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Address

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A EUROPEAN ASSESSMENT OF NUCLEAR AND CONVENTIONAL FUEL COSTS

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INTRODUCTION

It is a particular pleasure for me to be able once again to give the Atomic Industrial Forum an exposition of the trends in the development of atomic energy in the European Community.

I have already been privileged to address you on this subject on two previous occasions, in 1960 and in 1964, and if after two years I am again standing before you, I am astounded - just as I was last time - to see how rapidly nuclear development is forging ahead not only in the United States but also in our own European Community.

I promised the organizers of this forum that I would present data on the evolution of the cost of fuels, both conventional and nuclear. Before doing so, however, it seems to me as well first to show you, with reference to a few graphs, the results of a study that we have just carried out in collaboration with the governments of our six Member-states, namely Germany, France, the Netherlands, Belgium, Luxembourg, and Italy, and also in collaboration with industrial enterprises in those six countries, with the large electricity producers, with the insurance companies and with the trade-unions.

When you have seen these graphs, you will have acquired some background information which will enable you the better to understand my exposition on raw-material costs.

The first graph shows the Community's energy sources in 1965. Chief among these are indigenous coal (33.6%) and oil (46.1%), more than 90% of which is imported. It can also be seen from this graph that Europe is heavily dependent on imports for its energy supplies.

The second graph shows the sources of electricity production in 1964. In this sector coal and water power are at present playing a predominant part. The influence of the latter is, however, declining, since most sources of water power are to all intents and purposes already being fully utilized. We may assume that henceforth fuel oil and, above all, nuclear energy, will increase greatly in importance. This is illustrated in the fourth graph, which I shall come to shortly.

Graph No. 3 shows the estimated gross electricity consumption in the Community up to 1975. This doubles approximately every ten years and will amount to about 800×10^9 kWh in 1975, as compared with just over 400×10^9 kWh in 1965.

The fourth graph gives an estimate of electricity production in the Community up to the year 2000, broken down into production from hydro-power, fossil fuels and nuclear energy. Production from nuclear energy will rise very steeply; in the year 2000 it will account for roughly 70% of the total electricity output. The absolute production from thermal power will also continue to increase, though to a much lesser extent than that from nuclear energy.

Graph No. 5 indicates the relation of nuclear power plants to the total installed capacity. We expect that in the year 2000 about half the installed capacity will be in the form of nuclear power plants. Furthermore, it follows from this graph and the previous one that nuclear energy, entirely in conformity with its cost structure, will be used to provide the basic load.

The sixth graph shows the hypothetical participation of various reactor types according to four development models. We drew up these models in order to obtain an idea of the line of policy to be adopted by the Community and its member-states as regards the future use of nuclear energy. In our opinion, it is model No. 4 which will have to serve as a basis for this. We believe that, after the present proven-type reactors, advanced reactors will play a significant rôle before it ultimately becomes possible to introduce breeders on a large scale.

Finally, the seventh graph gives the estimated trend of installed nuclear capacity according to reactor categories. This graph is derived from the previously mentioned model No. 4.

My object in the subsequent part of my address is to provide a few comparative data on the present situation and the foreseeable trend for fossil and nuclear fuels in the European Community countries.

These two types of fuel, which are found side by side on the market, will condition the future of nuclear energy in the six countries concerned.

I

FOSSIL FUELS

Leaving aside certain fuels such as blast-furnace gas, and even lignite, whose influence will be appreciably curtailed in the future, we shall examine the position of fossil fuels used in electric power plants, i.e. coal, fuel-oil and natural gas, which are likely to compete with nuclear fuels.

1. COAL

a) At the present time, coal mined in the Community costs at least $15/tonne ex pithead.

As regards the future, the only conceivable possibility would appear to be a rise in unit prices, mainly because of the trends followed by wages and productivity respectively. By way of example, for 1965, the anticipated productivity increases do not exceed 3.5%, whereas wage increases either already resolved upon or under discussion range from 6% to 8%. There is no sign that in the longer term the tendency will be reversed and that productivity can be stepped up continuously at a faster rate than, or even the same rate as, the movement of wages. The result will therefore be a rise in costs which will have its repercussions on prices.

Keeping extraction at a level approximating to that of current production means, on the one hand, maintaining capacity at a volume such that there is no very appreciable expansion in output and, on the other hand, calls for a standing force of

miners which cannot be maintained without mine wages rising, at any rate in proportion to other earnings. Only a major cut in production capacity could have a favourable effect on prices, with extraction concentrated on the best deposits. But the effect of the ensuing reduction in output would then be to diminish considerably the quantity of Community coal supplied to the electric power stations, and increase the proportion of other fuels correspondingly.

b) Of the coals imported into the Community, bituminous slacks from the USA, for instance, used until the spring of 1963 to cost $7.5-8/t fob East Coast of the United States. Since then, these prices have risen to $9 or $10. To this must be added Atlantic freight, which in about 1962 was no higher than $2.50/t for short-term contracts, but which in the meantime has almost doubled.

In the years immediately ahead, there is expected to be, in the case of coal from the United States (which forms the main bulk of our imports), a steady but fairly moderate downward trend in ex-mine prices, transport costs to the East Coast of the USA, and transatlantic freight rates. The long-term freight rate in particular may average $4/t, a rate which seems just to cover expenses including return on capital. At this rate, the price for bituminous slacks c.i.f. European ports would come to $13-14/t.

It seems, however, according to certain recent studies, that delivered prices could be brought substantially lower - indeed, the price of $8 per tonne c.i.f. European port has been quoted - if there were a large steady flow from mine to consumer, using the most modern, ultra-high-capacity transport facilities.

2. FUEL OIL

Prices of heavy fuel-oil, taxes and dues included, differ widely from country to country; the average is between $16 and $20 per tonne fuel-oil ex refinery.

Thus the price per calorie ex refinery is in general lower than the ex mine prices for domestic coal and even the c.i.f. prices for imported coal. Those Community countries that have an important coal industry, however, apply a customs or fiscal policy to bring the prices of cheap energy sources, including fuel-oil, into line with the higher-prices of their domestic coal.

Over the medium term, there is no apparent reason to expect either a rise or a drop in the delivered-refinery prices of crude petroleum. As regards the production cost, various contrary factors are at work, such as, on the one hand, the need to deepen the wells and the growing proportion of dry wells, and on the other, the constant technical progress in drilling and recovery methods. As to royalties or dues, their tendency is certainly upward, whereas it should be possible to bring transport costs down. These various contradictory factors rather suggest that prices will remain relatively stable or fall a little over the coming years.

In the long term, however, it is probable that the mining law of diminishing returns and rising costs will come into play. Hitherto the oil industry has always succeeded in discovering ever-greater reserves, capable of exploitation at costs similar to those of earlier fields. But in view of the enormous growth of demand, and considering that the earth's crust does not contain an unlimited amount of oil and that the quantity recoverable at costs equal to or even slightly higher than today's costs is yet more limited, there is some possibility that oil prices may rise moderately before the end of the century.

It is likewise probable that the future common energy policy will continue to give a certain degree of protection to Community coal. Assuming a uniform due or tax of $2 to $4 per tonne fuel-oil, one may suppose that towards 1970, in the Community, the minimum price for fuel-oil, ex refinery, will be between $15 and $17 per tonne which would be equivalent to $10-12 per tonne of coal.

(3) NATURAL GAS

With regard to natural gas, it appears for the moment that the price for delivery to electric power stations will be about $ 12/t.c.e. This price is based more on market conditions than on production costs.

Substantial deposits of natural gas have, of course, been discovered in the Community, and it is highly probable that further reserves will be discovered as prospecting continues.

These new reserves, coupled with the possibility of importing Sahara gas, will certainly have a beneficial effect on the Community's energy balance, which as a whole features a shortage of domestic sources.

Nevertheless, owing to this fuel's specific qualities and the considerable potential demand, natural gas will probably continue to be regarded as a comparatively rare commodity even if new deposits come to light. This noble energy source deserves, from both the technical and the price standpoint, to be put to more appropriate and hence more profitable uses than mere burning up in electric-generator furnaces. Consequently, there will not be very many power plants running entirely on natural gas. More probably there will be a number of mixed-type plants which will take up seasonal or temporary surpluses of natural gas, benefiting from special conditions.

Thus, in the present state of affairs, it does not look as though natural gas will play any direct rôle of importance in Community electricity generation, so that if its price does fall it will have no decisive effect on the cost of future electricity output.

After this brief consideration of the present and future situation as regards the cost of conventional fuels, let us now examine the position of the European Community with respect to the cost of nuclear fuels.

NUCLEAR FUELS

1. NATURAL URANIUM

At present the European Community's domestic resources of uranium barely exceed 30,000 tons (U metal) for the proven reserves and an additional 20,000 tons of indicated reserves, both available at costs below 10 $ lb U_3O_8. The present production of uranium metal amounts to some 1500 tons per year. Of these 1500 tons about 1/3 comes from overseas mines controlled by member countries. All this metal is purchased at about 8 $ lb U_3O_8.

On the other hand, the long-term requirements of the whole European Community between 1970 and 1980 will reach the cumulative figure of 54,000 tons (U metal). So it is clear that to an ever greater extent, we must seek our sources of supply outside the Community. Euratom is therefore paying very clos attention to the trend of uranium prices. The few spot-lot transactions which are at present concluded or being negociated show prices of around 4-5 $ lb U_3O_8. We are aware that these prices allow neither normal amortization of plants nor development of new resources. It is to be expected, not to say hoped, that as soon as a substantial civilian demand arises, the prices will increase to a realistic level - say about 6-8 $ lb U_3O_8.

In the long run, according to all forecasts both Euratom's and those announced at the 3rd Geneva Conference and the 2nd Congress of the European Atomic Forum the requirements inside and outside the Community will rise to a very high level and at an unusually fast rate for the mining industry, even in the case of the lowest hypotheses as to nuclear fuel consumption. The present proven reserves may run out sooner if nuclear power-plant operators, in accordance with the common practice in the energy sector, cover their requirements for a long period ahead, thus earmarking the known reserves well in advance. Further requirements could only be met at high cost if no new discoveries are made. Hence, as Euratom has emphasized for a long time, prospecting efforts should enable the low-cost resources to be increased, provided that these prospecting efforts start soon enough to permit a steady and healthy growth of the uranium-mining industry. Such a growth must be based on a long-term supply policy.

2. ENRICHED URANIUM

No enrichment on an industrial scale is yet being done in the Community. The industrial demand for enriched uranium is not so spasmodic as that for natural uranium. Even on lowest assumptions, the consumption of enriched uranium will rise rapidly, reaching the cumulative figure of about 28,000 tons of natural U metal in 1980, and to this must be added a similar trend in the rest of the western world.

As far as enriched uranium is concerned the European Community is even more dependent on imports than it is for natural uranium, and it relies almost entirely on a single producer, the USA. More precisely, considering the USAEC's huge enrichment capacities and our Agreement for Cooperation with the US, the Community should not

have to worry about the quantitative aspect of supply until well into the 70's. The only problem that might arise, in the more or less remote future, would be that of prices, and more generally the terms of supply. In that respect, it is of the utmost importance for us that, in both the US legislation on private ownership of special nuclear materials and the proposed criteria for toll-enrichment contracts, just published by the AEC, the US adhere to their principles of price stability, security of supply and of non-discrimination between domestic and foreign users. Prices of enriched uranium will always echo the fluctuations of the natural uranium price. Isotope separation work, forming as it does the greater part of the cost of enriched fuel, nevertheless remains a considerable factor of stability. In the long term, the trend of prices and conditions is hard to foresee, especially if private uranium enrichment should replace Government services in this field.

In any event, the problem of enriched uranium supply has such far-reaching and vital implications that the European Community cannot neglect studying from now the many and varied aspects of any initiative of its industry in the field of isotope separation.

We may point out in this connection that, according to certain information received, the French installations will be able to produce slightly enriched uranium at prices about 30% higher than those currently ruling in the United States. The UKAEA, for its part, is believed to be prepared to supply at a price only 10% higher than the USAEC prices.

3. PLUTONIUM

Plutonium prices are mainly a domestic problem and not an immediate one for the nuclear industry in the European Community, since it will be some years before there will be any demand for plutonium as fuel for power stations.

Owing to the fact that plutonium is a by-product of electricity-generation, it can be expected that as its extractions costs go down, it will in a few years be available at prices lower than its utilization value in fast breeders and even in thermal reactors.

The importance of plutonium for the European industry is all the greater in the long run, as this material will be of predominanfly domestic origin and also has a very high energy value.

All these considerations have played their part in the shaping of Euratom's forecasts up to the end of this century which I traced for you in headlines at the beginning of my address. Euratom's assumptions are based on the smallest possible growth in nuclear fuel requirements and the best possible utilization of fuel, in the form of natural, enriched or generated material. Such a pattern of evolution seems highly desirable, because it makes it possible to keep down the proportion accounted for by the fuel cycle in the cost of nuclear energy and also represents a contribution to the stability of nuclear-fuel prices in the western world.

In closing, may I remind you that the three existing European Communities:

- The European Coal and Steel Community,
- The European Atomic Energy Community,
- and the European Economic Community,

have so far met with great difficulties in formulating a common energy policy, owing principally to the national interests at stake.

Nevertheless we hope that the forthcoming amalgamation of the three Communities will at last make it possible to bring a truly common energy policy into being, so that harmonious solutions can be found for the power supply problems of the six countries, where traditional and nuclear fuels all play a balanced part.

Such a policy is a vital factor to economic development and a higher standard of living in all the Community countries, as also to all other countries that have permanent and close relations with the Common Market.