Consumption, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).

LUXEMBOURG

ENERGY TRENDS

180. The Luxembourg economy is small and dominated by the steel industry which accounts for around half of final energy demand. There are practically no indigenous energy resources; virtually all primary energy supplies (including **electricity**) have to be imported from neighbouring countries, especially Belgium and Germany.

181. During the 1960s and early 1970s high rates of economic growth, related to a buoyant steel industry, brought substantial increases in energy demand. At the same time there was a substantial shift to **oil products** in steel-making at the expense of coal as the traditional source of supply. Between 1960 and 1974 coal use in the economy as a whole declined from 3.2 mtoe to 2.7 mtoe, while oil use rose from 0.2 to 1.5 mtoe.

182. Developments since 1973-74 have been dominated by the slowdown in activity in the steel industry; a substantial fall in energy demand resulting from this and increased efficiency of energy use in the industry; an accompanying fall in oil demand; and a slowdown in the rate of decline of coal use, combined with increased electricity penetration and the introduction of natural gas. In 1982 energy demand was around two-thirds its 1973 level and dependence on oil imports had been reduced slightly to one-third of energy demand.

THE EVOLUTION OF ENERGY POLICY

183. There have been no major changes in energy policy in recent years. The main objectives are currently seen as: secure supplies of **electricity**; reinforcement of the **energy distribution infrastructure** ; further **substitution of oil products**; **diversification** of sources of imported energy supplies; and increased **efficiency of energy use.** New and renewable energies are thought by the authorities to have generally limited prospects in Luxembourg, although financial support is being given to a few demonstration projects on **heat pumps.**

THE ENERGY OUTLOOK

184. Current forecasts to 1990 are more conservative about the outlook for energy demand than those submitted for the last review, reflecting a downward revision of the GDP growth rate assumed (now put at 1-2% p.a. over the period 1985-1990). They point to continuing increases in the efficiency of energy use and a further, though limited reduction of **dependence** on imported oil and increases in the use of coal and natural gas. Despite the readjustments since the previous forecasts, the present figures still point, however, to a small **increase in oil use.** It is recognised that this evolution will depend very heavily, as in the past, on developments in the steel industry.

SECTORAL AND HORIZONTAL DEVELOPMENTS

Energy Efficiency and Energy Pricing

185. In past years only limited attention has been given by the Government of Luxembourg to energy saving policy as a whole. There have been substantial increases in the efficiency of energy use by the steel industry, related to cost-cutting induced by the financial pressures on the industry and fuel-switching. An **information** campaign has been under way since 1979; modest **thermal insulation standards** have been set for new buildings; there are regulations relating to temperature levels in **public buildings**; and grant aids for the **insulation and regulation of existing housing.** But the scope of these measures is limited compared with those in force in some other Community countries.

186. **Low rates of taxation** on energy products (notably motor fuels), combined with lower than average pre-tax prices for energy, have weakened the incentive to save energy. In the past two years there have been substantial price increases for all types of energy, a significant increase in excise duty on petroleum products and a new structure of electricity tariffs which removes the elements of depressivity which existed hitherto. These changes should help to produce greater incentives to rational energy use, although pre- and post-tax prices, and notably the post-tax prices of motor fuels, still remain markedly lower than in neighbouring countries.

Coal

187. As noted earlier, the rate of decline in coal use slowed down after 1974. Nevertheless the use of coke and coal by the steel industry (representing 90% of coal demand) was down in 1982 to 46% of its 1974 level and coal use in the domestic sector had more than halved.

188. Despite these trends, **coal and coke seem likely to remain the most important single source of energy supply in Luxembourg for the foreseeable future.** Guaranteeing adequate and secure supplies of coke

must therefore remain a key element in energy policy. Supplies currently come largely from other Member States and notably Germany, reflecting the close links between the Luxembourg steel industry and the Ruhr and Aachen coal fields. The aim of diversification has also led to the purchase by Luxembourg industries of holdings in coal mines outside the Community and the signature of commercial contracts with external coal suppliers outside the Community. Some supplies from these sources are for use in Belgium.

Electricity

189. 40% of electricity is consumed in the steel industry. Despite the slowdown in output in the industry in the past few years, electricity use in steel-making has continued to increase, though less rapidly than the penetration of electricity in the domestic and commercial sectors where the direct substitution for oil in heating has been marked.

190. At present, Luxembourg's commercial electricity is supplied under two contracts: the Belgian company UNERG supplies the steel industry network and the German RWE the public supply system. Contracts with both organisations expire at the end of 1985. The immediate options are:

- long-term supply contracts with one or more utilities in neighbouring countries (discussions are already under way with potential suppliers);

- part-ownership of one or more power stations in neighbouring countries.

In the longer-term the option of construction of a thermal power plant at home remains, but this seems likely to be an issue for the 1990s rather than for the remainder of this decade.

Gas

191. Natural gas currently accounts for nearly 10% of Luxembourg's primary energy supply. **Natural gas** was introduced in 1972 and after substantial growth in demand has come to account (1982) for nearly 10% of final energy demand. Over 40% of this natural gas is used in the steel industry to enrich the blast-furnace gas and the evolution of total demand will therefore be heavily influenced by the outlook for the steel industry. In the **residential** sector there has been a steady growth in gas use and it now accounts for 45% of natural gas demand. Further penetration is limited by the distribution system which is confined to the city of Luxembourg and the southern part of the country. Long-term supply contracts, with Belgium and France do not expire until 1995.

192. Blast furnace gas, which is produced from coal in the steel-making process, accounts for some 10% of final consumption. Some of it is used for electricity generation in the steel industry and the rest directly in the steel mills themselves.

CONCLUSIONS

Total primary energy demand in Luxembourg is less than 3.5 mtoe compared with over 900 mtoe for the Ten. The evolution of the energy balance will therefore have only a marginal impact on the Community as a whole, although it remains an important issue at national level. The outlook is, also of some direct relevance to Belgium and Germany as Luxembourg's major sources of natural gas, coal, electricity and oil products. Moreover, for its own economic reasons, as well as reasons of Community solidarity, it is clearly important that Luxembourg should consolidate the gains already made in reducing dependence on oil and increasing the efficiency of energy use. Against that background there are four aspects of energy policy where uncertainties or inadequacies persist:

(i) medium- and long-term sources of **electricity supply**;

(ii) the scope for improving and extending the **natural gas distribution** network so as to give wider access by domestic consumers to gas as an alternative to oil for heating;

(iii) the desirability of fleshing out a more comprehensive **energy saving policy**;

(iv) further progress in bringing the post-tax prices of **motor fuels** more into line with those in other Community countries.

Table 1 SUMMARIZED ENERGY BALANCE - LUXEMBOURG

in million toe	1973[a]	1979[a]	1982[a]	1985[b]	1990[b]
I. **Gross Energy Consumption**	4,50	3,85	2,98	3,21	3,43
- Bunkers	-	-	-	-	-
- Inland consumption	4,50	3,85	2,98	3,21	3,43
II. **Inland Energy Consumption**	4,50	3,85	2,98	3,21	3,43
- Solid fuels	2,45	1,84	1,37	1,50	1,60
- Oil	1,65	1,29	1,04	1,10	1,10
- Gas	0,22	0,47	0,27	0,30	0,40
- Primary electricity, etc.	0,18	0,25	0,30	0,31	0,33
III. **Indigenous Production**[1]	0,01	0,02	0,03	0,01	1,01
- Hard coal	-	-	-	-	-
- Lignite & peat	-	-	-	-	-
- Oil	-	-	-	-	-
- Natural gas	-	-	-	-	-
- Nuclear energy	-	-	-	-	-
- Hydro & geothermal[2]	0,01	0,01	0,01	(0,01)	(0,01)
- Others & renewables	0,00	0,01	0,02	-	-
IV. **Net Imports**[3]	4,50	3,91	2,95	3,20	3,42
- Solid fuels	2,46	1,88	1,37	1,50	1,60
- Oil	1,65	1,33	1,04	1,10	1,10
- Natural gas	0,22	0,47	0,27	0,30	0,40
- Electricity[2]	0,17	0,23	0,27	0,30	0,32
V. **Stock changes**[4]	+0,01	+0,01	-0,00	..	..
- Solid fuels	+0,01	+0,00	-0,00	..	..
- Oil	-	+0,01	+0,00	..	..
- Gas	-	-	-	..	..
VI. **Electricity Generation Input**	0,45	0,32	0,16	0,14	0,15
- Solid fuels[5]	0,29	0,14	0,10	0,10	0,11
- Oil	0,11	0,04	0,03	0,03	0,02
- Natural gas	0,04	0,12	0,00	0,00	0,01
- Nuclear energy	-	-	-	-	-
- Hydro & geothermal[2]	0,01	0,01	0,01	0,01	0,01
- Others & renewables	0,00	0,01	0,02	-	-
VII. **Electricity Gross Production** (in TWh)	1,40	1,10	0,54	[c] (0,49)	[c] (0,52)
- Hydro & geothermal[6]	0,06	0,09	0,09	(0,10)	(0,10)
- Nuclear	-	-	-	-	-
- Conventional thermal	1,34	1,01	0,45	(0,39)	(0,42)
VIII. **Electricity Gross Consumpt** (in TWh)	4,22	4,02	4,08	(4,47)	(4,86)

Sources: a. Statistical Office of the European Communities.
b. Review of National Energy Programmes 1983 Luxembourg - 12 August 1983.
c. Commission's estimates.

Notes: 1. Production of primary sources, including recovered products.
2. The conversion of electricity, including hydro and geothermal, is based on its actual energy content: 3600 kjoules/kWh or 860 kcal/kWh.
3. The (-) sign means net exports.
4. The (-) sign means a stock decrease.
5. Including coke oven gas and blast furnace gas (derived from coal).
6. Without pumped storage hydroelectricity.

General notes:
1° figures submitted by Member States have been adapted where necessary to ensure consistency with SOEC statistical definitions or conversion factors.
2° direct comparisons between 1982 and 1985 are not always possible, given that some forecasts use 1980 or 1981 as the basis for projection.

Table 2 MAIN ENERGY INDICATORS - LUXEMBOURG

(related to 1990 Objectives)

	1973	1979	1982	1985	1990
I. Share of Oil in Gross Energy Consumption	36.7%	33.5%	34.9%	34.3%	32%
II. Fuel inputs to Electricity production(1): Shares taken by:					
- Solid fuels	64.5%	43.8%	62.5%	71.4%	73%
- Nuclear	-	-	-	-	-
- Hydro and others	2.2%	6.2%	18.8%	7.2%	7%
- Natural Gas	8.9%	37.5%	0.0%	0.0%	7%
- Oil	24.4%	12.5%	18.7%	21.4%	13%
III. Supply dependence on:(2)					
- Imported oil	36.7%	34.6%	34.9%	34.3%	32%
- Imported solid fuels	54.7%	48.8%	46.0%	46.7%	47%
- Imported natural gas	4.4%	12.2%	9.1%	9.4%	12%
IV. Share of imports in (3) gross consumption of:					
- Energy	99.8%	99.5%	99.0%	99.7%	99.5%
- Oil	100%	100%	100%	100%	100%
- Solid fuels	100%	100%	100%	100%	100%
- Natural gas	100%	100%	100%	100%	100%

	1973/63	1975/73	1979/75	1982/79	1990/85
V. Average annual growth rates:					
G D P	+4.9%	-1.3%	+2.8%	+0.4%	+1.5%
Inland energy consumption	+3.5%	-7.5%	-	-8.2%	+1.4%
Final energy consumption(4)	+3.4%	-7.1%	+0.2%	-7.7%	+1.4%
VI. Energy coefficient(5)	0.71	-	-	-	0.61

	1973	1979	1982	1985	1990
VII. Energy ratio (6) (in kg oe per 10^4 LFR)	505.7	396.5	303.2	312.3	309.7
VIII. Energy intensity(7) (in kg oe per 10^4 LFR)	463.0	368.6	284.9	301.6	297.9

Sources and General notes: see footnotes under Table 1.

Notes:
1. Basic data expressed in oil equivalent terms.
2. Respective shares of imported oil, imported natural gas or imported solid fuels in gross energy consumption.
3. Share of each imported energy source, in gross consumption of that source.
4. Non energy use included.
5. Energy coefficient = ratio between growth rates of inland energy consumption and GDP.
6. Energy ratio = volume of inland energy consumption per unit of GDP, expressed in real terms, at 1975 prices. (in kg of oil equivalent per unit of national currency).
7. Energy intensity = volume of final energy demand per unit of GDP expressed in real terms at 1975 prices.

Table 3 TRENDS IN FINAL ENERGY CONSUMPTION - LUXEMBOURG

	1973	1979	1982	1985	1990
INDUSTRY:					
Energy consumption (1) (in million toe)	3.29	2.46	1.70	1.9	2.1
Share in final consumption	79.8%	68.7%	60.7%	61.4%	63.6%
Energy consumption per unit of value-added(2) (in kg oe per 10^4 LFR)	1075.0	839.3	679.1	725	744
TRANSPORT:					
Energy consumption (1) (in million toe)	0.30	0.48	0.54	0.6	0.6
Share in final consumption	7.3%	13.4%	19.3%	19.3%	18.2%
Energy consumption per unit of GDP (3) (in kg oe per 10^4 LFR)	33.71	49.71	54.9	58.4	54.2
HOUSEHOLDS, etc...					
Energy consumption (1) (in million toe)	0.53	0.64	0.56	0.6	0.6
Share in final consumption	12.9%	17.9%	20.0%	19.3%	18.2%
Energy consumption per unit of private consumption (4) (in kg oe per 10^4 LFR)	117.3	114.1	96.7	99.0	91.9
FINAL ENERGY CONSUMPTION (in million toe) (1)	4.12	3.58	2.80	3.1	3.3
of which: Oil	36.1%	34.3%	34.7%	34.5%	32.5%
Final non-energy use (in million toe)	0.03	0.03	0.04	0.0	0.0

Sources and General Notes: see footnotes under Table 1.

Notes: (1) non-energy use, not included.
(2) volume of energy consumed in the industrial sector, per unit of value-added produced by industry, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(3) volume of energy consumed in the transport sector, per unit of GDP, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(4) volume of energy consumed in the residential + tertiary sector, per unit of Private Consumption, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).

THE NETHERLANDS

ENERGY TRENDS

193. Following the discovery of the Groningen field in 1959, natural gas rapidly became central to the Dutch energy economy and an inceasingly important source of Government revenue. By 1973 the Netherlands was a large net exporter of gas; gas accounted for over 46% of inland energy consumption (only a little behind oil); and provided over 80% of the inputs to the electricity sector.

194. With the peaking of production from Groningen in the mid-1970s, decisions were taken to slow down its rate of development by using gas at home only for premium uses (i.e. its use in electricity generation or as a boiler fuel in industry should be minimised), by substituting offshore gas wherever possible and by developing imports of pipeline gas and LNG to supplement gas reserves. The corollary was a short-term policy of switching existing dual-fired (gas and oil) power stations back to **oil**, combined with a longer-term policy of basing new generation facilities on coal and encouraging coal use in industry.

195. By 1979 oil use in power-stations had risen to 4.8 mtoe or nearly 34% of total primary energy inputs to electricity-generation and overall oil dependence was still over 50% compared with 56% in 1973.

The last four years have brought significant changes. Overall energy demand fell by 10 mtoe or 14% between 1979 and 1982; oil demand by nearly 8 mtoe or 25%; and natural gas demand by 5 mtoe or 15%. Solid fuel use, on the other hand, has actually increased by 1.5 mtoe (47%), the first fruits of the policy of developing coal use in the electricity-generating sector. In 1982 coal provided 22% of the inputs to electricity-generation; gas 45%; and oil 23%.

196. The Dutch economy is relatively energy-intensive, with industry in particular having a high level of intensity. The availability of natural gas itself facilitated the rapid expansion in the 1960s of energy-intensive industries, reflected in an energy coefficient of some 1.8 for the period 1960-73. But the ratio between energy demand and GDP has declined significantly since 1973 and in both industry and, especially, the household sector there have been major improvements in the intensity of final energy demand.

THE EVOLUTION OF ENERGY POLICY

197. Energy policy over the past ten years has had three main strands:

- optimal management of the development of Dutch gas reserves;
- the gradual introduction of coal into the electricity-generating system;
- energy conservation policy. The programme developed during the 1970s and early 1980s involved significant information campaigns; regulatory elements and an increasingly important set of financial inducements (notably for retrofitting in the residential sector); fiscal incentives in industry; and subsidies for district heating. In 1982 the Dutch Government provided one of the highest levels in the Community of per capita financial support to energy conservation investment.

198. In September 1983 the new Dutch Government announced the results of a reexamination of energy policy in a note submitted to Parliament. This focussed particularly on natural gas policy, the organisation of the electricity generating sector and energy conservation policy. These subjects are discussed further below. The new gas policy was approvd by Parliament in autumn 1983. In January 1984 Parliament set the directon for a reorganisation of the electicity sector. 1984 should also see the finalisation of the Public Debate on (Nuclear) Energy, begun in 1978, which should lead to a decision about the place of nuclear power in the electricity sector in the 1990s.

THE ENERGY OUTLOOK

199. In December 1981 the Dutch Government published a so-called "reference scenario" for the future development of energy supply and demand which formed the basis for the report made by the Commission in its last review of national programmes. Reflecting the immediate effects of the second oil shock, that "reference scenario" implied a stabilisation of gas use up to 1990 at around its 1981 level (26 mtoe) and major **new efforts to increase the rôle for coal which was then expected to become the dominant source of power generation in the second half of the decade.**

No new comprehensive set of forecasts or scenarios has been completed since then. But a tentative update was submitted to the Commission towards the end of 1983, taking into account the slow down in economic growth and the new energy situation of the early 1980s. The revised projections are summarised in Tables 1-3. They indicate an overall level of primary energy demand some 11 mtoe or 13% below that projected earlier; natural gas demand 2 mtoe or 7% lower; and **coal use 5 mtoe or 40% lower** than projected in 1981. At the same time natural gas output is projected at 6.5 mtoe and net gas exports at nearly 9 mtoe above the earlier figures. Inland oil demand is projected to increase in volume by

15% between 1982 and 1990 and oil dependence will rise a little rather than fall although oil use in absolute terms will still be lower than 1979 and 1980.

The projections also imply some reversal in the improvements of the past years in levels of energy-intensity, notably in industry.

SECTORAL AND HORIZONTAL DEVELOPMENTS

Energy Pricing Policy

200. From 1 August 1981 controls on oil product prices were provisionally abolished and from 19 September 1983 definitively abolished, even for sub-crisis situations. There are no Government controls over the prices of imported coal.

201. Natural gas prices are negotiated between Gasunie and users but subject to the approval of the Ministry of Economic Affairs. The general approach is to link prices to the competitive alternative fuel, such as heavy fuel oil for industry, electricity and horticulture and domestic heating oil for the residential sector. The Commission is examining the pricing arrangements for the fertiliser industry and also those under new contracts with the electricity industry (see below).

202. Gas prices to the residential sector are significantly below heating oil prices. But since 1981 oil prices to industry and households have fallen while gas prices have risen, thus bridging the gap somewhat. The Dutch Government has proposed to Parliament that there should be an equalisation of these prices within three years.

203. Electricity tariffs are set by the electricity utilities but the Minister of Economic Affairs has powers to intervene if he considers proposed price rises to be too high. Dutch electricity tariffs tend to be higher than those of neighbouring countries partly because of the dependence on high cost oil and gas-based electricity. One of the reasons for the new lower-cost gas sales to the electricity industry has been to help improve industrial competitivity (see paragraph 207 below).

Energy Efficiency

204. The importance of continued efforts to improve energy efficiency is underlined by the relatively high level of energy use in industry and households referred to earlier. The present Government remains committed to energy conservation as a central element of energy policy. But a number of elements in that policy have been reexamined:

- an Energy Conservation for Appliances Bill was placed before Parliament in December 1981 with the aim of giving the Government authority to prescribe, inter alia, efficiency standards, energy

labels and individual metering. Some elements of this Bill have subsequently been reconsidered by the Government within the framework of its deregulation programme;

- a second element in proposed Government legislation (use of waste heat for district heating) has been abandoned;

- a Committee with representatives of industry, public utilities and Government has recently reported on ways to overcome the barriers to CHP, and the report has been approved by the Government;

- a Government study began in autumn 1983 to evaluate the effectiveness of the general subsidy schemes for investment in energy conservation;

Behind this new approach appear to lie two main objectives: firstly, the wish, as far as possible, to strengthen the rôle of the market by removing administrative and legislative barriers (while at the same time improving advisory and R, D & D facilities); and secondly, the desire to concentrate Government spending in this field on priority sectors against a background of financial stringency. It is important that this new approach should take due account of the possible effects on energy saving investment of the expectation of declining real oil prices. The Government will also need to take into account the requirements of energy conservation, including CHP/DH, in the policy which they adopt on gas sales to the domestic market given the scope for some conflict of objectives. The authorities consider that this conflict can be avoided by the policy of linking gas prices to the price of competing alternative fuels.

Electricity

205. On the basis of the latest submission from the Dutch Government the demand for primary inputs to electricity-generation in 1990 will be of the order of 11.8 mtoe compared with the 15 mtoe forecast in 1981. This change reflects a reassessment of requirements in the light of **negative** growth of electricity demand and the increasing level of surplus capacity (plant margins amount to over 40%). Already two **new** coal-fired power stations (Dordrecht and Amsterdam), the construction of which was planned for the latter half of the 1980s, have been cancelled (another factor in these decisions was the cost of meeting emission controls). The Dutch authorities argue, however, that it should still be possible to raise the share of coal use in electricity generation from its existing 20% of fuel inputs to about 40% at the beginning of the 1990s by a **continuing programme of conversion to coal-firing**, although the projected volumes of coal consumption will be smaller. An important step forward in this respect was taken by the decisions last year on the conversions to coal of Maasvlakte power station (1050 Mw), Borssele (400 Mw) and Buggenum (200 Mw).

206. Early in 1982 arrangements were concluded between Gasunie and the electricity industry for the supply of 20 bcm (around 16 mtoe) additional gas to power stations over the period to 1987, as an **interim** arrangement during the completion of the coal conversion programme. These

arrangements ought not **of themselves** to alter the longer-term prospects for coal. The gas thus used is intended to displace oil and the arrangement is limited in time. If the arrangements were extended beyond 1987, there would obviously be implications for the coal conversion programme,but the authorities rule this out as a possibility.

207. The gas for power stations contract was negotiated by Gasunie and SEP (the organisation of electricity utilities) at a price below the fuel oil equivalent price. It was intended to compensate for the decreasing volume of gas sold by Gasunie, which also had a significant negative influence on Government revenues. A major and immediately accessible outlet has been found through SEP, but only on conditions which enabled SEP and the utilities to sell electricity to some 100 large industrial users with high load factors at prices stated to be in line with **coal-based** electricity prices. New coal-based tariffs to industrial consumers using more than 30 m KwH were therefore introduced in July 1982. The Commission is currently examining these pricing arrangements separately and in detail in relation to the Community's pricing principles adopted in a Council Resolution of 1980, recognising that the costs of Dutch electricity are high in relation to neighbouring countries.

208. In January 1984 Parliament debated the Government proposal for a reorganisation of the electricity generating sector. The main characteristics of the new organisation, aimed at a more competitive and efficient arrangement, and as agreed by the majority in Parliament, are:

- concentration of large-scale electricity generating in a few companies (currently there are 16);
- separation of generation and distribution of electricity;
- pooling of generating costs;
- statutory powers for the Minister of Economic Affairs, in relation to capacity, fuelmix, and tariff structures;
- improving the scope for small scale generation by the distribution companies, and for CHP and imports of electricity by industry, as a spur to competition.

Coal Use

209. In 1980 the then Government set an objective of 12 m tonnes (8 mtoe) consumption in 1990, including a specific target for industry, and 30 m tonnes (20 mtoe) in 2000. Now coal use is projected at slightly less than the objectives for 1990 and industrial use at 2.8 mtoe, with the steel industry alone accounting for 2 mtoe. For 2000 the objective of 20 mtoe is no longer expected to be reached, mainly because of revised assumptions about the development of coal gasification (expected contribution down from 7 m tonnes to 1 m tonnes). Recently a study was completed for the Ministry of Economic Affairs on the technical and economic feasibility of coal-use in a number of representative Dutch enterprises with a view to the development of CHP from coal. The results

showed a general preference for gas-turbine-based CHP, for technical and economic reasons, which has reinforced the increasingly conservative forecasts of coal use.

210. One particularly important factor in influencing attitudes to coal use in industry appears to be the stringent environmental **(including waste-disposal) requirements** that are operative. In 1983 the Government agreed to relax temporarily the requirements in respect of SO_2 emissions for new coal-fired boilers built before 1990 where coal use does not exceed 1.5 m tonnes a year. But there remain tough emission standards for coal-fired generating plants, with requirements to install flue-gas desulphurisation units.

Nuclear

211. Nuclear power makes only a minor contribution to public electricity supply: the Dodewaard reactor (which came into service in 1969) is a small research station (50 Mw) and output from the 445 Mw reactor at Borssele (in service since 1973) is largely dedicated to the PU aluminium smelter. In 1974 programmes were announced to increase capacity to 3,500 Mw but encountered strong public and political opposition. In 1978 the Government and Parliament decided to launch a Public Debate on (Nuclear) Energy to break the impasse. This debate was finally launched in the summer of 1981 with nomination of an independent Steering Committee to lead it. The Committee produced an interim report in January 1983 which set out various technical assessments of the rôle which the different energy sources could play up to 2000 and assessments of the cost of nuclear power relative to other sources, as the basis for discussion at a considerable number of public meetings. Following public discussions and further soundings of opinion (including that of the European Commission) the Committee's final report was published early in 1984, coming out against further expansion of nuclear power. Government and Parliament will take final decisions about the future of the nuclear programme, possibly in the second half of 1984.

212. Even if a decision is taken to adopt the nuclear option, no new capacity could be available until 1994 at the latest, given the long lead-times involved in nuclear power station construction. **If the decision is negative there will clearly be implications for coal and gas use in the 1990s.** At present there is large surplus capacity in the Dutch electricity industry. By the mid-1990s, even with limited development of electricity demand, a number of the existing power stations will need replacement. A decision of Government and Parliament against the nuclear option would make it even more important than at present to determine the future rôle for coal in electricity-generation.

In the meantime, and given the high cost of producing Dutch electricity there is evident interest on the part of SEP in **importing nuclear electricity** from Belgium and France.

213. The Government also set up a Committee in May 1982 to investigate the consequences of keeping open, mothballing or closing down the two existing nuclear stations. In January 1983 the Committee reported that the costs of closing down would be large (3-5 bn guilders) and would have adverse effects on the prospects for new nuclear installations. In March 1983 the Government made clear that, in the light of this report, it intended to continue to operate both stations.

Natural Gas

214. Natural gas policy was debated in Parliament in autumn 1983, following the Government's note on energy policy. Parliament has agreed that gas policy should now be based on the following principles:

(i) the volume of gas sold in the Netherlands should be dictated by market factors, notably gas prices;

(ii) gas should be used to replace oil in electricity generation in anticipation of the completion of the coal conversion programme;

(iii) a more selective gas import policy (discussions on imports of natural gas from the USSR were suspended last year);

(iv) a new gas export policy (see below);

In addition it should be noted that there has been some easing of restrictions on gas sales to industry. The Government has given approval until 1986 at least for new contracts with industry up to a total of 25 bcm of gas for underfiring applications (the previous limit was 10 bcm).

215. This new approach reflects the fall in demand for gas both in the Netherlands and in other Community countries receiving gas from the Netherlands (Dutch gas exports were down in 1982 to 35 bcm, 30% below the figure of 49 bcm in 1979); the corresponding fall in Government revenues from gas; and an upgrading of natural gas reserves in 1982 and 1983. Gas reserves (proven and probable) in July 1983 were estimated at 1930 bcm, or about 33 times 1982 production. On the basis of forward projections of gas demand and export commitments these reserves will be sufficient for more than 50 years. The Government has indicated to Parliament that against that background it envisages some relaxation of the existing ban on **new export contracts** so as to allow a more gradual run-down of Dutch gas exports in the 1990s (under present contracts Dutch exports are expected to decline sharply to practically zero by the end of the century) so as to guarantee to other West European countries the possibility of falling back on Dutch gas if interruptions in supplies from other sources were to occur.

These decisions by the Dutch Government on gas depletion and gas export policy are very important to the rest of the Community. The Netherlands remains the largest source of supply of gas imported by other Member States. In 1990 it should still remain the largest single source of supply. The Government is willing to agree on commercial deals which

contribute to a strengthening of European supply security with respect to gas after 1990. The ultimate form, including the quantity of additional export commitments will depend on commercial negotiations between Gasunie and foreign gas companies starting this year.

CONCLUSIONS

The availability of large supplies of indigenous natural gas in the Netherlands has helped in itself to reduce Dutch dependence on oil and has made an important contribution to the diversification of sources of gas supplies in other Member States. But the availability of gas has also discouraged vigorous attempts to switch to other non-oil fuels, notably in the power station sector, where progress has been slow compared with some other Community countries. In 1982 the Netherlands was still dependent on oil for over 48% of her energy demand and for nearly one-quarter of the inputs to electricity-generation. It is understood that these percentages fell significantly in 1983 as a result of the increased sales of gas to power stations. But there clearly remains some risk that the existing high levels of electricity capacity, downward revisions to projected energy and electricity demand and budgetary pressures encouraging minimum levels of gas offtake could slow down the pace of restructuring in the electricity sector.

Even if existing projections are realised, inland oil demand will increase in volume by 15% between 1982 and 1990 and oil dependence increase (to over 50%). The trends would be even less satisfactory if existing interim arrangements for the burning of higher levels of natural gas in power stations were to be renewed. The Dutch authorities, however, rule this out.

The process of change on the demand side has been faster. The Netherlands has had one of the most wide-ranging energy conservation programmes in the Community, with a high level of Government budgetary expenditure. It is right that the priorities should now be examined carefully, together with the cost-effectiveness of different kinds of action. But any new guidelines for policy that emerge should take full account of the constraints on investment in efficient energy use in a generally depressed investment climate.

Other areas of major interest for the longer-term are:

- **gas export policy**: the new policy on gas exports is of interest to the whole Community. It is important that the scope for additional exports in the 1990s should be clarified as soon as possible;

- **nuclear**: it is essential that a clear decision be taken as soon as possible one way or the other about the rôle of nuclear in the power-station mix in the 1990s. Without such a decision, sensible planning of new coal fired stations and of the rôle for gas in the electricity sector in the longer-term will be rendered particularly difficult.

Table 1 SUMMARIZED ENERGY BALANCE - NEDERLAND

in million toe	1973[a]	1979[a]	1982[a]	1985[b]	1990[b]
I. **Gross Energy Consumption**	72,89	75,34	65,03	70,9	73,3
- Bunkers	11,53	7,78	8,66	10,6	11,8
- Inland consumption	61,36	67,56	56,37	60,3	61,5
II. **Inland Energy Consumption**	61,36	67,56	56,37	60,3	61,5
- Solid fuels	3,16	3,29	4,85	5,45	7,6
- Oil	29,51	30,64	22,70	22,9	26,2
- Gas	28,50	32,38	27,39	30,5	26,2
- Primary electricity, etc.	0,19	1,25	1,43	1,4	1,5
III. **Indigenous Production**[1]	56,78	73,60	55,55	59,9	54,7
- Hard coal	1,19	-	-	-	-
- Lignite & peat	-	-	-	-	-
- Oil	1,54	1,58	1,92	3,7	3,7
- Natural gas	53,75	70,78	52,45	55,0	49,9
- Nuclear energy	0,30	0,90	0,98	1,0	1,0
- Hydro & geothermal[2]	-	-	-	-	-
- Others & renewables	-	0,34	0,20	0,2	0,1
IV. **Net Imports**[3]	16,28	3,59	9,03	11,0	18,6
- Solid fuels	1,69	3,49	6,00	5,45	7,6
- Oil	39,96	38,48	27,84	29,8	34,3
- Natural gas	-25,25	-38,39	-25,06	-24,45	-23,7
- Electricity[2]	-0,12	0,01	0,25	0,2	0,4
V. **Stock changes**[4]	+0,18	+1,86	-0,46	..	..
- Solid fuels	-0,28	+0,20	+1,14	..	..
- Oil	+0,46	+1,65	-1,60	..	..
- Gas	-	+ 0,01	-0,00	..	..
VI. **Electricity Generation Input**	12,03	14,20	12,76	12,4	11,8
- Solid fuels[5]	0,81	1,12	2,84	3,1	4,9
- Oil	1,55	4,77	2,98	0,3	1,7
- Natural gas	9,37	7,07	5,76	7,8	4,1
- Nuclear energy	0,30	0,90	0,98	1,0	1,0
- Hydro & geothermal[2]	-	-	-	-	-
- Others & renewables	-	0,34	0,20	0,20	0,1
VII. **Electricity Gross Production** (in TWh)	52,63	64,46	60,31	52,7	50,2
- Hydro & geothermal[6]	-	-	-	-	-
- Nuclear	1,11	3,49	3,90	4,2	4,2
- Conventional thermal	51,52	60,97	56,41	48,5	46,0
VIII. Electricity Gross Consumpt (in TWh)	51,28	64,61	63,18	52,5	53,5

Sources: a. Statistical Office of the European Communities.
b. Review of National Energy Programmes 1983 Netherlands - 30 January 1984.

Notes: 1. Production of primary sources, including recovered products.
2. The conversion of electricity, including hydro and geothermal, is based on its actual energy content: 3600 kjoules/kWh or 860 kcal/kWh.
3. The (-) sign means net exports.
4. The (-) sign means a stock decrease.
5. Including coke oven gas and blast furnace gas (derived from coal).
6. Without pumped storage hydroelectricity.

General notes:
1° figures submitted by Member States have been adapted where necessary to ensure consistency with SOEC statistical definitions or conversion factors.
2° direct comparisons between 1982 and 1985 are not always possible, given that some forecasts use 1980 or 1981 as the basis for projection.

Table 2 MAIN ENERGY INDICATORS - NEDERLAND

(related to 1990 Objectives)

	1973	1979	1982	1985	1990
I. Share of Oil in Gross Energy Consumption	56.3%	51.0%	48.2%	47.3%	51.8
II. Fuel inputs to electricity production(1): Shares taken by:					
- Solid fuels	6.7%	7.9%	22.3%	25.0%	42%
- Nuclear	2.5%	6.3%	7.7%	8.1%	8%
- Hydro and others	-	2.4%	1.6%	1.6%	1%
- Natural Gas	77.9%	49.8%	45.1%	62.9%	35
- Oil	12.9%	33.6%	23.3%	24%	14%
III. Supply dependence on:(2)					
- Imported oil	54.8%	51.1%	42.8%	42.0%	47%
- Imported solid fuels	2.3%	4.6%	9.2%	7.7%	10%
- Imported natural gas	-	-	-	-	-
IV. Share of imports in (3) gross consumption of:					
- Energy	22.3%	4.8%	13.9%	15.5%	25%
- Oil	96.2%	95.9%	93.9%	89.0%	90%
- Solid fuels	53.5%	100%	100%	100%	100%
- Natural gas	-	-	-	-	-

	1973/63	1975/73	1979/75	1982/79	1990/85
V. Average annual growth rates:					
G D P	+5.5%	+1.2%	+4.4%	-0.6%	+1.25%
Inland energy consumption	+8.3%	-2.2%	+3.6%	-5.8%	+0.4%
Final energy consumption(4)	+8.9%	-2.2%	+4.2%	-7.7%	+0.5%
VI. Energy coefficient (5)	1.51	-	0.82	-	0.32

	1973	1979	1982	1985	1990
VII. Energy ratio (6) (in kg oe per 10^3 HFL)	300.2	271.3	230.6	241.4	231.9
VIII. Energy intensity (7) (in kg oe per 10^3 HFL)	198.1	1184.3	157.5	164.9	156.9

Sources and General notes: see footnotes under Table 1.

Notes:
1. Basic data expressed in oil equivalent terms.
2. Respective shares of imported oil, imported natural gas or imported solid fuels in gross energy consumption.
3. Share of each imported energy source, in gross consumption of that source.
4. Non energy use included.
5. Energy coefficient = ratio between growth rates of inland energy consumption and GDP.
6. Energy ratio = volume of inland energy consumption per unit of GDP, expressed in real terms, at 1975 prices. (in kg of oil equivalent per unit of national currency).
7. Energy intensity = final energy demand per unit of GDP expressed in real terms at 1975 prices.

Table 3 TRENDS IN FINAL ENERGY CONSUMPTION - NEDERLAND

	1973	1979	1982	1985	1990
INDUSTRY:					
Energy consumption (1) (in million toe)	13.13	15.49	12.04	12.1	13.2
Share in final consumption	32.4%	33.8%	31.3%	29.4%	31.7%
Energy consumption per unit of value-added(2) (in kg oe per 10^3 HFL)	273.7	297.4	242.9	240.2	225.6
TRANSPORT:					
Energy consumption (1) (in million toe)	7.18	8.40	8.32	8.6	8.1
Share in final consumption	17.7%	18.3%	21.6%	20.9%	19.5%
Energy consumption per unit of GDP (3) (in kg oe per 10^3 HFL)	35.13	33.73	34.04	34.42	30.54
HOUSEHOLDS, etc...					
Energy consumption (1) (in million toe)	20.19	21.99	18.14	20.5	20.3
Share in final consumption	49.9%	47.9%	47.1%	49.7%	48.8%
Energy consumption per unit of private consumption (4) (in kg oe per 10^3 HFL)	178.0	146.2	125.5	143.4	131.8
FINAL ENERGY CONSUMPTION (in million toe) (1)	40.50	45.88	38.50	41.2	41.6
of which: Oil	40.8%	33.4%	31.2%	32.5%	33.3%
Final non-energy use (in million toe)	9.02	9.93	5.47	7.7	8.6

Sources and General Notes: see footnotes under Table 1.

Notes: (1) non-energy use, not included.
(2) volume of energy consumed in the industrial sector, per unit of value-added produced by industry, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(3) volume of energy consumed in the transport sector, per unit of GDP, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(4) volume of energy consumed in the residential + tertiary sector, per unit of Private Consumption, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).

UNITED KINGDOM

ENERGY TRENDS

216. The United Kingdom's energy economy has undergone profound structural change in the post-World War II period. Coal met 90% of primary energy demand in 1950. Today the structure of supply and demand is much more diversified - oil meeting 39% of demand, coal 36%, natural gas 20% and nuclear and hydro 5%. Broadly speaking, coal's share declined in every year from 1950-1972, and thereafter has hovered around today's share. By contrast, **oil demand** grew every year over the same period to reach a peak of 48% in 1972. The advent of the first oil crisis, reinforced by the second, then resulted in a falling oil share in virtually every year since 1973. Meanwhile, the market share of natural gas, introduced into the UK energy markets in the mid-1960s, has grown for 20 consecutive years.

217. Between 1979-1982, energy consumption declined in the United Kingdom by 12.5% to reach a level equivalent to that experienced some 15 years before. Indications are that in 1983, the United Kingdom again consumed less oil (-4%), although gas and electricity demand both slightly increased. Coal consumption was flat. Overall energy consumption is likely to be around the 1982 level - this in spite of a 2-3% GDP growth rate in 1983 (the highest in the European Community).

218. The structure of demand has changed in recent years with a fall in the share taken by industry and an increase in the shares taken by the household and transport sectors. The intensity of final energy use has improved, notably in industry, but less significantly than in some other Member States and the level of energy-intensity is among the highest in the Community in all three main sectors (industry, transport, households).

219. The discovery of oil and gas on the United Kingdom continental shelf in the 1960s and 1970s has completely transformed the United Kingdom's supply of energy during the last decade. From being a **net importer of energy** - with import dependence of 48% in 1972 for example - the United Kingdom, since 1981, has been a **net exporter of total energy.** In 1983 UK net exports of crude oil amounted to 45 m tonnes. A large share of these oil exports went to its Community partners. The United Kingdom is now the fifth largest oil producer in the world - with production expected to peak at around 2.5 mbd in 1985. Thereafter, production will start to decline later in the decade and this trend is likely to continue into the 1990s unless there are new discoveries. Indigenous gas production, currently supplying about 80% of the UK's gas

market is expected to hold up during the 1980s, but could decline thereafter. Indigenous coal production is plentiful, but constrained by demand and the costs of production.

220. The United Kingdom has the largest energy resources in the Community. Coal reserves are said to be equivalent to 300 years of supply at current rates of consumption. Oil and gas reserves (proven and probable) represent 23 and 20 years respectively of current UK oil and gas demand.

THE EVOLUTION OF ENERGY POLICY

221. The post-war nationalisation legislation gave the British Government important powers in relation to the capital investment programmes and operations of the main energy supply industries other than oil. Major features of energy policy in the 1970s were the approval of large capital investment programmes by the gas and electricity industries; a revival of interest in the coal industry (reflected in an ambitious long-term Plan For Coal); and the introduction and application of new legislation to deal with the development of North Sea hydrocarbon resources. For much of the 1970s energy policy objectives (and particularly energy pricing policy) were balanced against those of counter inflation, social and regional policies.

222. During the past few years important efforts have been made to integrate energy policy more closely with overall economic policy. The energy supply industries are major industrial investors and employers, while North Sea revenues are a key source of budgetary finance. The direct economic importance of the energy sector is therefore self-evident. Under the present Government, policy has concentrated on:

- improving the economic performance of the nationalised energy industries by means of financial targets, cash limits and the introduction where possible of market disciplines;

- economic pricing of energy;

- breaking unnecessary monopolies and increasing private sector involvement in energy investment, production and sales;

- dissemination of information and advice to help the demand side of the energy market to work properly.

Several Acts of Parliament (the Oil and Gas Enterprise Act 1982, the Energy Act 1983, changes in domestic gas tariffs (1980-2), the sales of stock in Britoil (the former upstream assets of BNOC), and new initiatives in energy conservation via the formation of the new Energy Efficiency Office (EEO), are examples of how these principles have been translated into practice.

THE ENERGY OUTLOOK

223. The United Kingdom Government does not make energy supply projections. This reflects its view that it is for producers and suppliers of energy to respond to market conditions and to determine production levels themselves. However, as part of its evidence to the Sizewell PWR enquiry (see below), the Department of Energy has developed eight long-term energy demand scenarios for the years 1990, 2000 and 2010, from which the Commission has selected a central range as a basis for the analysis that follows. These, together with compatible supply estimates, are outlined in Tables 1-3.

224. The scenarios chosen are based upon average GDP growth assumptions between 1980 and 1990 of 1.5% p.a. and 2.5% p.a. respectively. The main features of these scenarios, in the context of developments to 1990 are as follows:

- inland energy demand in 1990 could be between 9.8% and 18.5% higher than in 1982;

- primary demand for solid fuels may remain at about its 1982 level under the lower growth scenario, but would increase by 16% under the higher growth scenario;

- **primary demand for oil may increase by betwen 7.5% and 12.7%** over the period 1982-1990, and primary demand for gas may increase by between 11% and 18%;

- by 1990 electricity output may be up by between 12% and 24%;

- oil burn in power stations could decline from 9.6% in 1982 to between 4 and 5% of total fuel inputs in 1990;

- two thirds of inputs to electricity production will be coal (more or less the same as today);

- nuclear fuel use in electricity generation may increase by 60%;

- gas burn in power stations should remain negligible;

- industrial demand for coal is assumed to increase, but could be at least offset by reductions in household demand;

- non energy uses of oil are shown as increasing from 7.6 m tonnes in 1982 to between 9 and 12 m tonnes in 1990;

- oil use in transport could increase to between 37 m tonnes and 40 m tonnes in 1990 from its level of 32.7 m tonnes in 1982;

- the projected increase in primary demand for oil is principally associated with increases in demand for refinery feedstocks and transport fuels, with some increases in industrial demand being offset by a decline in power station fuel burn;

- in the natural gas markets, industrial demand remains fairly constant. Increases in the domestic and commercial sectors are largely responsible for increases in gas demand of between 15% and 27%.

The projections of energy supply and balance of trade presented in Table 1 indicate that indigenous energy production by 1990 will be lower than the 1982 level. Coal production in 1990 is assumed to be close to current levels and domestic production of natural gas to increase slightly. On that basis, net imports of energy would increase by 1990 in line with falling domestic production and increasing demand.

SECTORAL AND HORIZONTAL DEVELOPMENTS

Energy Pricing Policy

225. Economic pricing is now a key aim of the UK Government's energy strategy and during the past few years a number of steps have been taken to rationalise the pricing of gas and electricity in the UK.

226. **Electricity** prices were held down for some years during the 1970s for counter-inflationary reasons. They are now set within the framework of financial targets and external financing limits fixed by Government. Overall prices are designed to be close to long-run marginal costs. Post-tax industrial prices for high load factors seem on the high side in the UK at present. Domestic electricity prices in the United Kingdom, however, are well below Community average prices.

A new extensive load management scheme to reduce load demand at peak - including the "contracted consumer load scheme" estimated to be worth £100m/year to consumers over three years (1.4.82 - 1.4.85) - is currently operating. Under this scheme, large consumers willing to reduce their loads during peak periods can reduce their charges substantially. Over 100 of the largest electricity consumers have subscribed.

227. **Gas** prices in the United Kingdom are calculated as a result of a number of different factors, most notably BGC's costs and Government financial targets. There have been evident anomalies, particularly as regards the relation between domestic and industrial gas prices. The Government, however, went some way to remedy these distortions by agreeing three annual 10% real price rises for the domestic sector between 1980 and 1982. In the industrial sector there has been a series of price freezes since March 1981. This has meant that gas prices under contract renewals have risen by only 3.5%-4% since the end of 1980. One factor has been the aim that industrial gas prices should not get out of line with those of European competitors. It is by no means clear that these pricing practices are in line with long-run marginal costs, bearing in mind in particular that BCG's future gas supplies will be more expensive in relative terms as new supplies come on stream.

228. **Coal** prices to the CEGB are proportional to an index composed of the retail price index and world coal prices. Above a 65 million tonne threshold, the CEGB will in future have to pay international coal prices.

229. The United Kingdom operates no price controls on **crude oil or on products** - and prices of the latter tend to be high as the tax component is periodically raised in the light of inflation. In 1983 prices of motor spirit (including tax) increased in real terms, whilst those of gasoil and fueloil appear to have fallen.

Energy Efficiency

230. Until recently the present Government had given less attention to the "fifth fuel" than to supply side issues. Reliance has been placed on market forces as the chief means of achieving improvements in energy use. The creation in 1983 of an Energy Efficiency Office (EEO) within the Department of Energy reflects a recognition of the need to do more to help market forces operate more effectively by, notably, a strengthening of the Government information effort. The Government argues that of the £100 m spent per day on energy, £20m/day is wasted. The job of the EEO is to discourage that waste and to make the UK thereby "the most energy-efficient country in the western world" by increasing awareness amongst consumers of the potential for reducing costs and increasing efficiency. The EEO is to streamline and coordinate actions previously spread across 12 Ministries and it will also have overall responsibility for many specific conservation programmes.

231. Per capita financial support by Government for energy conservation is below half that of the Community average (1982) and there has as yet been no increase in the overall level of financial provisions as a result of the recent creation of the EEO. One of the tasks of the EEO is to seek ways of improving the effectiveness of Government incentive schemes. The most important programmes are the Homes Insulation Scheme, energy saving in the National Health Service, research and development, and demonstration projects. The breakdown by sector shows that the domestic sector receives the largest share of these budgets (about 35%), followed by the tertiary sector (27%). Research and development accounts for 25%. The share for industry is small.

232. There have been sizeable improvements in energy-efficiency in the United Kingdom. Energy intensity as a whole is at a historically low level and fell by 17% between 1973 and 1982. Industrial energy intensity fell by nearly 20% over the same period.However, the rate of improvement in industry and the household sector has been one of the slowest in the Community; in the household sector there has been some increase in energy intensity per capita when corrected for climatic changes; and in all three main sectors (industry, transport, households) the UK has still one of the highest levels of energy-intensity in the Community. It is evident that much scope for energy saving remains to be exploited, as the Government recognises.

Oil

233. Oil is now a major factor in the United Kingdom's economy. Not only is the UK a major oil producer, it is also a major trader of oil. Movements in international oil prices immediately rebound on the British economy, notably on the Government's tax take and sterling's exchange rate, as well as affecting the profitability of hydrocarbon fields and the pace of future exploration and, even more, development.

234. Oil demand in the United Kingdom has fallen by about 20% since 1979. Broadly speaking, demand for the lighter cuts has held (transport, etc.), whilst non-transport use of gas oil has declined by 25% and fuel oil deliveries have decreased by 41% (over 11 million tonnes; half attributable to industry and half to power stations). Deliveries to power stations have nearly halved in this period. Total demand for oil fell by another 4% in 1983. The low growth Department of Energy scenario used in Tables 1-3 suggests that oil demand might increase by 8-10% to the year 1990 over 1982 figures.

235. On the supply side, the Government sees it as a vital priority to set the right conditions, financial and political, to encourage further exploration and development in the North Sea. North Sea oil production is currently expected to peak around 1985 and new fields need to be brought on stream in a timely way to replace the declining deposits. No new offshore oil developments were started in 1980 and 1981 and the Government was concerned that the total fiscal charge arising from royalties, petroleum revenue tax and corporation tax, was a deterrent to further developments which are likely to be relatively less profitable than the first generation UK fields because they are smaller and geologically more difficult. The March 1983 budget addressed this problem with a series of North Sea taxation changes estimated to be worth £800 million to North Sea producers over the next four years. The measures have had the effect of increasing internal rates of return on some marginal fields with the result that several new developments, previously mothballed, are now expected to come on stream. The tax measures also provide an impetus for new exploration.

236. The Oil and Gas Enterprise Act of 1982 transferred the oil and gas exploration and producing business of BNOC to its subsidiary, Britoil, which was later "floated" as a private sector company. Similarly, the oil interests of the British Gas Company have been transferred to a now independent company, "Enterprise Oil", awaiting share flotation. The Government's shareholding in BP has been reduced. BNOC, via its 51% participation clauses in UK licences, still retains however an important role in the international oil markets.

237. An eighth round of licensing was completed in early 1983 with the award of about 70 licences. New opportunities in the southern North Sea to explore for gas and in other undrilled areas were on offer. A ninth round is under consideration.

Solid Fuels

238. The United Kingdom's coal production is currently in excess of profitable sales. In the last five years, the United Kingdom's production has more or less held constant, whilst overall consumption has fallen. The result has been a very large increase of stocks held at mine heads and by end users, which are very expensive to finance. Traditional industrial coal markets in the United Kingdom have been hit particularly severely by the recession and the domestic sector's consumption has also slightly decreased. In the power generation sector, inputs of solid fuels have decreased in the last three years - evidence of stagnant electricity demand and some nuclear substitution. In response to this, the CEGB has agreed to temporarily limit coal imports.

239. Government subsidies to the coal industry are currently running at above £5/tonne produced. The Government regards it as one of its energy policy priorities to ensure that the coal industry can be put on a more viable footing. A process of modernisation and rationalisation is underway with the gradual running down of the higher cost pits. During the coming years some 15m tonnes of new, highly productive capacity is coming on stream (Selby, Belvoir, etc).

240. Table 1 shows that little increase in solid fuel demand is expected to 1990 under the lower growth scenario (the same is true for 2000). Consumption in power stations should stay around 45-47 mtoe (depending on the level of new nuclear capacity). Industrial demand should increase (iron and steel and some new conversions) but this could be offset by falling household demand. Environmental considerations are not cited as important impediments to industrial coal expansion, but space requirements and worries about security of supply are more often underlined.

241. The CEGB is the most important customer of the NCB. A "joint understanding" between the two organisations involves a trading of the assurance of offtake for the NCB against for price stability for the CEGB. A new arrangement covering the period November 1983 to 1987 has just been agreed between the two organizations. The CEGB agreed to take at least 70 million tonnes during the first twelve-month period, but has made no further commitment to a minimum volume after this. The CEGB, however, has agreed to take 95% of its coal needs from the NCB.

242. Due to excess coal production in the last two years, the CEGB at Government request has restricted its imports of coal to 3/4 million tonnes/year since the beginning of 1981 with the Government bearing the costs of storage of contracted volumes abroad. The maximum import/export capacity is about 10-12 million tonnes with the present infrastructure.

Electricity/Nuclear

243. Electricity demand fell from 1980-1982 in the United Kingdom as a result of the recession. In fact electricity demand is still no higher than it was 10 years ago. In 1982 the predominant fuel input for power stations in the United Kingdom was coal (70%), followed by nuclear (18%), oil (11%), gas (0.7%) and hydro (0.3%). Indeed oil use in power stations has fallen from over 19 million tonnes in 1973 to only about 7 million tonnes a year now. Electricity demand is expected to be about 10% higher in 1990 than at present, with some revival in industrial demand and more modest growth in the domestic sector. Fuel inputs by 1990 are however expected to change considerably, with coal commanding only a 65% share, nuclear increasing to 30% and hydrocarbons down to a mere 4%.

244. At present a very detailed public enquiry into the CEGB's application to build a pressurised water reactor at Sizewell, Suffolk, is taking place. At stake is the medium to long term path of nuclear energy in the United Kingdom, perhaps the future of Britain's own nuclear industry and the competing claims of coal. A decision is not expected before 1985. On certain central scenarios of the CEGB, assuming the commissioning of all plant under construction, decommissioning after 1982 based on normal plant life, and reconversion of 2 GW of oil-fired plant to coal, Sizewell will not be needed on capacity arguments alone before 1993. The CEGB has argued its case, however, principally on the cost savings that a PWR reactor would provide. The assumptions on future oil and coal prices, exchange rates and whether the reactor would be built to time and cost are crucial variables in the calculation. A further point is that the PWR reactor also offers a greater diversity of supply.

245. The CEGB is also constructing a two-way connection under the Channel with Electricité de France for trading and peak shaving. The capacity is 2000 MW. This is due to come into operation in 1985.

246. The Energy Act came into effect in 1983. This, amongst other things, allows the private generation of electricity as a main business and permits the national transmission and distribution system to be used as a common carrier of electricity. So far, it is too early to judge whether this will have a major effect on electricity distribution. The likelihood is that it will produce some limited competition at the margin. The CEGB is in a healthy financial state and an extension of privatisation into the electricity industry is forecast in the Conservative Party Manifesto of June 1983.

Natural Gas

247. The United Kingdom is a major producer and consumer of natural gas. Demand for gas was flat in the United Kingdom between 1979 and 1982, although it has increased in 1983. The demand scenarios show that natural gas demand in the United Kingdom could increase by over 10% up to 1990. The increasing household share of demand means a larger seasonal swing in demand in future years.

248. The main focus of interest in the UK natural gas balance sheet, however, is on the supply side. The British Gas Corporation has a potential "supply gap" problem which could open at the end of the decade. Existing contracted supplies could be as little as 50% of requirements by the early 1990s. The current negotiations for the Norwegian Sleipner field would, if successful, cover about one-third of the 1990s supply gap (replacing imports of Frigg gas). The replacement gas is also likely to be relatively more expensive that BGC's earlier supplies.

There are three other potential sources of supply

(i) new Southern basin fields (there has been a significant increase in exploration and appraisal activity in the basin with 62 wells being drilled over the past 2 years and considerable interest was shown in the area in the recently completed 8th Licensing Round. This is related to BGC's willingness to pay higher prices for new indigenous gas discoveries);

(ii) gas from condensate fields in the Northern basin (the timing and manner of such developments is as yet uncertain) and associated gas;

(iii) other import contracts.

249. The UK gas supply system is not linked directly to the continental gas grid, although - like the continental gas supply system -it is linked to the Norwegian sector of the North Sea. There is a licence requirement that the Secretary of State for Energy's permission must be obtained if gas from the UK Continental Shelf is landed directly outside the UK. Although at present the UK is a net gas importer to the extent of 20-25% of her needs and this could continue beyond the end of the decade, reexamination of the benefits of linking directly to the European mainland would now seem appropriate, particularly in view of supply uncertainties and the potential advantages of a more integrated European gas network.

On security of supply, BGC is developing the Morecambe field as a seasonal supply facility and is converting the Rough field into seasonal storage.

250. The Government's policy of "privatisation" has also affected the gas industry. The "Oil and Gas" Enterprise Act 1982 has ended the statutory purchasing privileges of BGC, and its monopoly of gas supply to large and medium consumers. To date it is too early to judge the effects.

251. A final point to note in the context of gas is the very special situation of Northern Ireland which until now has depended solely on town gas manufactured from coal. Agreement was recently reached between the Irish and British Governments on the extension of the Irish gas grid to Northern Ireland. Deliveries of gas are expected to begin in 1985.

CONCLUSIONS

The United Kingdom has enjoyed a uniquely favourable set of circumstances in the energy field since 1973 in comparison with other Member States - an already diversified energy supply structure, the advent of North Sea oil, and powerful tools of Government intervention. The harnessing of North Sea oil resources is one of the major success stories of the 1970s. In 1973 the United Kingdom together depended on imported oil for nearly 50% of her energy demand. In 1982 she was a sizeable net exporter.

A large share of oil exports from the UK have gone to other Community members. But access to North Sea oil and gas has reduced pressures to develop a more integrated gas market, in particular, with continental Europe. It could be of interest both to the UK and to other Community members to encourage better links with the continent, exploiting the scope for cost savings all round and improving energy security.

A second effect of access to large-scale indigenous resources has perhaps been to circumscribe the rôle of energy savings policy. The United Kingdom has made progress in reducing energy intensity but at a slower pace than many other Community countries; and the scope for improvement in the industrial sector appears to be particularly great. Successive policies of restraint on energy prices in the 1970s undoubtedly discouraged improvements in energy efficiency. During the past four years pricing poicy has been put on a sounder footing, and the financial situation of the gas and electricity industries is now much healthier. The recent creation of an Energy Efficiency Office is intended to reflect a new priority for energy savings policy. It has a major job to do in ensuring that the potential for energy savings can be exploited.

The available data suggest that oil dependence of 40% in the United Kingdom should have fallen a little below the 1982 level at the end of the decade although oil demand in volume could increase. The main element will be the coming on stream of new nuclear stations. Demand for coal is expected, at best, to stabilise. A difficult process of structural adjustment is now under way in the UK coal industry and will be a continuing focus of policy attention. There are also important decisions to be made in the coming years about the "new generation" nuclear programme in the light of the results of the ongoing enquiry into the construction of a PWR at Sizewell. The results of this enquiry should be acted on in a timely fashion so as to reduce uncertainty for the nuclear and electricity industries.

Table 1 SUMMARIZED ENERGY BALANCE - UNITED KINGDOM

in million toe	1973[a]	1979[a]	1982[a]	1985[b]	1990[b]
I. **Gross Energy Consumption**	227,04	222,41	196,61	203,0	216,0/233,0
- Bunkers	5,31	2,60	2,59	3,0	3,0
- Inland consumption	221,73	219,81	194,02	200,0	213,0/230,0
II. **Inland Energy Consumption**	221,73	219,81	194,02	200,0	213,0/230,0
- Solid fuels	79,17	75,09	64,55	66,0	65,0/75,0
- Oil	108,24	92,87	76,28	78,0	82,0/86,0
- Gas	25,11	40,44	40,67	41,0	45,0/48,0
- Primary electricity, etc.	9,21	11,41	12,52	15,0	21,0
III. **Indigenous Production**[1]	113,00	193,51	221,39	244,0	210,5/217,0
- Hard coal	78,67	70,88	72,46	72,0	71,0
- Lignite & peat	-	-	-	-	-
- Oil	0,68	78,27	104,65	125,0	85,0/90,0
- Natural gas	24,44	32,95	31,76	32,0	33,5/35,0
- Nuclear energy	8,88	11,04	12,04	14,0	19,5
- Hydro & geothermal[2]	0,33	0,37	0,39	0,5	0,5
- Others & renewables	-	-	0,09	0,5	1,0
IV. **Net Imports**[3]	112,88	27,58	-22,13	-41,0	5,5/16,0
- Solid fuels	-0,85	1,15	-2,57	-6,0	-6,0/+4,0
- Oil	113,06	18,94	-28,46	-44,0	-/-1,0
- Natural gas	0,67	7,49	8,90	9,0	11,5/13,0
- Electricity[2]	0,00	-	-	-	-
V. **Stock changes**[4]	-1,16	-1,32	+2,66	..	..
- Solid fuels	-1,35	-3,07	+5,34	..	..
- Oil	+0,19	+1,75	-2,68	..	..
- Gas	-	-	-	..	..
VI. **Electricity Generation Input**	72,66	74,28	65,96	66,6	67,2/76,2
- Solid fuels[5]	44,17	49,84	45,64	47,0	44,0/52,0
- Oil	18,34	12,25	7,42	5,0	3,0/4,0
- Natural gas	0,94	0,78	0,38	0,0	0,0
- Nuclear energy	8,88	11,04	12,04	14,0	19,5
- Hydro & geothermal[2]	0,33	0,37	0,39	0,5	0,5
- Others & renewables	-	-	0,09	0,1	0,2
VII. **Electricity Gross Production** (in TWh)	281,21	298,69	271,08	272,0	273,0/302,0
- Hydro & geothermal[6]	3,89	4,29	4,56	(5,0)	5,0
- Nuclear	28,00	38,31	43,97	(50,0)	78,0
- Conventional thermal	249,32	256,09	222,55	(217,0)	190,0/219,0
VIII. Electricity Gross Consumpt. (in TWh)	281,94	299,86	272,16[7]	272,0	273,0/302,0[8]

Sources: a. Statistical Office of the European Communities.
b. Review of National Energy Programmes 1983 United Kingdom - July 1983, D/Energy evidence to the Sizewell enquiry and Commission estimates.

Notes: 1. Production of primary sources, including recovered products.
2. The conversion of electricity, including hydro and geothermal, is based on its actual energy content: 3600 kjoules/kWh or 860 kcal/kWh.
3. The (-) sign means net exports.
4. The (-) sign means a stock decrease.
5. Including coke oven gas and blast furnace gas (derived from coal).
6. Without pumped storage hydroelectricity.
7. Includes autoproduction of electricity by the conversion industry (28 TwH).
8. Excludes autoproduction.

General notes:
1° figures submitted by Member States have been adapted where necessary to ensure consistency with SOEC statistical definitions or conversion factors.
2° direct comparisons between 1982 and 1985 are not always possible, given that some forecasts use 1980 or 1981 as the basis for projection.

Table 2 MAIN ENERGY INDICATORS - UNITED KINGDOM

(related to 1990 Objectives)

	1973	1979	1982	1985	1990
I. Share of Oil in Gross Energy Consumption	50.0%	42.9%	40.1%	39.9%	39%/38%
II. Fuel inputs to Electricity production(1): Shares taken by:					
- Solid fuels	60.8%	67.1%	69.2%	70.6%	65%/68%
- Nuclear	12.2%	14.9%	18.3%	21.0%	29%/26%
- Hydro and others	0.5%	0.5%	0.7%	0.9%	1%
- Natural Gas	1.3%	1.0%	0.6%	-	-
- Oil	25.2%	16.5%	11.2%	7.5%	5%
III.Supply dependence on:(2)					
- Imported oil	49.8%	8.5%	-	-	-
- Imported solid fuels	-	0.5%	-	-	-/2%
- Imported natural gas	0.3%	3.4%	4.5%	4.4%	5%/6%
IV. Share of imports in (3) gross consumption of:					
- Energy	49.7%	12.4%	-	-	3%/7%
- Oil	99.4%	19.8%	-	-	-
- Solid fuels	-	1.5%	-	-	-/5%
- Natural gas	2.7%	18.5%	21.9%	22.0%	26%/27%

	1973/63	1975/73	1979/75	1982/79	1990/85
V. Average annual growth rates:					
G D P	+3.2%	-0.9%	+2.5%	-0.8%	1.5%/2.5%
Inland energy consumption	+1.8%	-4.8%	+2.2%	-4.0%	1.3%/2.8%
Final energy consumption(4)	+2.1%	-4.9%	+2.3%	-4.1%	1.9%/2.4%
VI. Energy coefficient (5)	0.56	-	0.88	-	0.87/1.12

	1973	1979	1982	1985	1990
VII.Energy ratio(6) (in kg oe per 10^2 UKL)	208.6	190.3	172.3	164.1	162.2/166.8
VIII.Energy intensity(7) (in kg oe per 10^2 UKL)	133.0	120.1	112.3	110.8	105.1/107.3

Sources and General Notes: see footnotes under Table 1.

Notes:
1. Basic data expressed in oil equivalent terms.
2. Respective shares of imported oil, imported natural gas or imported solid fuels in gross energy consumption.
3. Share of each imported energy source, in gross consumption of that source.
4. Non energy use included.
5. Energy coefficient = ratio between growth rates of inland energy consumption and GDP.
6. Energy ratio = volume of inland energy consumption per unit of GDP, expressed in real terms, at 1975 prices. (in kg of oil equivalent per unit of national currency).
7. Energy intensity = final energy demand per unit of GDP, expressed in real terms, at 1975 prices.

Table 3 TRENDS IN FINAL ENERGY CONSUMPTION - UNITED KINGDOM

	1973	1979	1982	1985	1990
INDUSTRY:					
Energy consumption (1) (in million toe)	57.58	46.84	38.46	44.0	45.0/49.0
Share in final consumption	40.7%	33.8%	30.4%	32.6%	33%
Energy consumption per unit of value-added(2) (in kg oe per 10^2 UKL)	207.5	175.6	167.4	167.7	139.3/144.5
TRANSPORT:					
Energy consumption (1) (in million toe)	29.79	32.80	32.66	35.0	37.0/40.0
Share in final consumption	21.1%	23.6%	25.8%	25.9%	27%
Energy consumption per unit of GDP (3) (in kg oe per 10^2 UKL)	28.02	28.40	29.00	28.72	28.18/29.01
HOUSEHOLDS, etc...					
Energy consumption (1) (in million toe)	53.98	59.11	55.37	56.0	56.0/59.0
Share in final consumption	38.2%	42.6%	43.8%	41.5%	40%
Energy consumption per unit of private consumption (4) (in kg oe per 10^2 UKL)	81.75	82.63	77.29	72.03	65.88/65.63
FINAL ENERGY CONSUMPTION (in million toe) (1)	141.35	138.75	126.49	135.0	138.0/148.0
of which: Oil	47.5%	45.3%	41.8%	42.2%	44%/42%
Final non-energy use (in million toe)	12.29	13.81	7.95	(10.0)	13.0/16.0

Sources and General Notes: see footnotes under Table 1.

Notes: (1) non-energy use, not included.
(2) volume of energy consumed in the industrial sector, per unit of value-added produced by industry, expressed in real terms, at 1975 prices (i kg of oil equivalent per unit of national currency).
(3) volume of energy consumed in the transport sector, per unit of GDP, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).
(4) volume of energy consumed in the residential + tertiary sector, per unit of Private Consumption, expressed in real terms, at 1975 prices (in kg of oil equivalent per unit of national currency).