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EUROPEAN ATOMIC
ENERGY COMMUNITY

E U R A T O M

The Commission

A D D R E S S

by His Excellency Mr. E.M.J.A. SASSEN,
Member of the Euratom Commission

to the Energy Conference organized by the
European Movement and held at Haarlem on
Thursday, 16 September 1965.

Subject: THE DEVELOPMENT OF AND PROSPECTS FOR NUCLEAR ENERGY

There have recently been repeated references in various quarters to the fact that nuclear energy has now passed out of the stage of preparatory research. From now on, nuclear energy can be used on economically attractive terms and on an industrial scale for the production of electricity.

This might prompt the conclusion that Euratom has thereby more or less completed its task, that industry can henceforth manage on its own and that in future Euratom can confine itself to research of a secondary nature. Such a situation would be gratifying for those who would like to see the virtual liquidation of Euratom as a result of the fusion of the Common Market and Euratom Commissions and the High Authority of the European Coal and Steel Community.

This misunderstanding stems from the still widely held belief that Euratom is really a research institution. The misconception is reinforced by the considerable attention which

has recently been devoted, mainly by the Press, to our second five-year programme and the research budget associated with it.

Understandable though this misconception is, it seems to me of the utmost importance to place on record that Euratom's primary task is not to carry out a research programme but to promote the growth of a nuclear industry in the European Community. This is laid down unequivocally in Article 1 of the Euratom Treaty, which states that:

> "It shall be the aim of the Community to contribute to the raising of the standard of living in Member States and to the development of commercial exchanges with other countries by the creation of conditions necessary for the speedy establishment and growth of nuclear industries".

At a time when the nuclear reactor is becoming an industrial means of production, there is indeed a certain change as regards the implementation of the task thus defined. For Euratom, the period from which we have just emerged was one of preparation; we are now on the threshold of an industrial phase, in which nuclear energy will play an ever more important part.

I should like just to give you an outline of the significance of nuclear energy against the background of the development of the energy situation in the six countries of the Community. You know, of course, that the total energy production in the Community is doubling every twenty years and that electricity is accounting for an increasing share of this total energy output. The growth of electricity production is in fact marked by a virtual doubling in ten years. Whereas for 1965 we are counting on a production of some 400,000 million kWh, the estimated figure for 1975 is 790,000 million kWh. It is within the framework of this rapidly developing electricity

production that nuclear energy has taken its place. For nuclear energy is primarily - and in the immediate future will be almost exclusively - a means of generating electricity.

During the next ten years, the range of fuels on which we in Europe must rely will undergo important changes in structure. Coal consumption is more or less stable: in the Community it is between 200 and 250 million tons coal equivalent a year. If, as is expected, consumption remains roughly at this level, coal's share in the total energy supply will decline.

On the other hand, oil and natural gas will make a much larger contribution: in 1963, oil accounted for just over a third of the Community's energy production, but in 1975 more than half the total energy will be obtained from oil. The contribution made by natural gas, at present about 3%, will then have risen to 10% or over.

With the increasing consumption of oil and the decline - relatively at least - in the importance of coal, we are becoming more dependent on imported energy sources. Before the second world war, Europe was able to meet 95% of its requirements from indigenous raw materials. In 1960, we imported slightly over a third of the fuels needed for our energy supply, and the time is now rapidly approaching when approximately half the necessary fuels will be imported.

As far as the other sources of energy are concerned, I naturally leave the discussion to other speakers and shall confine myself here to this broad outline of the energy-supply position in general; for the rest, I shall deal only with electricity supply and, more particularly with the part that nuclear energy will play in this process.

At the start of my talk, I quoted Article 1 of the Euratom Treaty. I should now like to acquaint you with another important Article of that Treaty, namely Article 40, which runs as follows:

"In order to stimulate the initiative of persons and enterprises and to facilitate the coordinated development of investment by them in the nuclear field, the Commission shall periodically publish programmes indicating, in particular, the production targets for nuclear energy and the various types of investment required for their attainment."

"The Commission shall request the opinion of the Economic and Social Committee on such programmes prior to their publication".

The time is now ripe for drawing up such a target programme, submitting it to the Economic and Social Committee and then publishing it. During the early years of the European Atomic Energy Community's existence, there were still too many uncertainties to enable the various possible lines of development to be reliably assessed and a suitable choice to be made. By 1960, however, the Euratom Commission was already able to give very general indications of the probable development. In our Third General Report, it was estimated that in the year 1980 the countries of the European Community would possess a nuclear electricity capacity of 40,000 MWe. To give you some idea of what this figure means, I will tell you that it is equivalent to the capacity of 200 large power stations of 200 megawatts each, that is to say, eight times the present installed generating capacity of the Netherlands.

At the time, this first long-term forecast was considered by many people to be over-optimistic. Similar reactions were discerned two years later when more comprehensive forecasts were compiled in collaboration between the EEC, the ECSC and Euratom. These latter forecasts were published under the title "A Study on Long-term Energy Prospects in the European Community". This study was carried out by a working group which was set up as part of the collaboration in this field between the Commission of the European Economic Community, the High Authority of the European Coal and Steel Community and the Euratom Commission. When this document was published, criticism was again heard from those who believed that we had made the future outlook for nuclear

energy too rose-coloured. Nevertheless, we were of the opinion that this forecast should be left unchanged.

The criticism has now been completely silenced by cold facts. There are no longer any doubts about the economic attractiveness of nuclear power plants, nor about their safety and reliability. Moreover, there is a growing conviction that it is necessary to build up in Europe a nuclear industry capable of withstanding competition from the major overseas concerns.

As a result of all this, a considerable number of nuclear power stations have already been built or are currently under construction in Europe. If we now compare the forecast with the actual plans in existence and with the achievements to date, we come to a surprising conclusion. The forecast spoke of 3,500 to 4,000 MWe of installed capacity in 1970; by that year, however, the nuclear power plants now completed, under construction or planned will have reached a total capacity which even exceeds the upper limit predicted. In fact, by that time the atomic power stations in operation will have a total installed capacity of about 4,200 megawatts. There is every reason to suppose that the construction of atomic power stations will thereafter be stepped up in keeping with our forecasts, since the vast expansion in electricity production offers adequate scope for the building of nuclear power plants on a large scale and the low production costs make it attractive for the electricity producers to avail themselves of nuclear energy, primarily for supplying the basic load.

The facts have thus shown that our forecast erred on the side of caution rather than of optimism. Consequently, there is scarcely anyone who still doubts that, from the economic standpoint too, nuclear energy offers excellent prospects as regards power supply and that our initial estimates were, to say the least, extremely realistic.

Nonetheless, there are still obstacles to the optimum utilization of this new and cheap source of energy. A target programme, within the meaning of Article 40 of the Euratom Treaty, which, on the basis of a forecast of nuclear energy development, indicates what auxiliary industries will be required in order to make this development possible, is therefore essential (I shall come back to this point presently) but not in itself sufficient. The atomic generating stations and the auxiliary industries must indeed come, but in the short-term view some of the projects are not commercially attractive, or at least not yet. A target programme must therefore be supplemented by an industrial policy in the nuclear field which aims at surmounting these obstacles. Such an industrial policy must, of course, fit in with the energy policy of the six Community countries and must not be allowed to clash with the general industrial policy being pursued under the Treaties of Rome and Paris.

These treaties, however, make no provision for a Community energy policy. In 1957, the six governments did sign a protocol in which it was agreed that the High Authority should have the main say as regards energy policy. Problems relating to energy are dealt with in a Special Council of Ministers of the European Coal and Steel Community. This Council acts on proposals of the High Authority and the two Commissions in Brussels, who collaborate within the framework of an Inter-Executive Working Group which has meanwhile been set up and is composed of three members of the High Authority of the Coal and Steel Community, three members of the Common Market Commission and two members of the Euratom Commission.

Euratom's target programme must accordingly link up with the proposals that the Inter-Executive Working Group has made from time to time in order to arrive at a common policy on energy. The fundamental points of this policy, as laid down in a memorandum

published in 1962, are: cheap energy supply, safeguarding of the supply, a free choice of energy sources for the consumer and a joint commercial policy. The object of the proposals is in the long term to ensure that energy is supplied as cheaply as possible under conditions affording maximum safeguarding of supply. This amounts to a common and open, albeit not entirely unprotected, energy market.

In view of these aims, and especially in view of the efforts to ensure dependability of supply and a low price, nuclear energy can play an important part. But we have already seen that in the case of nuclear energy it is not simply a question of building a power plant which may or may not produce electricity more cheaply than an equivalent conventional generating station. A nuclear power plant can only function to the optimum effect, both from the economic point of view and from that of basic materials availability, when it forms part of a nuclear production apparatus in which a suitable balance is struck between the contributions of the various components.

For it is not enough merely to state the capacity of the nuclear power plants at a given moment; it is also necessary to ascertain how the various possible forms of nuclear energy production make their respective contributions within the overall pattern of development. This necessity arises from the fact that atomic energy is not produced by a simple process like combustion but by the complicated process of nuclear fission. Let me try to explain this more fully.

It is true that from the point of view of costs nuclear power plants of the present type can stand comparison with coal- and oil-fired generating stations. However, if we were to use the present-day reactor type exclusively, only about 1% of the atomic nuclei present in the uranium would be split, i.e. made to produce energy. This would be a waste of nature's uranium resources - a waste which would be all the more reprehensible in view of the fact that modern nuclear technology opens up the possibility of eventually increasing this figure to 60% or 70%.

In this connection, I must warn you against a serious misconception. The reactors in which a far more efficient consumption of nuclear fuel is achieved, and which are known as "breeders", will not come into service until about 1980.

Now it might be thought that until then the use of nuclear energy can easily be dispensed with so as to avoid wasting uranium. But that is not so. In order to make my meaning clear, I must tell you a little more about the technical background of uranium fission.

Uranium as extracted from natural sources contains only 0.7% of fissile material. That nevertheless 1% net of the uranium can ultimately be made to undergo fission is due to the fact that in the reactor itself, while the fission process is taking place, a very small number of new fissile atoms are formed from the remaining 99%. These new fissile atoms consist of plutonium.

The new reactor type I mentioned, the breeder, does more than just produce a little extra fuel; breeder reactors actually produce more fissile atoms than they consume. However, this requires the presence in the reactor of a certain quantity of plutonium.

Thus the production pattern which will lead to the optimum use of basic materials will consist in a succession of different reactor types. Present-day reactors provide cheap energy and also produce some plutonium. This plutonium can be extracted

from the irradiated fuel, but we have to have a certain quantity of it before we can supply the necessary initial charge for the breeder reactors. The breeders in turn will then step up the production of plutonium.

As regards the succession of these reactor types, the Euratom Commission has endeavoured to find the optimum pattern. But it is not merely a question of phasing-in the contributions of what I have so far called "present-day reactors" and "breeders". In the first place, there are two distinct lines of development within the category of present-day reactors; secondly, there is a class of reactors which by virtue of their properties fall in between these two categories and which are equally deserving of attention.

Let us first consider the distinction according to lines of development. In the United States, a technique has been developed whereby the natural uranium is not used as such. By means of an expensive process, some of the fissile uranium is separated, thus increasing the content of fissile U-235. The idea was that this would enable cheaper and more compact reactors to be built.

In Britain and France, on the other hand, a nuclear technology was developed which differed from American practice in certain important respects. In those countries, work was done on a reactor type using natural uranium as fuel. (Since it contains no enrichment, natural uranium is much cheaper but also much less fissile). At that time, i.e. about ten years ago, Britain already had considerable practical experience in this field.

When Euratom began its activities in 1958, therefore, it was faced with a choice between two courses:

- either it could concentrate nuclear research in the six Member States entirely on the development of natural-uranium reactors, by dint of a combined effort and possibly in collaboration with Britain,
- or it could give the Community the chance of using enriched-uranium reactors side by side with the former type.

The Commission chose the second course, and there was no lack of criticism as a result. Nevertheless, it is still as firmly convinced as ever of the soundness of its choice.

This is not the place to go into the advantages and disadvantages of each of the previously mentioned reactor types from the standpoints of technology, fuel availability, capital investment, fuel and operating costs, etc. There is no doubt, however, that:

- both reactor types are fully viable, and that
- European industry quickly showed its ability to build nuclear power plants of both types on terms that are economically and technically acceptable to the electricity producers.

If in 1958 the Euratom Commission had elected to take the other course, this would at the same time have led to the adoption of a protectionist policy in respect of nuclear energy in order to safeguard a European nuclear industry which would then have put all its eggs in one basket. As it was, however, Euratom was able in that same year to enter into an extensive programme of cooperation with the United States and thus to broaden the basis for nuclear industry in Europe. In 1959, there followed an agreement for cooperation with Britain. Moreover, Euratom's own research programme was, and still is, directed towards the development of both reactor types. The reproach sometimes heard that Euratom is in this way prejudicing "European" technology to the benefit of "American" is not really tenable. For also in the design, construction and operation of enriched-uranium reactors - thanks not least of all to the Euratom programme but also, of course, to its own efforts - the European nuclear industry has acquired ideas, experience and know-how which will enable it to steer a more independent and original course of action and development in the future.

The second point I made concerned the existence of a reactor type which, so to speak, comes mid-way between the proven-type reactor and the breeder. I shall call these reactors "intermediate" or "advanced" reactors. If these did not exist, we should merely need

to store up the plutonium obtained and wait until the breeder reactor has attained technical maturity, so that we could then use the plutonium to produce nuclear energy in a manner which is also the most efficient from the basic-materials point of view.

But our studies have shown that this is not the best way. In order to ascertain what is the best way, we drew up four theoretical models in which the use of advanced reactors was taken into account in some cases and left out in others. Of these four, we chose the model that offers the most attractive prospects from the economic and basic-materials standpoint. It was this model which served as a basis for the target programme that the Euratom Commission proposes to publish shortly.

This optimum line of development can be summarized as follows:

From about 1980 onwards, breeder reactors will be taken into industrial use. The exact date cannot, of course, be given at this stage; it will depend on the demands made during the next few years by the technical development of the breeder reactor.

When the time comes for putting breeders into service, however, the Community must not only possess proven-type reactors; it will also need to have reactors of a more advanced type in operation so as to contribute to a speedy lowering of the cost of electricity generation and at the same time to make possible the rapid production of plutonium which is essential for the start-up of the breeders. As regards these two points, the advanced reactors are, all in all, highly promising. They provide cheap energy and they produce more plutonium than the present type. In 1980, when the breeder becomes operational, advanced reactors will make up some 20% of the nuclear generating capacity. Around 1990, this share will have risen to about one-third. By then the present-day proven-type reactors will no longer account for more than half the installed nuclear capacity. At about that time, all further capacity expansions in the form of proven-type reactors

will cease. In the year 2000 or thereabouts, when fast breeders will have increased their share of the total nuclear generating capacity to one-half, approximately 30% of that capacity will consist of advanced reactors and only 20% will be accounted for by proven-type reactors.

From the foregoing it can be concluded that the pattern of evolution still leaves room for the further development of advanced reactors. Incidentally, this philosophy is again amply illustrated in practice by the decision of Britain's Central Electricity Generating Board to build an advanced gas-cooled reactor, to be known as Dungeness B, which will produce electricity for the national grid at a cost 10% lower than would be possible with a comparable conventional power station.

There is an obvious connection between Euratom's present research programmes and this model. However, that was not the criterion for the choice. The four models were compared, and it emerged from the comparison that the one eventually chosen offered the lowest production costs and the most favourable uranium consumption pattern.

Naturally, there are still a number of uncertainties; for instance, the possibility cannot be ruled out a priori that the development of fast reactors will meet with unexpected delays, which might mean limiting the programme for a considerable time to proven-type and advanced reactors. But this risk is not a very serious one and it can be further reduced by intensification and co-ordination of the activities involved in research on and development and improvement of fast-reactor technology.

The model chosen is furthermore particularly flexible and can be readily adapted to the circumstances, since it embodies a fairly elastic intermediate stage; this will be even more the case if during that stage there is a partial switch-over to high-temperature reactors which could subsequently serve as thermal breeders - a welcome alternative in the event of delay in the

development of fast reactors. This flexibility is an important additional advantage of the forecast.

I previously mentioned that this model is closely linked to the Community's research programme. For example, Euratom is vigorously engaged on the development of a certain intermediate reactor type known as ORGEL, a name compounded from elements of the French words "organique" and "eau lourde". This type of reactor uses natural uranium as fuel; as moderator - that is to say, the medium in which the neutrons are slowed down to the speed required for this type of reactor - heavy water is employed, while the heat-transfer is provided by an organic liquid.

This controversial ORGEL project has shown the truth of the old Dutch proverb that it is not the worst fruit that attracts the wasps.

At the last International Conference on the Peaceful Uses of Atomic Energy, held at Geneva in 1964, the American representatives expressed a keen interest in the development of ORGEL. Since then, the United States has put forward proposals for collaboration with Euratom, which has a certain lead in this field. The Commission noted these proposals with satisfaction, has already established the necessary preliminary contacts and is energetically investigating ways and means of co-operating with the Americans on ORGEL development. For over five years now, this same field has been the subject of extremely close, fruitful and cordial co-operation with Canada, where excellent work is being done on heavy-water reactors.

But Euratom is also following another line of research in the field of "intermediate" reactors (so called because they lie half-way between the present proven types and the breeders), namely the reactor type I mentioned a moment ago, in which a fairly high yield is achieved as a result of the extremely high temperatures employed. Euratom is doing so, on the one hand, through participation in the Dragon Project in England, a joint venture with the United Kingdom, the Scandinavian countries, Switzerland and Austria, which is being carried out within the

framework of the OECD and in which Euratom is taking part on an equal footing with the UK; and, on the other hand, through an association with a leading German combine who have designed a highly original variant of this reactor type.

The Community's research and development activity extends also to breeder reactors, which, as I previously remarked, constitute the third phase of the target programme. However, the research programme that Euratom is carrying out in this connection in association with national institutes in practically all the Member States, and which will necessitate an expenditure of over 200 million dollars for the current five-year programme alone, is not being conducted solely on a European basis. It has already led to a twofold agreement for cooperation with the United States.

This cooperation with America relates on the one hand to the pooling of information and on the other hand to the guaranteed supply of the necessary special fissile materials in the substantial quantities and in the very special grades required for this extensive long-term programme.

Let me now return to the nuclear industry. The European firms are faced with a number of difficulties. The enterprise engaged in one way or another on the development of nuclear energy are legion, but the future of this industry will be jeopardized unless the appropriate conclusions are drawn from the fact that it is still insufficiently adapted to the structure and size of the European Community. In the United States, two concerns of world rank make up the core of the nuclear industry. In Britain, the industry was at first organized into five consortia and these were soon reduced to three by mergers. In the six countries of the Community, there are signs of a trend towards collaboration and amalgamation, but these attempts are still to all intents and purposes of an experimental nature.

It should not be thought that there is anything in the EEC Treaty which prohibits efforts to attain a scale of operation

which is commensurate both with the prospects offered by a nuclear common market of the Six and with the opportunities that exist for European industry outside that market. On the contrary, that treaty expressly permits the amalgamation of enterprises for the purpose of furthering technical or economic progress. Unlike the general common market, which is still in the process of formation and which since 1958 has been passing through a three-stage transitional period towards its eventual completion - at present it is half-way through the second stage - the nuclear common market has been a fully accomplished fact ever since 1 January 1959. From the industrial standpoint, the object of such a market is to provide a framework within which industry - in this case the nuclear industry - can specialize and combine in a manner and to a degree consistent with the dimensions of the Community, that is to say, with its size and with the prospects it offers in the field of nuclear energy. If that process is duly carried though, the European nuclear industry will be in a far better position to compete on the world market than it is today. Euratom's aim, therefore, is by no means to eliminate internal or to protect the Community from external competition, but to make its nuclear industry competitive with a view to stimulating technical and economic progress.

When I speak of an industrial policy as an extension of the target programme as contemplated by Article 40 of the Euratom Treaty, there is a great deal more involved than the mere promotion of an adequate economy of scale for the nuclear industry in Europe. The phasing-in of the various reactor strings, as provided for in the target programme, will not take place automatically. Consequently, the programme is pointless unless, by means of a coordinated industrial policy, the conditions are created for the realization, or at least the furthering, of the optimum line of development.

Now that nuclear energy has definitely emerged as an economically acceptable alternative to conventional methods of energy production, the Commission intends to formulate such an

industrial policy and to submit concrete proposals to the Council of Ministers on the subject. You will appreciate that I cannot anticipate the tenor of these proposals. However, I can try to give you an idea of the problems that will have to be solved within the framework of such an industrial policy.

These problems are of two kinds. In the first place, it is of economic importance that in practice the development process should coincide with the target programme as closely as possible. If there are obstacles which can be surmounted through the intervention of a national government or of the European Community, then it behoves the Commission to study the possibilities with the utmost care. These obstacles may be of a financial or legal nature. The Commission can make proposals or recommendations for overcoming them by measures taken at Community or national level.

The second group of problems concerns the construction of prototypes in preparation for the industrial phase of nuclear power plants. This is, of course, necessary in order to test the type of reactor in question, but from a commercial point of view it is not as attractive.

I will now say something more specific about these two sets of problems, though here again there is a limit to what I may tell you.

First of all, there is the problem of standards and specifications. Even after a common market has finally been established there is still a danger that, despite the withdrawal of the former customary protection, the industry of a particular country will continue to be shielded in some other way. When certain components and materials are ordered for the construction of an industrial plant, they have to comply with certain spepifications. You are no doubt aware that these specifications are not drawn up in the form of a summary of the various requirements which the particular component or material must satisfy. In the case of many

requirements, it is sufficient merely to refer to an existing standard. In international practice, this system is found to entail difficulties. Notwithstanding the international consultation that has been going on for years on this subject, it makes a definite difference whether a firm works to German or to French standards. This means that, in order to avoid trouble with certain standardization regulations, there is no choice but to order the parts from a firm which has attuned its production to these norms. Thus, for instance, a Dutch firm supplying a component for a French atomic power station could scarcely obtain certain materials from any country other than France, even though cheaper or better-quality materials might be available elsewhere. In this way, it is possible for, say, the French steel market to enjoy de facto protection. Conversely, a French company could hardly supply components for a nuclear power plant of German design. We have found in practice that this state of affairs makes it extremely difficult for the constructor of a nuclear power plant to obtain his equipment and materials on the economically most attractive terms from whichever Community country he chooses or, if he desires, from countries outside the Community. The Euratom Commission is of the opinion that, within the framework of an industrial policy - at least as far as nuclear energy is concerned - it must work for the introduction of uniform standards and specifications, in close collaboration, of course, with the existing national and international organizations in this field.

Another point is industrial property. Here too the Commission has various problems to contend with. When Euratom first started its activities, we were of the opinion that the dissemination of information in the interests of European industry could best be effected by granting non-exclusive licenses in respect of patents owned by the Commission, as is also the practice of the United States Atomic Energy Commission. Frequently, however, a firm's position in a particular market stands or falls by the exclusivity of a licence. It is therefore wholly legitimate to

ask whether it would not be desirable to formulate a more circumspect policy than the system of non-exclusivity, which at first sight appears so objective.

In this same sector, a further difficulty is encountered. In the larger countries outside continental Europe, such as the United States and Britain, the nuclear industry possesses a nuclear know-how which for the present is in advance of the knowledge and experience of the European Community. Consequently, there is a certain tendency on the part of European manufacturers to take the path of least resistance and to produce components for nuclear power plants under, say, American licences. In the initial stages, there can be no serious objection to this practice, since manufacture under licence provides an opportunity of "learning the trade". All the same, we must be fully alive to the necessity of gradually building up a know-how of our own in order little by little to reduce our dependence on other countries. An industrial policy ought to take account of this necessity. In particular, care must be taken that the conditions for the granting and acquisition of licences do not stand in the way of independent development.

As I said before, the second group of problems concerns the actual building of prototypes. When a specific reactor technique has reached the stage at which an industrial-scale prototype can be built, it is seldom that an electricity undertaking can be persuaded to take such a pilot plant into use unless compensation is offered for the extra costs involved. Economically speaking, these extra costs are well worth while in the long run because the experience gained with the prototype will make it possible to go ahead with the designing of profitable nuclear generating stations. The savings thereby obtained will eventually be many times the amoung spent in building the prototype. The Commission considers that it has a duty to consult with the power-plant constructors on the one hand and with the

electricity producers on the other in order to arrive at a policy that encourages the building and testing of prototypes. This also implies that ways must be found of providing at least partial compensation for the additional costs involved in operating the prototypes. This is another subject on which the Commission intends to draw up proposals.

Among other things, such a policy is of importance for the application of the ORGEL reactor of which I have just spoken. When this reactor has reached the stage of technical development at which it becomes possible to build a full-scale power plant, that will not mean that such a prototype is also economically attractive to operate. We thus find oursleves in a dilemma: on the one hand, the pattern of evolution outlined in the target programme requires that the ORGEL power plant be industrially proved, while on the other hand, in the absence of special provisions, it is not a worth-while proposition from an industrial standpoint for an electricity producer to take into service a first reactor of the ORGEL type. Technically and economically, there is every justification for taking steps at government level to create the conditions necessary for removing this barrier. Such a step would be entirely in keeping with Article 1 of the Euratom Treaty, to which I have already referred.

Another important point concerns the answer to the question: how many and what kind of prototypes should be developed, and what should be the Community's role in this activity ?

I previously mentioned two intermediate or advanced reactor types, namely :

- ORGEL, one of the heavy-water reactors, and
- DRAGON, one of the high-temperature reactors.

It is already plain that a number of variants are possible within each type or cateogry. Even in a Community like ours, however, it is inconceivable that each of these variants should be developed to the prototype stage. Just as every policy means taking decisions, so a policy for nuclear industry will involve the necessity of choosing one specific reactor type from the heavy-water category, e.g. ORGEL, and one from the high-temperature reactor string.

This is all the more cogent since, once such a choice has been made, it will in all probability be necessary to have more than one prototype of a given kind. In this connection, cooperation with Canada and the USA in the field of heavy-water reactors and with Britain and other European countries in that of high-temperature reactors can benefit the Community if the parties concerned are willing and able to make such a choice.

Here again the Commission's task is not invariably an easy one, for choosing is not always a simple matter.

There are also other reasons why, in my view, such choices are difficult to avoid. Quite apart from the construction of atomic power plants and their use for the generation of electricity, there are other activities upon which attention must be focussed with a view to the speedy establishment and growth of nuclear industries, namely the production of fuel elements and heavy water, uranium enrichment, the reprocessing of irradiated fuel elements and the treatment and safe disposal of radioactive waste.

In one or more of these sectors, it is feasible, not to say desirable or advisable, to set up in the Community, and on a Community basis, certain fundamental installations, possibly with Joint-Enterprise status. In order to arrive at a rational and profitable set-up for such installations, it is likewise obviously necessary that there should not be too great a diversity of types, so that here again a choice will have to be made.

In this talk, I have merely acquainted you with a few points of industrial policy as visualized by the Euratom Commission, and you will have noticed that comparatively little was said about Euratom's development programme. This was not an oversight on my part; on the contrary, it was my deliberate intention on this occasion to deal primarily with the industrial aspects of Euratom's work in the context of the development of and prospects for nuclear energy in Europe.