EUROPEAN COAL AND STEEL COMMUNITY

A Problem for Europe: The Supply of Energy

INFORMATION SERVICE OF THE HIGH AUTHORITY

The European Coal and Steel Community has set in motion a number of far-reaching changes in Europe.

Not everyone is as yet fully aware of what is going on, because the technical aspects of coal and steel problems often mask the scope and implications of these changes.

The object of this series of publications is to make the Community's work better known and understood in all its aspects.

This booklet is based on a study, made by a joint committee of the Council of Ministers and the High Authority, entitled "Etude sur la structure et les tendances de l'économie énergétique dans les pays de la Communauté". (1)

Already published:

Towards European Integration
First results for coal and steel

What is the Community?

Real Incomes of Workers in the Community

These booklets have been published in the four official languages of the Community and in English. The brochure entitled "What is the Community?" has also been translated into Spanish and Polish.

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(1) Obtainable from the Publications Department of the European Community.

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STEEL COMMUNITY

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FOR EUROPE:

THE SUPPLY OF ENERGY

LUXEMBOURG, FEBRUARY 1958

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EUROPE AND ENERGY

We all know how vitally important energy is in the world of today. And in Europe supremely so. Political events such as the Suez crisis in the autumn of 1956 have shown how quickly difficulties in supply, even on a limited scale, begin to make their effects felt in our everyday lives. *For the economic and social development of Europe is dependent upon a regular supply of energy.*

There is indeed quite a close correlation between an economy's social product and its energy supplies, so that a growing population can only be assured of a high and rising standard of living if the quantities of energy available go on increasing.

Today, not only are energy needs rapidly increasing — very much more rapidly than they were a hundred or two hundred years ago — but also they are concentrating more and more on those forms of energy which, being more convenient and more adaptable, are more valuable than energy in a crude state. As the mechanization of production proceeds and men continue to seek shorter working hours without loss of income, these trends will undoubtedly become more marked.

The world's supply of energy has hitherto mainly depended on the working of limited sources, such as coal, oil, natural gas and peat. Estimates vary very much as to how long this "natural capital" can be expected to last. But a still more important point is *how long it will be possible to go on securing energy supplies at present costs.*

For Europe the question of future energy supplies is especially important. Europe's economic expansion in the nineteenth and early twentieth centuries was founded on cheap supplies of coal, which it had in abundance. The position today is less favourable. Coal is still the main source of energy, but it no longer holds the pride of place. Other sources, such as oil and natural gas, in which Europe is unfortunately not at all rich, are now competing with coal.

More important still is the rising cost of winning coal. Sinking a new pit requires two to three times as much capital expenditure in Europe as in the United States. European deposits are more difficult to work with mechanized equipment, and accordingly the output per miner increases more slowly than it does in American pits; and labour costs represent a higher proportion of total operating costs. At the same time, engaged as he is on a peculiarly arduous and risky job, the miner can claim special privileges as regards pay and working hours.

For these various reasons, *supplies of coal have become insufficient and prices have risen.* European countries therefore have to cover more and more of their needs by means of imports. There would be no objection to such dependence on imports, if it were not that it upsets the balance of payments and endangers energy supplies in times of political tension. Moreover, the cost of transporting crude energy is very high and tends to fluctuate. Any sustained increase in imports would also necessitate considerable expenditure on harbour and transport facilities, as well as investment in the export industries which would have to bring in the foreign currency needed to pay for energy imports.

Hence Europe faces a decisive question: Are energy supplies to act as a brake on its economic development in the years to come? It is true that forecasts have never provided more than a glimpse into the distant future. But the decisions taken today will affect the situation tomorrow or the day after tomorrow. Whether such decisions are right or wrong must often depend on unforeseeable developments, but first and foremost it will depend on how far the original situation was known and correctly interpreted.

Let us therefore first of all examine *the energy balance-sheet of the Community for 1955,* in order to go on and try to *forecast the trend up to 1965 and 1975.*

I - THE ENERGY BALANCE-SHEET FOR 1955

What is an energy balance-sheet?

It is like a financial balance-sheet — a double-entry account showing on one side a given year's energy resources and, on the other, the way they have been used.

This study is based on the balance-sheet for 1955, the latest year for which full details are at present available. It enables us to follow the various energy products from their beginnings, through any conversion process they may undergo, up to their consumption by the "end consumer", and finally to the effective energy which they ultimately provide. The process can thus be divided into four separate stages.

First comes the *primary-energy stage,* comprising the following energy sources:

hard coal,
brown coal,
oil,
natural gas and methane,
peat,
water power,
terrestrial heat.

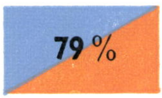
This is energy in its crude state, which can be used as it stands: coal and natural gas, for instance, may be burned in furnaces.

But nowadays primary energy is more and more often converted before it is used: hard coal is made to produce coke, gas and electricity; crude oil is used to produce petrol and fuel oil; gas and fuel oil are used to produce electricity. This is the *conversion stage*.

But conversion of energy itself involves energy consumption and energy losses. In other words, the secondary energy coming out of conversion is less than the primary energy going in. The ratio of the secondary energy obtained to the primary energy used to obtain it is called the

conversion efficiency.

The conversion efficiency for all six Community countries and all forms of energy is at present about



Primary energy for direct use, and secondary energy obtained by conversion, are supplied in their various forms to the end consumer. This is the *third stage* in the energy economy — the *consumption stage*. It comprises all the end uses, such as the burning of coal at home or in industrial furnaces, the use of coke in pig-iron production and of oil products for road transport, as well as the use of electricity (whether produced by means of heat or from water power) to run electric motors.

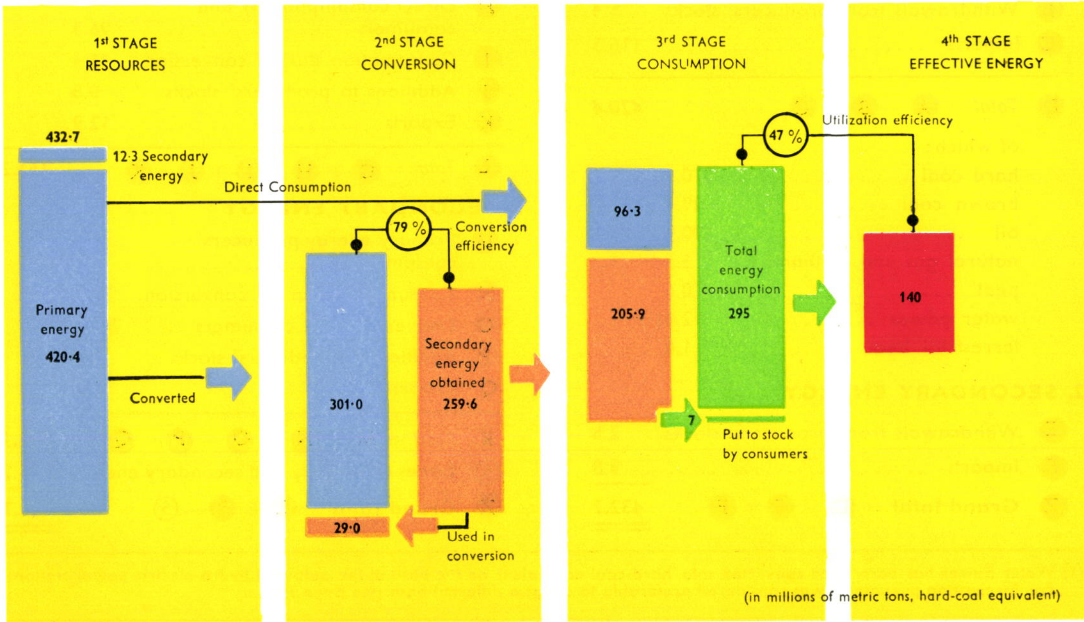
The *fourth stage*, finally, is that of the *effective energy* obtained by the end consumer — thermal units in heating, foot-pounds of mechanical energy in engines and motors, and so on. The effective energy obtained is considerably less than the total energy consumed. At this stage the ratio of effective energy obtained to total energy consumed is called the

utilization efficiency.

The utilization efficiency for all six Community countries and all forms of energy is at present about

The process by which energy thus passes through the four stages is illustrated in diagram form on opposite page.

THE COMMUNITY'S ENERGY PROCESS
— 1955 —



Energy balance-sheet for 1955

(in millions of metric tons, hard-coal equivalent)

RESOURCES

1. PRIMARY ENERGY

A	Production	298.5
B	Withdrawals from producers' stocks	5.4
C	Imports	116.5
D	*Total* = A + B + C	***420.4***

of which:

hard coal	270.4
brown coal	29.4
oil	100.9
natural gas and methane	5.5
peat	0.6
water power	12.0 (1)
terrestrial heat	1.6

2. SECONDARY ENERGY

E	Withdrawals from producers' stocks	2.5
F	Imports	9.8
Z	**Grand total** = D + E + F	**432.7**

UTILIZATION

1. PRIMARY ENERGY

G	Producers' own consumption	9.8	
H	Direct consumption by end consumers	96.3	
I	Consumption during conversion	41.4	
J	Additions to producers' stocks	0.8	
K	Exports	12.9	
L	*Total* = G + H + I + J + K		***161.2***

2. SECONDARY ENERGY

M	Primary-energy producers' consumption	2.2	
N	Consumption during conversion	29.0	
O	Delivery to end consumers	205.9	
P	Additions to producers' stocks	1.3	
Q	Exports	27.9	
R	*Total* = M + N + O + P + Q		***266.3***
S	Losses of primary and secondary energy		5.2
Z	**Grand total** = L + R + S		**432.7**

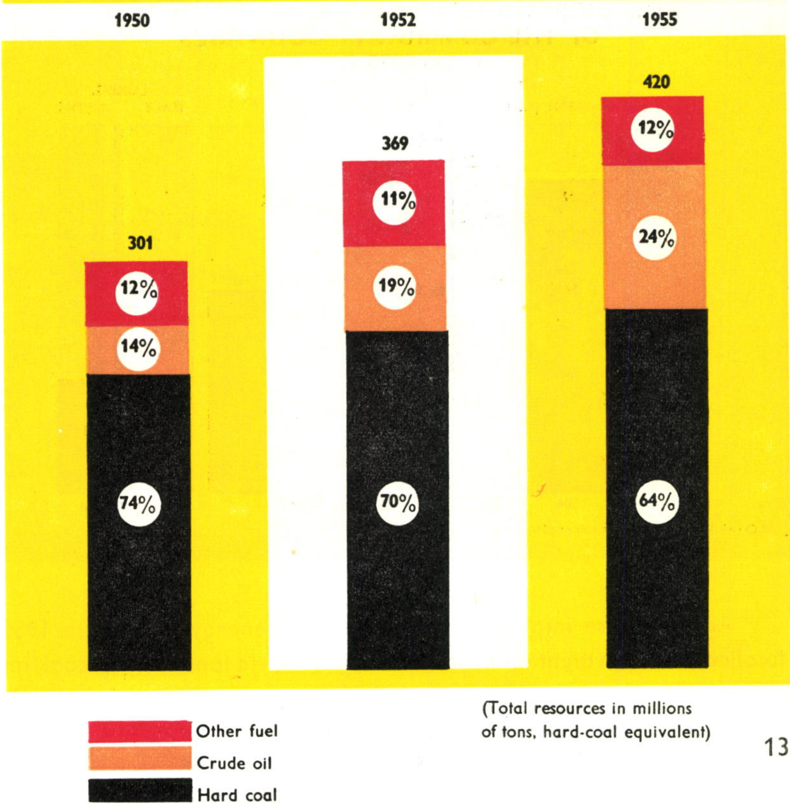
(1) Water power has here been converted into hard-coal equivalent on the basis of the output of hydro-electric power-stations. For forecasting purposes it was considered preferable to adopt a different basis (see page 39)

1. Energy resources

Let us now turn to the Community's energy balance-sheet for 1955.

Practically the whole of the Community's energy resources consist of primary energy. And *hard coal still represents nearly two-thirds of the Community's primary-energy resources.* But the proportion is declining: in 1950 it stood at 74%, and by 1955 it was down to 64%. The proportion of oil on the other hand is increasing: it rose from 14% in 1950 to 24% in 1955.

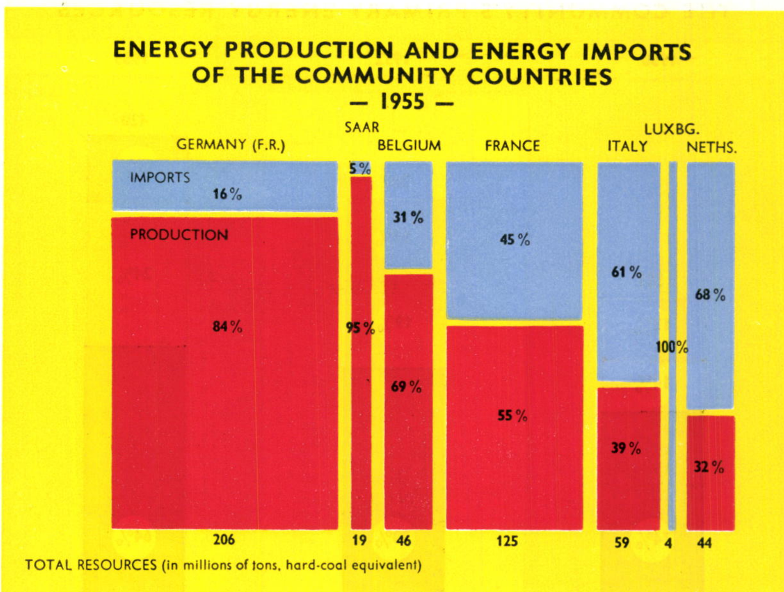
THE COMMUNITY'S PRIMARY ENERGY RESOURCES



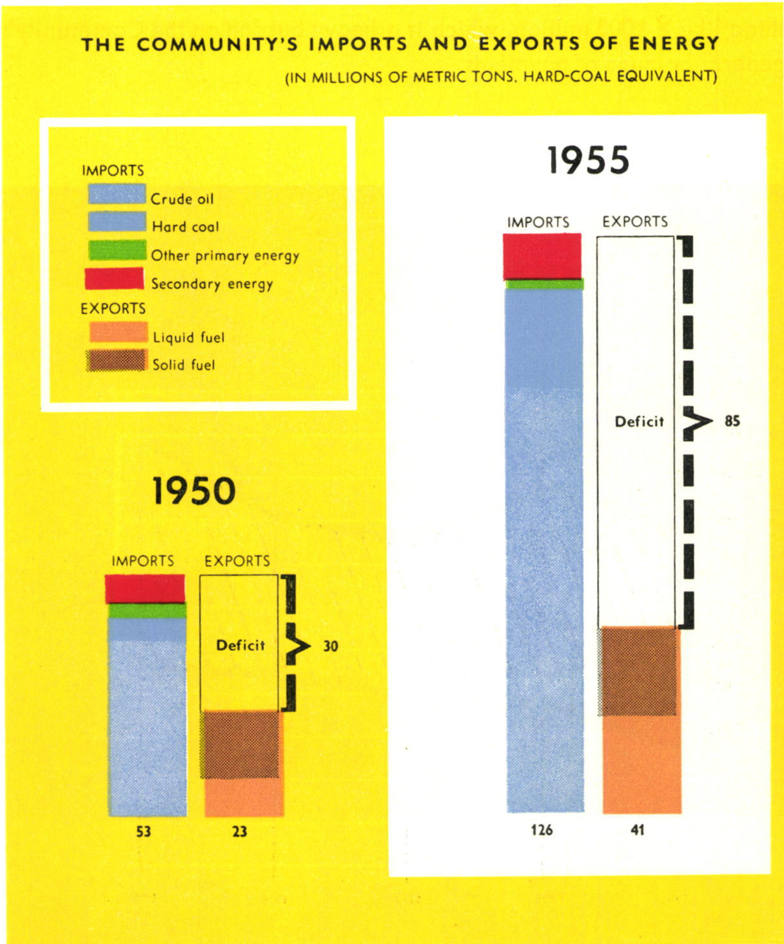
(Total resources in millions of tons, hard-coal equivalent)

A substantial proportion of the Community's total resources has to be imported. This is an essential feature of its whole energy economy. *Since its own energy production is not enough to meet its needs, it is having to import more and more* — the equivalent of 52.8 million metric tons of hard coal, or 17% of its total energy resources, in 1950, and 126.3 million or 29%, in 1955.

The position of the different Community countries in this respect is shown in the following diagram.

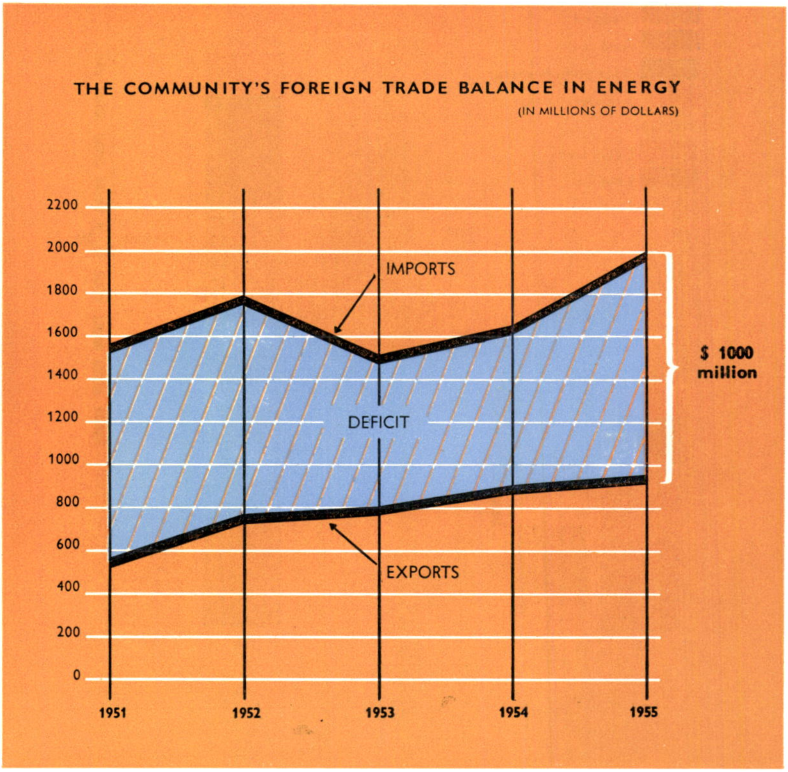


Against these imports, the Community's energy exports in 1955 totalled the equivalent of only 40.8 million metric tons of hard coal, including 28 million tons in the form of secondary energy.[1] The diagram below shows clearly the considerable increase in the Community's foreign trade gap caused by increasing energy imports.



(1) K + Q of the balance-sheet on page 12.

Admittedly, the gap is not so serious in value as it is in quantity, for the Community imports mostly primary energy, but exports mostly secondary energy, which has a higher value per unit. Nevertheless, as the following diagram shows, the deficit for 1955 amounted to something like $ 1000 million, which is a heavy burden on the Community's general balance of payments.



Secondary energy is only a minor item in the Community's overall imports. It is not until we turn to the actual *utilization of energy* that it emerges as a very major item indeed in the energy economy as a whole.

Looking at the right-hand side of the balance-sheet, we note first of all a number of general points:

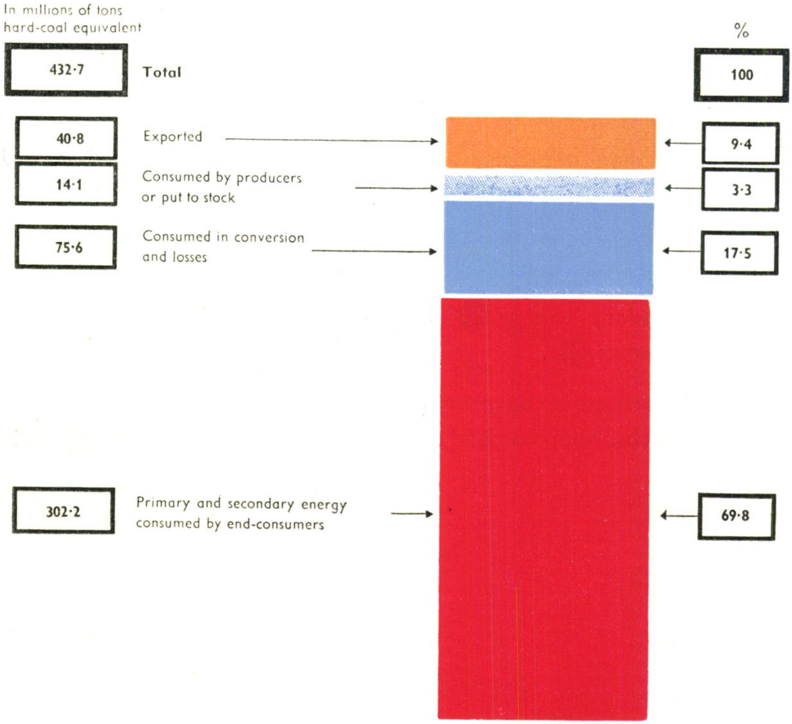
a) Less than one-quarter of the primary energy available D is consumed as such by Community end consumers H.

b) Community end-consumption of primary and secondary energy H + O amounts to about 70%, and exports of primary and secondary energy K + Q to about 10%, of total energy resources Z.

c) The process of converting primary energy into secondary energy absorbs approximately 18% of total energy resources Z.

UTILIZATION OF ENERGY IN THE COMMUNITY

— 1955 —



2. Energy conversion

As has already been mentioned, there is a very marked tendency in the energy economies of the industrialized countries towards greater use of energy in its secondary forms. Over the past thirty years the proportion of secondary energy in the total energy supplies of the Community has risen from one-third to two-thirds. For economic and technical reasons this trend can be expected to continue. Energy is scarce and expensive, and as economic progress develops, it is in ever-increasing demand. But it is more economical not to use it until after conversion into more efficient and convenient forms.

As may be seen from the following table, rather over 70% of the Community's primary energy resources D are converted into secondary energy. Secondary energy produced in the Community represents approximately 60% of the Community's total energy supply Z .

Conversion

(in millions of metric tons, hard-coal equivalent)

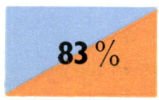
Primary energy used for conversion	301.0
Secondary energy consumed during conversion	29.0
Total	330.0
Secondary energy actually produced	259.6
Total amount of energy consumed during conversion	70.4

As will also be seen, conversion involves a certain consumption of energy. It will be recalled that the ratio of the secondary energy obtained to the energy used to obtain it is 79%[1]. Conversion is carried out by various processes, principally

1. distillation of hard coal in coking-plants and gasworks;
2. generation of electricity in thermal power-stations;
3. briquetting of hard coal and brown coal;
4. distillation of crude oil in refineries.

Coking-plants

use hard coal and fuel oil, but they have additional energy needs, mainly of gas for heating the ovens. Hard coal, fuel oil, gas, etc., together constitute the input: the output consists of coke, coke-oven gas, crude tar and crude benzole. Some of the gas produced during conversion is consumed by the coking-plants themselves, and so must be deducted from the gross output. The conversion efficiency — that is, the ratio of output to input — is approximately

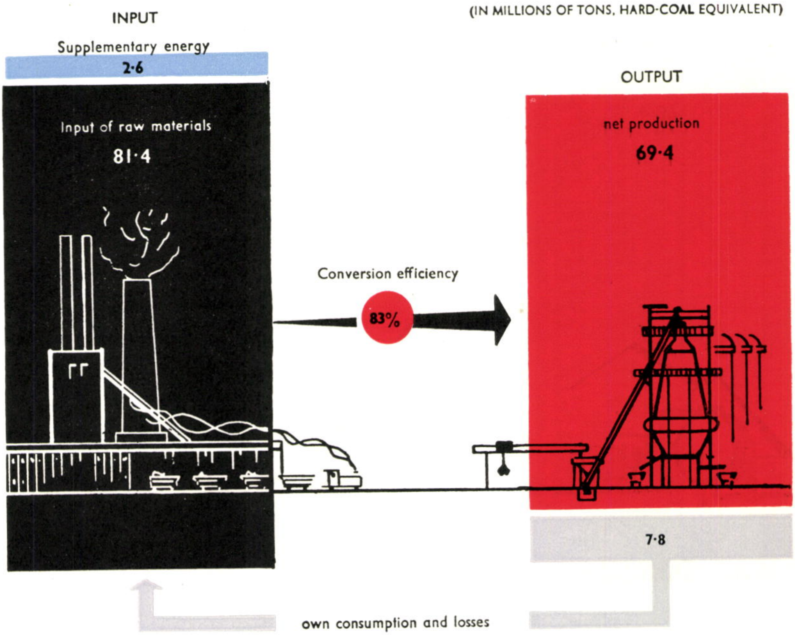


with slight variations from one Community country to another.

The conversion process for the Community as a whole may be presented in diagram form as follows:

(1) See page 9.

CONVERSION BY DISTILLATION OF HARD COAL IN THE COMMUNITY'S COKING PLANTS
— 1955 —

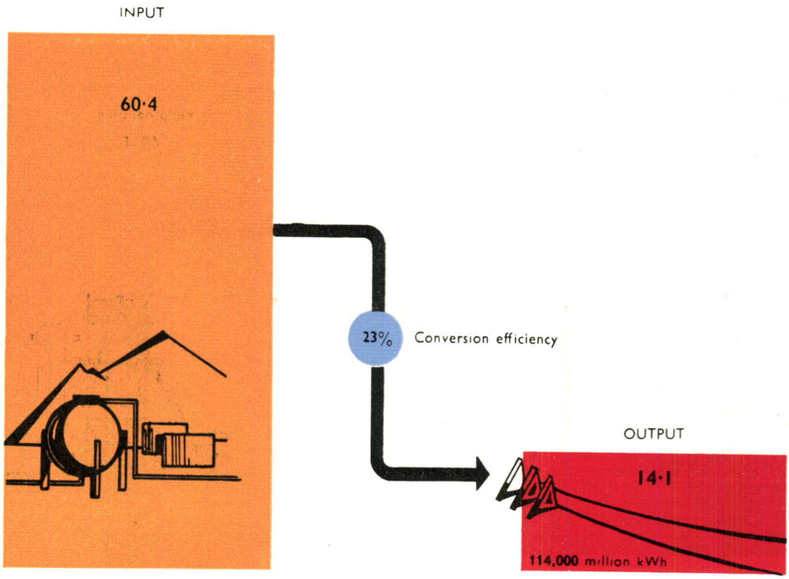


Thermal power-stations

use fuels such as hard coal, brown coal, fuel oil and gas (input). Their output is the amount of electricity they generate, part of which they consume themselves. The diagram following shows energy conversion by the Community thermal power-stations as a whole.

CONVERSION BY GENERATION OF ELECTRICITY IN THE COMMUNITY'S THERMAL POWER-STATIONS
— 1955 —

(IN MILLIONS OF TONS HARD-COAL EQUIVALENT)



The conversion efficiency of thermal power-stations in the Community is increasing gradually as a result of continual improvements in operating methods. The average for the Community is about

23 %.

In 1955, the average amount of energy consumed in producing one kilowatt/hour of electricity was 0.528 kg., whereas in modern power-stations it is less than 0.4 kg.

The conversion-efficiency rates of the power-stations vary considerably from one Community country to another.

Belgium	23.9%
France	20.9%
Germany (Federal Republic)	23.8%
Italy	27.6%
Luxembourg	21.7%
Netherlands	25.6%
Saar	18.2%

Statistics for the other conversion processes are not available in such detail. The *oil refineries* have a conversion efficiency of about 92%, allowing for certain non-energy products such as paraffin wax and tars. The efficiency for the *gasworks* is in the neighbourhood of 75%, for *brown-coal briquetting* about 81%, and for *hard-coal briquetting* not far off 100%.

3. Energy consumption

As we have seen, part of the Community's primary energy, and practically the whole of its secondary or converted energy, are supplied to Community consumers. Let us now go on to examine this further stage, that of *energy consumption*.

Energy supplied to Community consumers in 1955 totalled the equivalent of 302.2 million metric tons of hard coal H + O . If we allow for additions of some seven million tons to consumers' stocks, *end-consumption of energy* during 1955 comes to approximately

295 million metric tons,
hard-coal equivalent.

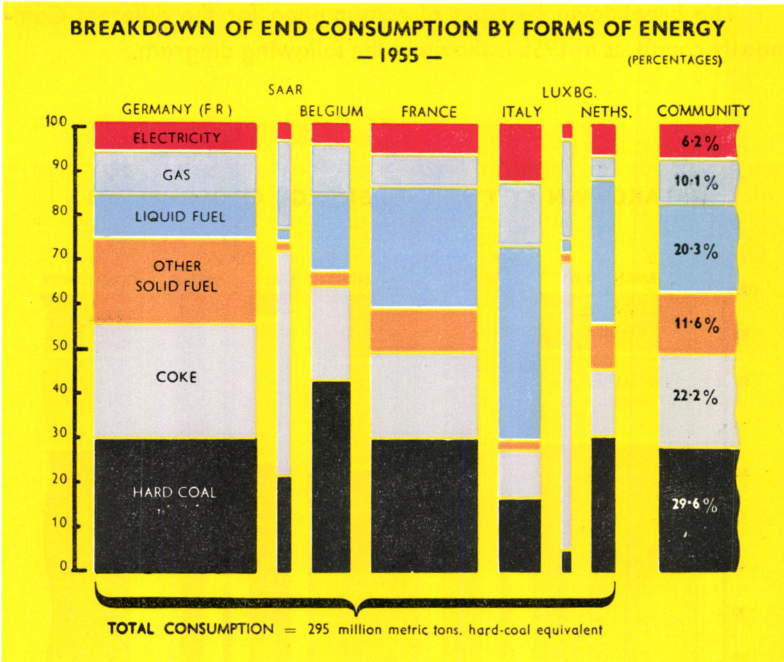
How is this total made up as regards

a) the different forms of energy,

b) the different types of energy consumption, and

c) the different energy consumer sectors?

a) **The breakdown of end-consumption by forms of energy** in the different Community countries in 1955 is shown in the following diagram:



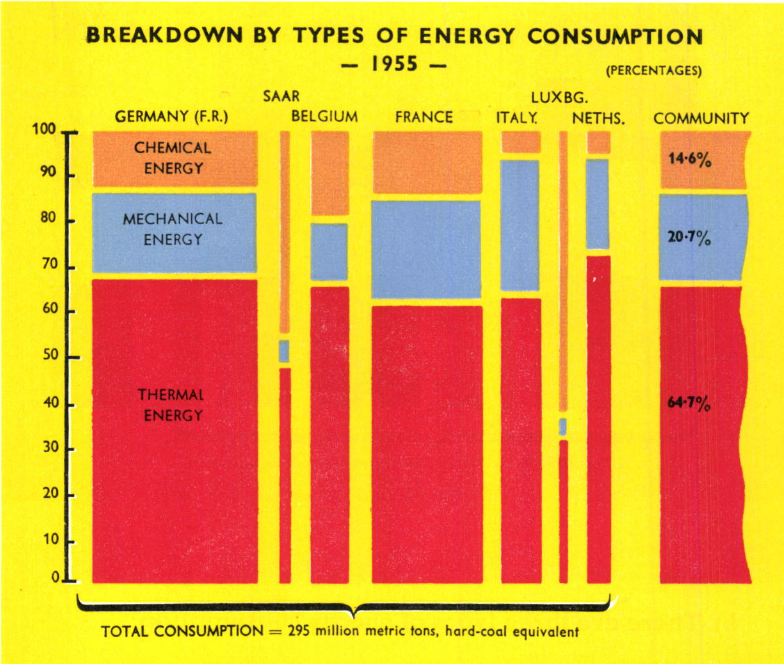
b) **There are three types of energy consumption:**

— **chemical:** consumption of coke in the steel, non-ferrous metal and chemical industries;

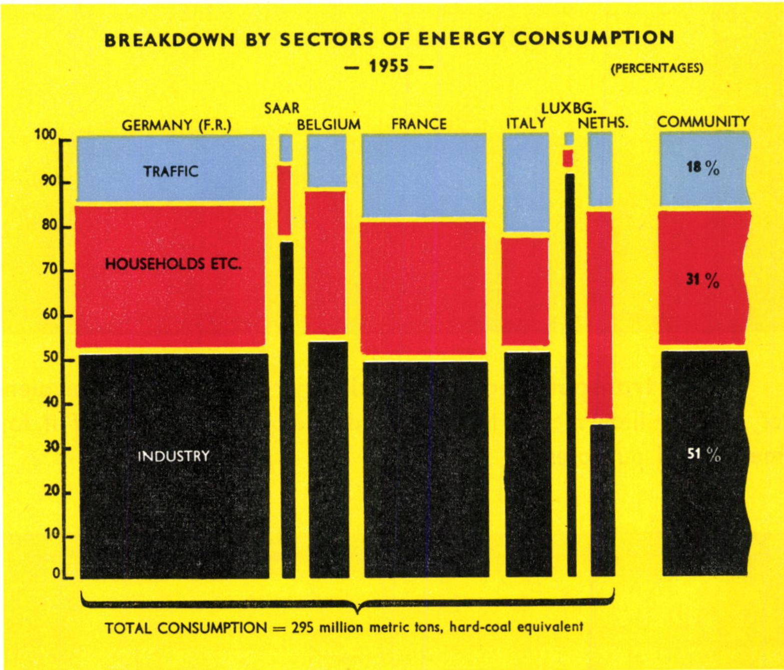
— **mechanical:** consumption of energy for traction purposes in transport, and almost all electricity consumption in industries other than the steel industry;

— **thermal:** all other uses of energy.

The breakdown by types of consumption for the different Community countries in 1955 is shown in the following diagram.



c) **The breakdown into different sectors of energy consumption** is not known in detail, since accurate and comparable statistics are not available. It is, however, possible to make a rough subdivision into three main sectors, for each of the Community countries, as shown in the following diagram:



The **industrial sector** can be further subdivided into *Steel Industry* and *Other Industries:*

Form of energy	Steel industry		Other industries	
	'000,000 tons HCE	%	'000,000 tons HCE	%
Solid fuel	44.5	67.5%	50.1	59.6 %
(of which: coke)	(39.8)	(60.4%)		
Liquid fuel	2.4	3.6%	15.5	18.5 %
Gas	16.9	25.7%	7.6	9.1 %
(of which: blast-furnace gas)	(12.0)	(8.2%)		
Electricity	2.1	3.2%	10.7	12.8 %
Total:	65.9	100.0%	83.9	100.0%

In the **transport sector,** the **railways** consume the equivalent of 19.26 million metric tons of hard coal, practically all of it for mechanical purposes.

Form of energy	Consumption	
	'000,000 tons HCE	%
Coal and briquettes	17.03	88.5 %
Fuel oil and diesel oil......	1.62	8.4 %
Electricity	0.61	3.1 %
Total:	19.26	100.0 %

In the sector comprising **"households, etc."**, consumption by dwelling-houses, public buildings, shops, street lighting, agriculture, and so on, accounts for the equivalent of 69.2 million metric tons of hard coal, and small industry the equivalent of 17.1 million metric tons.

4. Effective energy

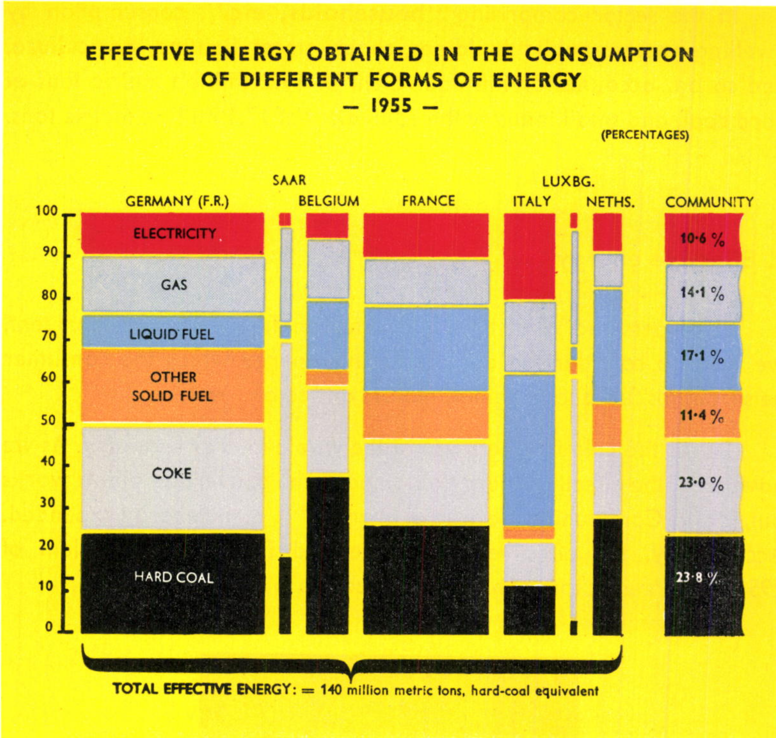
To understand what these consumption figures really represent, we have to consider the actual effective energy which the consumer gets from his furnaces, engines, motors and so on.

This is the culminating stage of the whole energy economy. As we have seen, the effective energy obtained in the conversion plants works out, for the Community as a whole, at only 47% of the energy expended. Accordingly, the effective energy derived from the equivalent of 295 million metric tons of hard coal [(1)] comes to

140 million metric tons,
hard-coal equivalent.

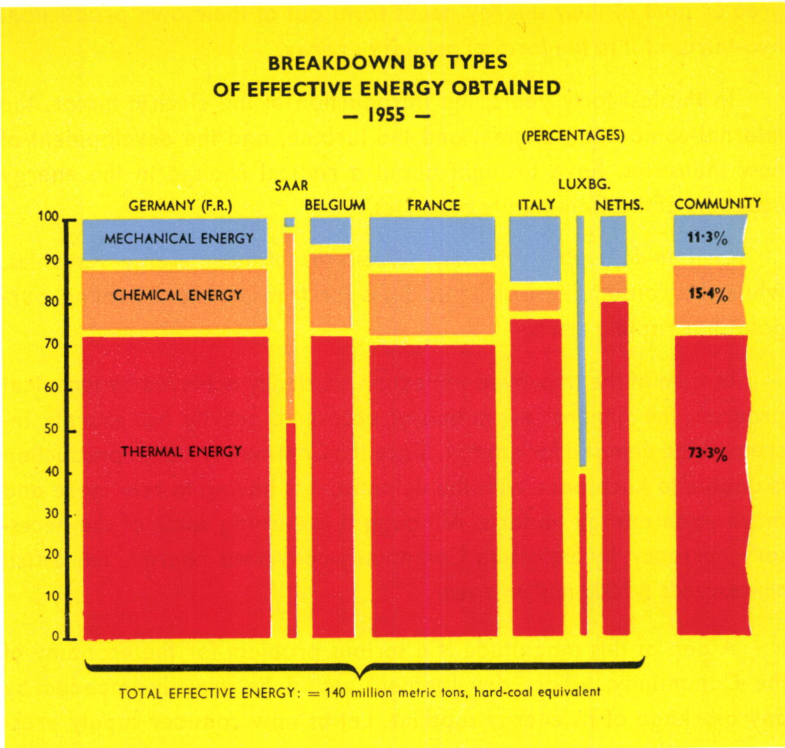
When we compare the proportion of total energy consumption represented by the various forms of energy with the proportion they

(1) See page 24.



represent in the total effective energy obtained, we find a number of shifts in relative values: the proportion of the solid and liquid fuels goes down, and the share of gas and electricity goes up. (1)

(1) See graphs pp. 25 and 26.



This, of course, is due to the fact that gas and electricity have a higher utilization efficiency than other forms of energy used in the same way, or that they can be used in more efficient ways.

Before the first world war, coal was practically the only source of energy of the Community countries, which were able to meet the greater part of their energy needs from out of their own production, two-thirds of it in the form of primary energy.

In the last forty years, the introduction of the electric motor, the internal-combustion engine, and the turbine, and the development of new industries, have brought about a radical change in the energy economy of the Community countries.

Coal to-day represents only three-fifths of total energy resources, while the consumption of liquid fuels for transport and heating purposes has rapidly risen.

In spite of the improved utilization efficiency achieved by technical progress, the general expansion of economic activity has sharply increased the demand for energy. Since the Community's own production is unable to keep pace with the demand, it is having to rely more and more upon energy imports. Although it is earning some of the necessary currency by exporting Community-converted energy, *the deficit now exceeds $ 1000 million a year.*

A gap of this magnitude is a serious problem for the economy of the Community, whose development would be gravely impeded by any blockage of its energy supplies. Let us now consider supply prospects over the next ten and twenty years.

II - FORECASTS FOR 1965 AND 1975

Why, it may be wondered, are forecasts made so far ahead? The reason is that these forecasts are made in order to guide the long-term action that is necessary to ensure a regular supply of energy to the European Community. The measures which are necessary to cope with growing supply difficulties only produce results after a considerable time-lag, particularly in the field of coal. It takes ten to fifteen years, for example, to plan, sink and bring into full production a new pit in a coal-mine.

Energy forecasts cannot be infallible predictions of the precise levels of future energy needs and energy production. They are only estimates of the levels likely to be reached in normal conditions, and provided that no unforeseeable political or economic upheavals occur.

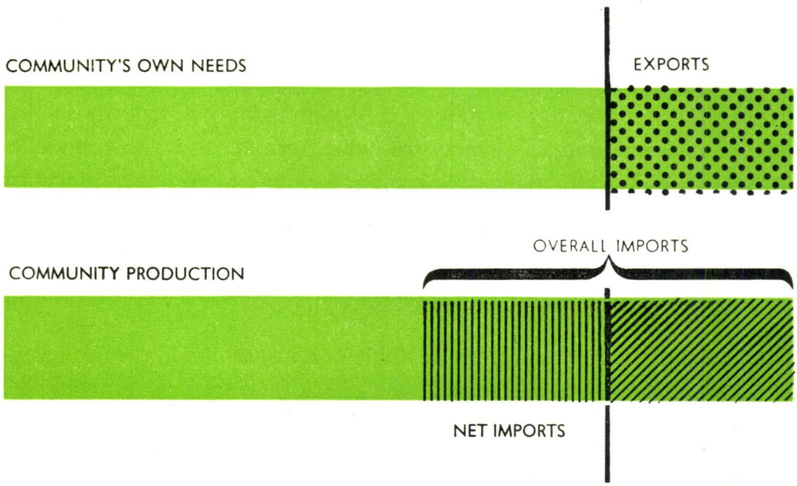
They have necessarily to cover the whole energy economy of the European Community. Let us therefore consider in turn:

— *forecasts of the Community's own needs;*

— *forecasts of Community production;*

— *forecasts of Community imports from third countries.*

c) is the difference between a) and b): that is to say, it represents *net imports* (overall imports minus exports). The trend in exports depends on a number of factors which are too uncertain to permit of direct forecasting. The object of our forecasts is therefore as shown in the following diagram:



1. Forecasts of energy needs

The national product of any given country or set of countries can be forecast more accurately than its energy needs. At the same time, there is a definite correlation between national product and energy needs. This correlation is known as

the coefficient of elasticity of energy needs relative to national product.

Thus, if over ten years the national product rises by 50% and energy needs by 40%, the coefficient of elasticity for those ten years is 40 divided by 50, which is to say 0.8.

If an economy doubles its national product, it does not, therefore, necessarily consume double the amount of energy: as a rule, it consumes slightly less than double. Certain new industries consuming very large amounts of energy — the chemical industries, for instance — do make for an even higher rate of increase. But this is more than counterbalanced by the fact that some kinds of consumption, such as household heating, increase only very gradually, while considerable quantities of energy are saved by more efficient utilization.

In order to forecast the trend in overall energy needs for a given period, therefore, it is necessary first of all to calculate *the rate of increase in the national product during that period.* The following figures have been worked out for the six countries of the European Community taken together.

Period	*Increase in national product*
1955—1965	+ 52 %
1965—1975	+ 35.5%
1955—1975	+ 106 %

Next, we have to work out *the coefficients of elasticity of energy needs against national product for the periods concerned.* These can be computed from statistical data for certain past periods: the coefficients obtained for these reference periods are corrected to allow for factors determining future developments, such as the rate of industrial expansion, technical progress, etc. The coefficients for the six European Community countries are;

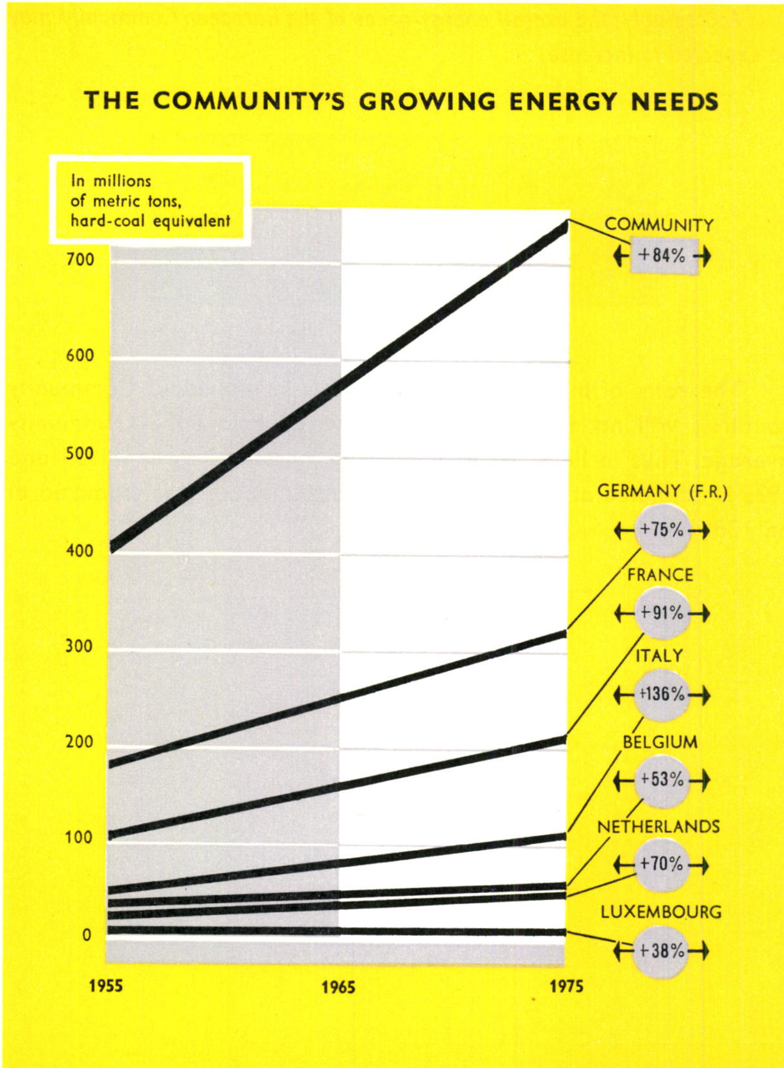
Period	*Coefficient of elasticity*
1955—1965	0.79
1965—1975	0.83

If we now multiply the rates of increase in the national product by these coefficients, we obtain *the rates of increase in energy needs* during the periods with which we are concerned.

Accordingly, the overall energy needs of the European Community may be expected to increase

by	41%	.... between 1955 and 1965,
by	30%	.... between 1965 and 1975,
and by	84%	.... between 1955 and 1975.

The rates of increase in energy needs in individual Community countries will no doubt be either above or below the Community average. Thus in Italy, for example, the increase between 1955 and 1975 is estimated at 136%, whereas in Luxembourg it is estimated at only 38%.


THE COMMUNITY'S GROWING ENERGY NEEDS
In millions
of metric tons,
hard-coal equivalent
700
600
500
400
300
200
100
0
1955
1965
1975
COMMUNITY
+84%
GERMANY (F.R.)
+75%
FRANCE
+91%
ITALY
+136%
BELGIUM
+53%
NETHERLANDS
+70%
LUXEMBOURG
+38%

To return for a moment to our energy balance-sheet for 1955[1]: in order to calculate the Community's energy needs for 1955, we have only to subtract from the total resources (Z) the additions to producers' stocks (J) + (P) and the exports to third countries (K) + (Q).

This indicates that *the Community's energy needs in 1955 amounted to the equivalent of some 400 million metric tons of hard coal*[2].

By applying the rates of increase just computed, we arrive at the following forecasts.

Overall Community energy needs

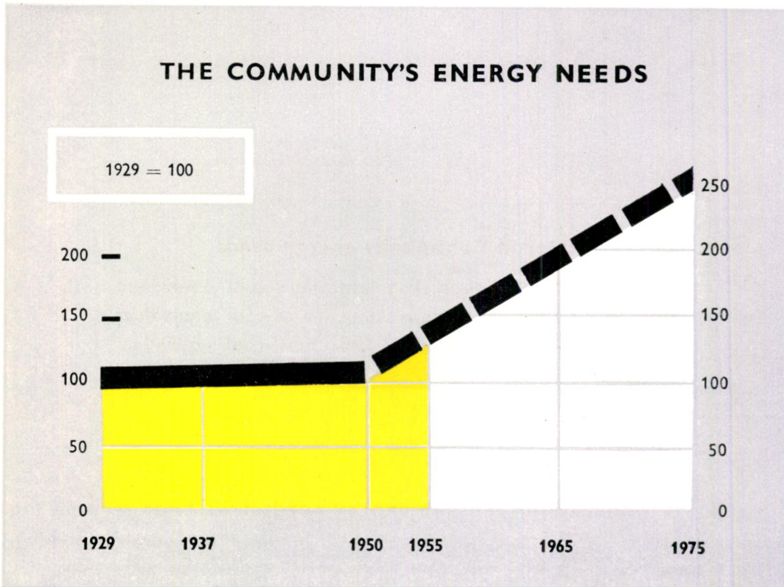
1955	....	**403** million metric tons, hard-coal equivalent
1965	....	**570** million metric tons, hard-coal equivalent
1975	....	**740** million metric tons, hard-coal equivalent

This is a startling increase in energy needs if we bear in mind that as late as 1950 energy consumption was not much greater than it had been in 1929. Energy needs remained stationary during those 21 years

(1) See page 12.

(2) The actual figure is 389.9 million tons. The discrepancy is due mainly to the fact that for forecasting purposes water power has been converted into the equivalent of hard coal on the basis of the average consumption of the *thermal* power-stations of the Community (0.528 kg/kWh). (See page 12, foot-note 1.)

as a result of the depression and the aftermath of two world wars. From 1950 onwards, on the other hand, energy needs soared; and they will continue to soar provided the Community economies are able to go on developing steadily.



Instructive and valuable though these forecasts are, they do not give any idea of possible changes which may affect the structure of the Community's energy economy over the periods studied. It is, therefore, necessary to analyse, in addition, the trend in demand for energy in certain consumer sectors.

Power-stations' energy needs

The needs of power-stations depend on the *amount of electricity* they will have to produce, and on their future *conversion efficiency.*

The demand for electricity is growing very rapidly in all fields — in industry, in household consumption, on the railways, and so on. The Community's electricity requirements are expected to be tripled between 1955 and 1975:

Community electricity needs

1955	**192** thousand million kWh
1965	**362** thousand million kWh
1975	**603** thousand million kWh

However, the power-stations' own energy needs will not increase as fast as this, since their efficiency will improve over the next twenty years. Specific consumption by the thermal power-stations (expressed as the equivalent of hard coal) should go down from 0.495 kilogrammes per kilowatt-hour in 1955 to 0.429 in 1965 and 0.387 in 1975).

This being so, the energy needs of the power-stations should increase by 66% from 1955 to 1965, and by 148% from 1955 to 1975. This compares with increases of only 41% and 84% respectively in the energy needs of the Community as a whole.(1)

The power-stations obtain their energy from various sources — water power, hard coal, brown coal, oil, gas and, in the near future, atomic energy. As resources in the form of water power, brown coal and gas are limited, it will be necessary to rely more and more on hard coal, oil and atomic energy.(2)

Power-stations' energy needs
(in millions of metric tons, hard-coal equivalent)

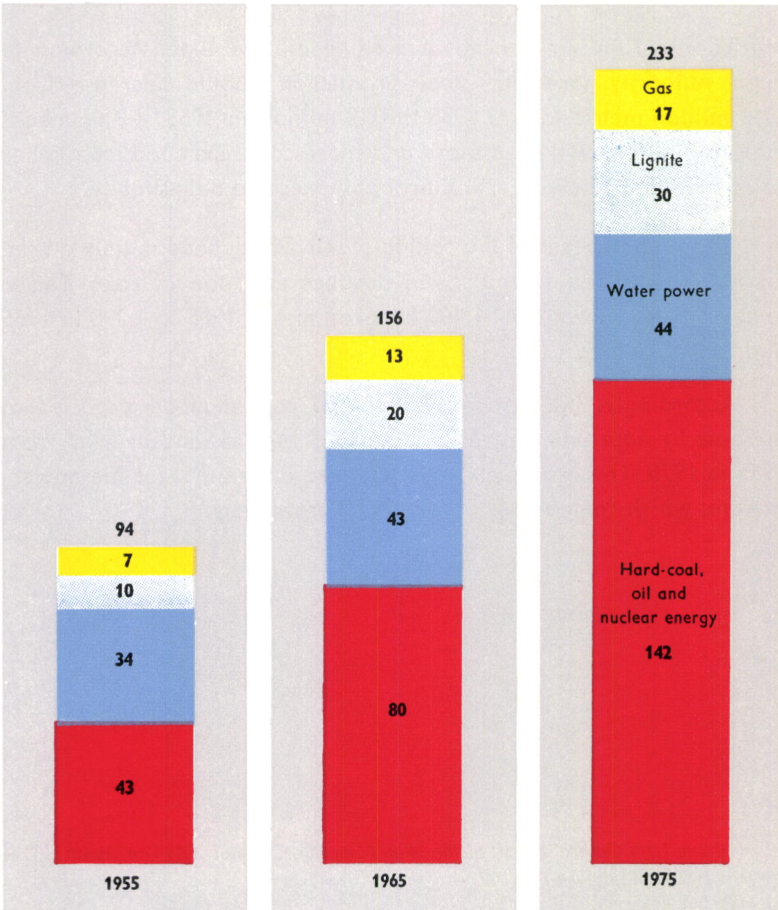
1955	**94**	whereof hard coal and oil	**43**
1965	**156**	whereof hard coal, oil and atomic energy	**80**
1975	**233**	whereof hard coal, oil and atomic energy	**142**

Thus nearly one-half of the increase in total energy needs after 1955 is expected to be due to the increased needs of the power-stations.(3)

(1) See page 37.
(2) See page 56.
(3) See page 39.

POWER-STATIONS' ENERGY SUPPLIES

(IN MILLIONS OF TONS, HARD-COAL EQUIVALENT)



Coking-plant energy needs

A good 50% of the coke produced in the Community in 1955 was absorbed by the iron and steel industry. The rest went mainly to other industries and to households.

The steel industry's needs are rising all the time. According to High Authority forecasts, steel production should increase from 52.6 million metric tons in 1955 to 78.5 million in 1965.(1) This means that the industry will need more and more coke. Demand from other coke consumers, however, will probably increase only slightly.

The energy needs of the coking-plants will depend mainly on the amount of hard coal required to produce each ton of coke. This is expected to go down from 1,400 kilogrammes in 1955 to 1,390 in 1965 and 1,370 in 1975.

Accordingly, the demand for coking coal may be expected to increase by approximately 31% from 1955 to 1965, and by 54% from 1955 to 1975. This is a much smaller increase than that for the power-stations, which came to 66% and 148% respectively.(2)

(1) See *Fifth General Report of the High Authority*, Chapter XII: The General Objectives of the Community.

(2) See page 41.

Requirements of coke and coking coal
(in millions of metric tons)

	Coke	*Coking coal*
1955	74	104
1965	97	136
1975	115	160

Road and air-transport energy needs

This is the sector in which energy needs may be expected to rise faster than anywhere else, because of the sharp increase in the number of motor vehicles and aircraft. Demand is expected to double between 1955 and 1965, and to be tripled between 1955 and 1975.

Road and air-transport energy needs

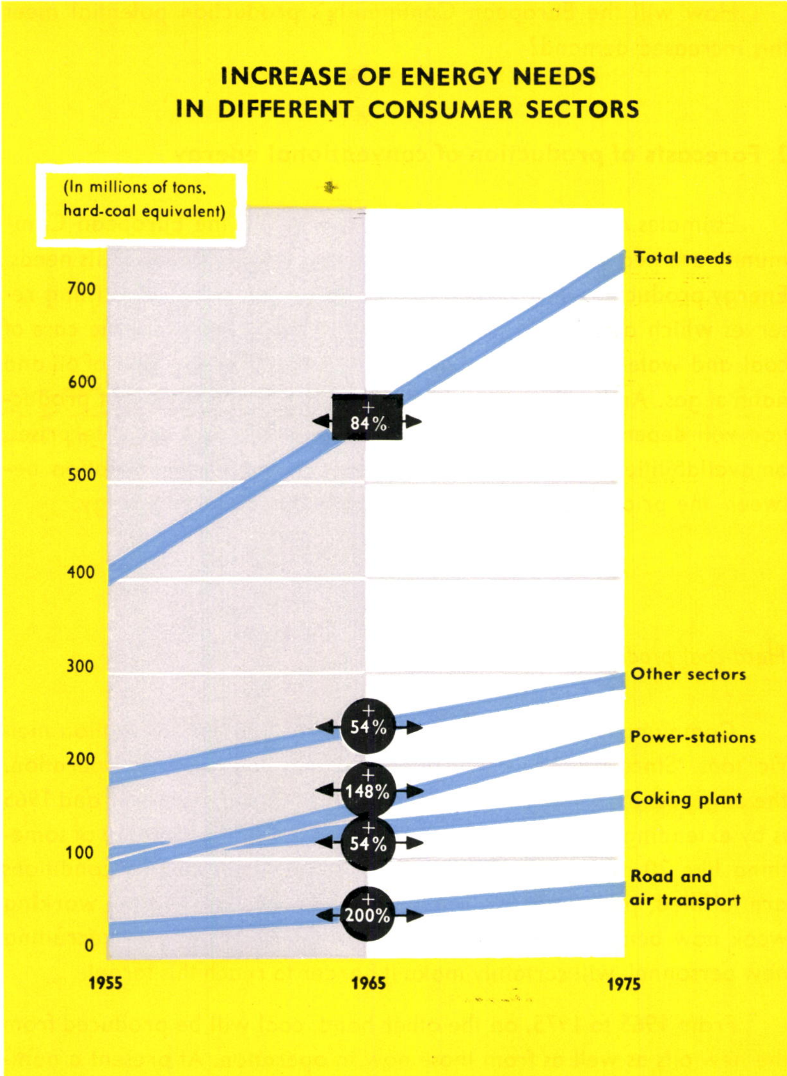
1955	21 million metric tons, hard-coal equivalent
1965	41 million metric tons, hard-coal equivalent
1975	63 million metric tons, hard-coal equivalent

Other sectors' needs

The probable needs of the other sectors — industries, households, railways, shipping, etc. — are arrived at by subtracting from overall needs the total needs of the sectors just dealt with.

	Other sectors' energy needs	
1955	....	184 million metric tons, hard-coal equivalent
1965	....	237 million metric tons, hard-coal equivalent
1975	....	284 million metric tons, hard-coal equivalent

This increase is more or less in line with the expected increase in coking coal requirements — 29% from 1955 to 1965 and 54% from 1955 to 1975. It is therefore much smaller than the increase for the power-stations and for road and air-transport.


INCREASE OF ENERGY NEEDS
IN DIFFERENT CONSUMER SECTORS
(In millions of tons,
hard-coal equivalent)
700
600
500
400
300
200
100
0
1955
1965
1975
Total needs
+ 84%
Other sectors
+ 54%
Power-stations
+ 148%
Coking plant
+ 54%
Road and
air transport
+ 200%

How will the European Community's production potential meet this increased demand?

2. Forecasts of production of conventional energy

Estimates of future energy production within the European Community are necessarily even more uncertain than estimates of its needs. Energy production is governed first of all by the extent of existing reserves which are economically workable: this is known in the case of coal and water power, but not at all accurately in the case of oil and natural gas. And even within these limits the future course of production will depend on the policy of the Governments and the enterprises, on availabilities of manpower and capital, and on the relation between the prices of imported and Community-produced energy.

Hard-coal production

Community hard-coal production in 1955 totalled 243 million metric tons. Since it takes a long time to bring new pits into operation, the only possible means of increasing production between 1955 and 1965 is by extending existing mines. This could produce an increase of something like 20 million metric tons or 9%, provided certain conditions are fulfilled, particularly as regards manpower. The shorter working week now being introduced, and the persistent difficulty of recruiting new personnel, will certainly make it harder to reach this target.

From 1965 to 1975, on the other hand, coal will be produced from the new pits as well as from those now in operation. At present a number of new pits are planned, particularly in the Ruhr. If they are completed, the increase during the period 1965—1975 should be about 30 million metric tons, or 11%. It will come from a few Community coalfields only — the Ruhr and Aachen in Germany, the Saar, Lorraine in France, the Campine in Belgium — since no similar expansion is possible elsewhere.

Brown-coal production

Forecasts of the expansion of brown-coal production — more than 90% of which comes from Germany — are more hopeful. It is estimated that production can be increased 34% by 1965 and 70% by 1975.

Oil production

Increased oil production will depend very largely on the results of the prospecting now in progress. Forecasts are very high, but cannot be too implicitly relied upon, since there is no accurate information about reserves and the possible rate of production in the various Community countries. Production is expected to go up 153% by 1965 and 280% by 1975.

Natural-gas production

Expansion in the production of natural gas will result almost entirely from the working of the reserves at Lacq, in France, which by

1975 will be supplying one-half of the Community's total production. Community production is expected to increase 180% by 1965 and 300% by 1975.

Water-power production

Little further expansion in water-power production is now possible, since the limit of the resources worth working in this field has almost been reached. Production can be increased 29% by 1965 and 35% by 1975.

Total conventional-energy production

Added together, these separate forecasts for the production of the various forms of conventional energy work out as follows:

Forecasts of production of conventional energy
(in millions of metric tons, hard-coal equivalent)

	1955	*1965*	*1975*
Hard coal	243	265	293
Brown coal	29	39	49
Oil	7.5	19	28.5
Natural gas	5.5	15.5	22
Water power (1)	33	42.5	44.5
Total:	**318**	**381**	**437**

(1) See page 39, foot-note 2.

Thus *total production of conventional energy may be expected to increase by*

	20 %	.... between 1955 and 1965,
	15 %	.... between 1965 and 1975,
and	37 %	.... between 1955 and 1975.

It is obvious that, despite the striking increase in the production of some forms of energy, there is a vast gap between these percentages and the percentage increase in the Community's needs. The latter, as we have seen,[(1)] are expected to increase by

	41 %	.... between 1955 and 1965,
	30 %	.... between 1965 and 1975,
and	84%	.... between 1955 and 1975

more than twice as fast as production.

(1) See page 37.

The significance — and the danger — of this energy gap may be seen from forecasts of the imports which it may necessitate.

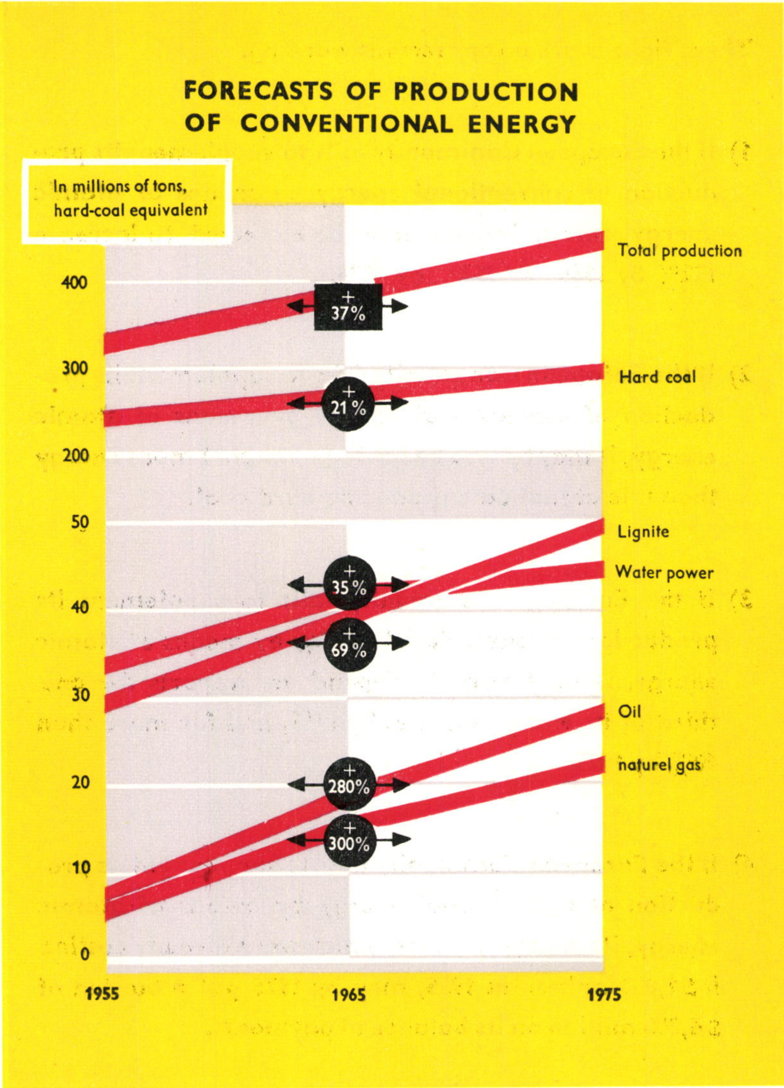
3. Forecasts of imports

Forecasts of net energy imports represent the difference between future production and future needs. [1]

Net imports
(in millions of metric tons, hard-coal equivalent)

	1955	1965	1975
Energy needs (2)	403	570	740
Production of conventional energy (3)...	318	381	437
Deficit:	**85**	**189**	**303**

(1) See page 34.
(2) See page 39.
(3) See page 50.


FORECASTS OF PRODUCTION
OF CONVENTIONAL ENERGY
In millions of tons,
hard-coal equivalent
Total production
Hard coal
Lignite
Water power
Oil
naturel gas
+ 37%
+ 21 %
+ 35 %
+ 69 %
+ 280%
+ 300%
400
300
200
50
40
30
20
10
0
1955
1965
1975

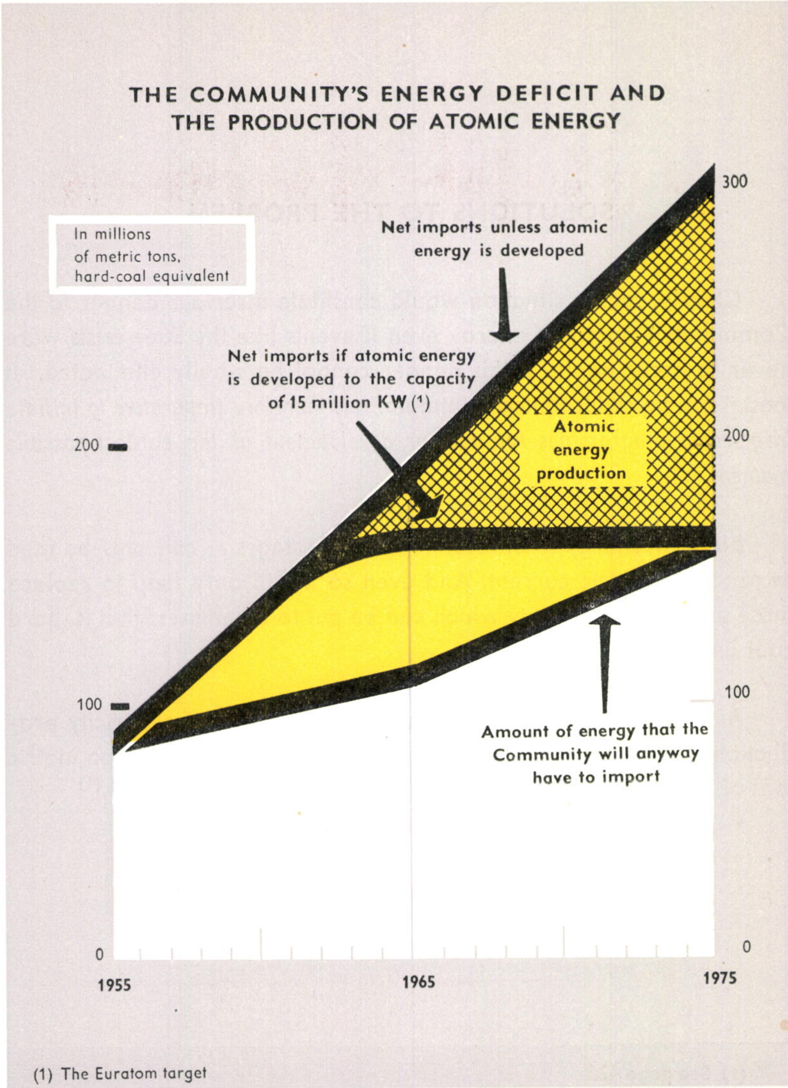
These figures are a very serious warning.

1) **If the European Community fails to supplement its production of conventional energy by means of atomic energy, energy imports may be expected to increase 122% by 1965 and 257% by 1975.**

2) **If the European Community fails to supplement its production of conventional energy by means of atomic energy, it may by 1975 be having to import more energy than it is at that date producing hard coal.**

3) **If the European Community fails to supplement its production of conventional energy by means of atomic energy, it may have to depend on imports for one third of its energy supplies by 1965, and for more than 40% by 1975.**

4) **If the European Community fails to supplement its production of conventional energy by means of atomic energy, its energy imports, which were already costing it $ 1,000 million in 1955, may by 1975 put a burden of $ 4,000 million on its balance of payments.**


THE COMMUNITY'S ENERGY DEFICIT AND THE PRODUCTION OF ATOMIC ENERGY
In millions of metric tons, hard-coal equivalent
Net imports unless atomic energy is developed
Net imports if atomic energy is developed to the capacity of 15 million KW (1)
Atomic energy production
Amount of energy that the Community will anyway have to import
300
200
100
0
1955
1965
1975
(1) The Euratom target

SOLUTIONS TO THE PROBLEM

Clearly, such a situation would constitute a serious danger to the Community's supply of energy even if events like the Suez crisis were never to occur again. If this danger cannot be wholly eliminated, at least it can be reduced to a minimum. *It is therefore imperative to initiate large-scale programmes for nuclear development at the earliest possible moment.*

Nuclear energy — at least in the early stages — can only be used to produce electric current. And even so it will only help to replace those sources of electricity which can be put to other uses: that is, hard coal and oil.

As we know, energy requirements for this part of electricity production are expected to amount to the equivalent of 80 million metric tons of hard coal by 1965, and 142 million metric tons by 1975.(1)

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(1) See page 42.

By subtracting these amounts from the Community's total energy gap,[1] we can work out the *tonnages which the Community must expect to have to import,* that is:

111 million metric tons, hard-coal equivalent, in 1965
161 million metric tons, hard-coal equivalent, in 1975

These represent 20% and 22% respectively of the increased requirements, and an increase of 28% and 87% over imports in 1955.

But actual imports will probably be higher still, since they will include the still quite substantial tonnages of coal and oil for those power-stations which are not run on nuclear energy, as well as the raw materials needed for its production.

Further action will therefore be needed to ensure that the Community is kept regularly supplied with energy. There will have to be *action in the field of consumption,* to explain and encourage efficient energy utilization. There will have to be *action in the field of production,* to promote the development of all sources of conventional energy up to the limit of economic workability. And there will have to be *action in the field of imports,* to bring costs down to a minimum, more particularly by rationalizing energy transport arrangements.

Action in all these fields will have to be carried on jointly. The countries of Europe can no longer afford the waste involved by policies

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(1) See page 52.

which in the past have been ill-coördinated and often mutually contradictory. The problem of Europe's energy supplies will never be solved until its resources and facilities are used economically and reasonably.

The countries of the European Community have learned this lesson. In the Coal and Steel Community they have laid the foundations of their joint economic development.

Experience has now shown that those foundations need to be extended to include all energy resources. And when the member Governments of the Community signed the Treaty establishing a European Economic Community, they decided at the same time *to go ahead together with the development of atomic energy, by setting up the European Atomic Energy Community (Euratom).* Immediately after the signature of these two Treaties, they instructed the High Authority of the European Coal and Steel Community to submit *proposals for co-ordinating the energy policies of the different Community countries.* The High Authority duly drew up a working programme, and the Council of Ministers, in a protocol issued on October 8, 1957, empowered it, on the basis of that programme, to study ways and means of ensuring a co-ordinated energy policy for the Community as a whole.

(1) See the *"Journal Officiel" of the Community, December 7, 1957*

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In

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(in the U.S.A.: UNITED EUROPE - THE FIRST STEP)

Based on the General Report 1957

of the High Authority,

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