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Report on:

"CURRENT AND FUTURE ENERGY PROBLEMS"

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Gentlemen,

In addition to thanking the organizers of this Symposium for giving me the opportunity of serving as chairman of this meeting, I wish to express special appreciation for the initiative being taken here which shows itself to be as valid as ever. Furthermore the subject chosen allows us a further occasion for reflection upon the importance at both the national and international levels, of discussing energy problems which are becoming more and more widespread and deserving of our most concerted interest.

I propose to introduce the subject: "CURRENT AND FUTURE ENERGY PROBLEMS" mentioning principally:

1) External factors which condition problems of energy economics;

to be followed by an examination of:

2) Quantitative problems of the sector with analyses of:

a) Past evolution and trends of the energy market;

b) Worldwide energy requirements to 1985;

c) Italian energy requirements to 1985;

d) Prospects of supply from the principal energy sources;

e) Problems of a financial nature

and in conclusion, I will give considerations to:

3) Problems of the environment with some of its reflections on:

4) Energy policy.

1) EXTERNAL FACTORS WHICH CONDITION PROBLEMS OF ENERGY ECONOMICS

It is not by chance that energy problems - as I mentioned previously - seem to take priority among government preoccupations and are arousing in public opinion a current of interest never before registered. The explanation for this may be brought back to two principal kinds of reasons. On one hand energy, while having always been an indispensible factor in economic, social and cultural growth, is becoming ever greater the more society is industrialized or tends toward a post-industrial type structure. On the other hand production, transport and distribution of energy have implications only now fully recognized by the collectivity. I refer in particular to the repercussions of these processes on the environment.

It is then to be noted that a profound evolution is taking place in the energy world, modifying the nature of problems and the way of facing them and eventually solving them. And not only in the energy world, for that matter, are transformations, even radical, going on.

During the last two or three years and even in recent months the rapid succession of important and special occurrences of a political, social and economic nature makes one ask oneself if the international

community is at a crucial turning-point in its development. One has the distinct sensation that the political and economic equilibrium under which the world came out of the second world war is being profoundly transformed and that today's events are a prelude to a new order, in which the usual fundamental problems could have a different content. Therefore, to meet and resolve these problems calls for a new approach with respect to the past.

It is not surprising that, in treating the subject relative to current and future energy problems, themes are also brought up which apparently could not have direct reference to the former. These are, for example, the subjects of general economic policy; ordering of territory; protecting the environment; or those of political relations with countries holding the main primary energy reserves. It is important not to forget - in this regard - how the energy factor has pervaded to such a point all our society's ways of life; that energy problems and consequently all the ways and instruments for resolving them are necessarily conditioned by and in their turn condition external factors in the energy context itself.

History teaches us that often, in the past, the vital need for energy and other raw material sources has represented one of the important criteria upon which the foreign policy of individual countries

has been formulated. In the same way today the requirement - felt in a great part of the major industrialized countries - of being provided with an energy policy may be understood as a manifestation of the country's will to include energy problems in a coherent manner in the vaster sphere of economic problems and to avoid creation of conflicts between the objectives of energy policy and the general objectives of national policy.

It is obvious that problems exist which pertain strictly to the energy economy, such as the evolution of demand; the availability of energy in general and, in particular, the economic and political conditions under which to make use of individual sources of the energy required; the availability of financial resources adequate to necessities of the sector; the possibility of making the technological progress necessary to utilize potentially abundant sources. Analysis of the problems pertaining to the energy problem cannot, nevertheless, be separated from analysis of the influences which external factors may exert upon them. From this arises the utility of amplifying the analysis from an economic standpoint and referring it to the most general possible framework within which to place the energy phenomenon, to better define its nature.

For the analysis which follows I believed it opportune to group the principal problems interesting the energy world into three categories, which only for clarity are formally distinguished, but which in reality pertain substantially to eachother, wherein the quantitative problem is more strictly relative to the supply and demand of energy and to environmental and political phenomena.

2) THE PROBLEMATIC OF QUANTITY.

a) Past evolution and trends of the energy market

Observation of the principal phenomena occurring in the last few years brings us to observe that the world energy market is going through a time of profound transformation.

During the period from the beginning of the 1950s to the end of the 1960s, the world energy market has been characterized by an abundant supply and - in regard to the petroleum sector - by substantially decreasing prices. On the energy market, in addition, situations of real scarcity were never existent - except for moments of tension provoked by circumstantial factors or political occurrences as in the case of nationalization of the Iranian petroleum industry in 1951; of closure of the Suez Canal in 1956 and 1967; the petroleum agreements in the 1970-71 period - and the major industrialized countries

had been able to supply themselves with energy under favorable enough conditions and within a sufficiently safe economic-political context.

This does not mean that there was a total absence of problems. The petroleum industry, for example, contained contradictions which had already been felt, but they regarded the political-economic structure of the sector and did not reflect upon its capacity to satisfy demand. There was also the situation of the coal industry whose decline posed problems of a social character relative to the necessity for reconverting and transferring labor from it to other sectors. All this however had never reflected on the balance of supply and demand as a whole.

Aside from such problems, therefore, the energy industry was pervaded by a fundamental optimism and the previsions then elaborated agreed upon a greater growth in consumption, upon a relative facility of finding sufficient new primary energy sources and, in regard to prices, upon a substantial stability.

Suddenly today one speaks of an "energy crisis". A "scarcity of reserves". The possibility of finding adequate new reserves begins to be doubted. To these doubts are added the economic doubtfulness of making available adequate financial resources for finding new reserves

and finally, for supplying energy which is "clean" both in the act of producing it and in that of consuming it.

How has this sudden inversion of foresight occurred? How have these perplexities originated regarding the possibility of keeping up with growth of demand and the greater qualitative requirement? These questions have been raised mainly under the stimulus of three factors: on one hand the oil industry is undergoing profound change; on the other hand there will be need for greater quantities of energy to keep up with the increasing demand due to increasing population and the necessity for sustaining further economic and social betterment; finally, the collectivity expects service from the energy industry which is qualitatively different from that required in the past.

From the point of view of time, the problem of "scarsity of reserves" of energy may be divided into two different periods. Regarding the nearest period (that is the next 15 to 20 years) which is expected to be a critical period for energy supply, we shall dwell deeply further on in this report. For the period following 1990 the problem of covering energy needs should present itself perhaps in a more simple manner, thanks to the availability of new energy sources which will be available to mankind. It is obvious that this availability

is not to be taken for granted, in the sense that it will not come about automatically without the expenditure of enormous scientific, technological and financial effort.

I wish to briefly call your attention to these latter aspects.

Technological innovation is capable of positively modifying the conditions of energy supply. New energy sources or new reserves or new utilizations of already known sources could substantially modify the physiognomy of the energy balance in the distant future.

Think, for example, of "controlled fusion" which — once achieved for industrial purposes — would make it superfluous to worry about a large part of the energy supply since it could use the hydrogen which is abundantly present in nature as a primary source.

The same hydrogen — obtainable from water via electrolysis by using low-cost electrical energy (that eventually produced by fast breeder reactors) — could advantageously integrate, as has been suggested, present liquid and gaseous fuels.

But other reports will deal more deeply with these aspects.

What I wish to emphasize here is that it seems reasonable to assume that, towards the end of the century, humanity may count to a considerable degree on new energy sources, possibly making non-existent

problems of physical availability.

But to achieve this situation of hoped-for energy abundance requires that from now on the problem of how to attain it is diligently confronted. The energy industry, in fact, needs to plan its future activity over a long period of time and the world community, too, must from now on plan development of all resources necessary to its economic, social and cultural progress, whether if it tends to reduce the system's rate of growth, as suggested by some, or whether, with greater reason, it intends to continue with high rates of economic development. In both cases, however, the energy industry will have to make a huge scientific, technological, financial, operative effort to make enormous quantities of energy available, the level of which, however, will not be modest even under the supposition of a reduced rate of economic development. If the availability of energy in abundant quantities is, in fact, indispensible for maintaining high economic growth, the same holds true for improving the quality of living standards.

Preoccupations for the distant future must not, however, distract us from more pressing problems which refer to a period closer at hand. The next fifteen to twenty years, in fact, are foreseen as a critical period for energy supply since obstructions and tensions

could occur on the international market of energy sources.

The point of departure for a concrete analysis of the medium-term evolution of the energy market is the observation that, beginning in 1970, a process of modification of its structure has begun, under the influence of many factors.

The economic-political conditions governing supply of the principal primary energy source, that is petroleum, are changed with respect to the past. The prospects of world demand indicate that among the large petroleum buyers on the international market will be added a new and very important one, the United States, which will compete with Western European countries and Japan for acquisition of oil produced in the Middle East, in Africa and also for any new sources which may be found elsewhere. In regard to oil producing countries, it is to be noted that they have acquired a complete awareness of the strong position they are in due to the gradual transformation of the oil market, from a buyer's market to a seller's market. In fact, they have succeeded recently in obtaining, through higher taxes and an increase in profit sharing from oil production such as to cause repercussions on the market prices of oil. They now seek to acquire direct control of the management of petroleum resources, through nationaliza-

tion provisions as well as the system of participation and, finally, through non-renewal of the old concessions when these expire.

All this indicates, therefore, that the energy market conditions of the 1960s, favorable to the consumer, will not continue in the future, thus causing situations and problems much different from those of the past. These problems may be better appreciated by making a comparison between world energy needs, on one hand, and the supply prospects of the principal primary sources, on the other.

b) Worldwide energy requirements to 1985

Although the prospects for evolution of energy needs are conditioned by the degree and type of development of each country or economic area, it may be believed that in the future worldwide energy demand will continue to increase at sustained rates.

This prevision is directly correlated to continuation of the economic development process, based on industrialization. Only in this way will it be possible to meet the growing need for goods and services required both by the foreseen world population increase in the next decade, and by the necessity of bringing the greater part of the world population to higher per capita income levels.

In this aspect the increase in energy demand will interest both industrialized countries which have not yet exhausted their growth

potential specially in innovative and technologically advanced sectors, and developing countries which cannot renounce the need to raise current productive plans in favor of more articulate and diversified systems requiring a larger amount of economic benefit from their energy resources.

In more detail with regard to countries having an industrialized market economy, the energy demand up to 1985 may reach an amount between 6 and 7.5 billion tons of equivalent oil, that is approximately double current consumption.

The majority of these countries will have to resort to imports to cover a large share of their energy requirements and will of course turn to the international market, specially in regard to crude oil supply.

The share of energy needs covered by oil, within industrialized countries, will undergo a differentiated evolutive process. In fact, while in the United States the weight of this factor seems destined to become reduced, even limitedly (with respect to the current two fifths), in favor of nuclear energy which will have a predominant role in electrical power production, in Western Europe and specially in Japan the share of petroleum should be further increased until it covers, respectively, 3/5 and 3/4 of total energy needs in 1985.

"Planned economy" countries shall probably consume, in 1985, about three times the quantities of energy now used and the energy balance structure will very probably undergo profound modifications. In fact, while currently about 3/5 of the energy needs of said countries are covered by solid fuels, compared to about 2/5 reserved to hydrocarbons, in 1985 oil and natural gas shall have assumed a greater importance than solid fuels, increasing their share to more than 50% while that relative to solid fuels should diminish to about 2/5.

In developing countries, too, the energy demand should increase at steady rates in the next 15-20 years, tripling itself in the period 1970-1985. In absolute terms nevertheless the energy demand of these countries will always represent a modest share of world needs running from the current 11% to 16% in 1985.

This dynamic condition, however, is completely insufficient for reducing the economic separation existing between industrialized and emerging countries, even in the energy field. Its motivation is not only the demographic growth of these countries but is also caused by a more rapid process of industrialization with an improvement in the standards of living.

In spite of the forecast of strong growth of total energy

consumption in Western Europe and the "planned economy" countries, the per capita energy consumption in these areas shall only in 1985 reach 70-80% of the current per capita consumption of the United States.

The per capita consumption of developing countries shall remain instead much below the current values of Western Europe and the "planned economy" countries.

In conclusion the world energy demand should continue to grow, in the 1970-1985 period, at average annual rates similar to those registered between 1955 and 1970, which were equal to about 5%.

This dynamic is explained by the fact that, among the most developed countries, only the United States is beginning to be transformed into a post-industrial society with energy consumption growth rates becoming less accentuated than in countries typically in the industrial phase of growth.

In countries of Western Europe and Japan, as in communist countries, ample margins still exist for further development of industrial activity and therefore for further expansion of energy consumption.

In developing countries the increase in energy demand at rates even more accentuated than in the past is justified by both the current low levels of per capita consumption and by the necessity of

adequately exploiting (also with greater availability of energy) the productive potential of these countries.

The growth of energy consumption on the worldwide level, motivated by the need for not arresting the process of economic expansion, must not cause overlooking the problem of a limitation of current energy sources nor the necessity for respecting the environment.

In other words, among the main subjects which the energy industry will have to confront in years to come (in addition to that of controlling wasteful consumption) there will be the necessity of rationalizing the use of known sources, preparing new technologies for energy production both of conventional sources and those yet to be developed, as well as utilization of sources, conventional and novel, so as not to jeopardize the environment.

c) Italian energy requirements to 1985

After the view on possible developments in worldwide energy demand, let us pause for a moment and give our attention to the prospects in Italy.

In the period subsequent to reconstruction, the Italian economy was characterized — in relation to broad modifications made in the country's productive and social structure — by a steady growth

both in the national income and, above all, in energy consumption.

In the 1955-70 period, to an increase in national income at an average annual rate of 5.6% there was a corresponding expansion in energy demand at an average annual rate of over 8%.

On one hand the strong growth in industrial activity, specially of those which are heavy energy consumers, and on the other the acquisition of new and abundant sources for consumption such as automobiles and household appliances, explain the divergence between rates of income growth and energy consumption.

Is it possible to forecast the future trend on basis of the past? The answer is not easy. However a forecast must take into account the fact that further expansion seems necessary of the country's industrial base, specially in southern Italy (Mezzogiorno), and that it is desirable to improve the standard of living of the population which still has an insufficient per capita income. All this requires continuation of the process of growth which in its turn will involve a steady increase in energy consumption.

Not to be overlooked is the possibility — in formulating hypotheses on future energy needs — that the type of growth that will characterize our country in future years may be different from that of the past. It will probably influence a gradual evolution towards pro-

ductive structures in which basic industries (that is, those characterized by particularly high energy consumption) will have decreasing importance in favor of other basic product manufacturing and transforming activities with productive processes requiring a relatively minor use of energy.

The preceding considerations and others omitted here for the sake of brevity make it reasonable to predict a growth of energy consumption in Italy in the 1970-85 period of between 6.5 and 7% a year.

An estimated slight decrease in energy demand expansion rate over the past must not deceive us about the quantity of the energy required in an absolute sense. Compared to the current 130 million tons of oil equivalent, energy consumption should be on the order of 300-340 million tons in 1985. In cumulative terms the Italian energy demand from now to 1985 should therefore be between 2,800 and 3,100 million tons, always in terms of oil equivalent. To give an idea of this amount it may be observed that it is almost equal to the currently known oil reserves in Libya.

The size of these needs places, also for our country, serious questions on the possibility of covering them and on conditions of economy and respect for the environment which characterize the manner

of satisfying the estimated demand in the future.

These questions begin with the not difficult forecast that the current prevalency of oil in the Italian energy balance structure (and not only the Italian for that matter) is destined to remain so for many years, even though the foreseeable impetus which nuclear energy will have should, starting in the 1980s, gradually lighten the burden. The accentuated dependency of the Italian energy balance on only one source (that is, oil) could also be partially modified by orienting the demand in a different way and favoring the process of substitution among sources in the uses where this is technically possible. But it is obvious that attainment of this objective, even though it is certainly not to be excluded, is faced with many limiting conditions, above all of an economic nature. It may be believed certain enough that in the next fifteen years an important process of substitution will take place of current fuels, which we call "traditional", with nuclear fuel in steam power uses, while the process will also be accentuated by the substitution of petroleum products with electrical energy in industrial heating and domestic uses. However the fact remains that the predominant share of the added energy demand shall be or shall have to be satisfied by resorting to oil, which (with reference to 1985) it is expected will supply about three-fourths of the energy by that time.

This situation will continue to expose our country, even in greater measure than others, to the vicissitudes of the international market since all the necessary oil will have to be imported. Added to this is the scarse existing possibility of finding considerable quantities of hydrocarbons and other primary energy sources in our national territory.

The inadequacy of domestic resources, even greater if compared to the growth of needs, is not only an Italian problem. All the economic areas which are currently heavy energy consumers and importers will continue to depend (and perhaps to an increasing degree) on resources located in other economic areas. This will go on until the problems of world energy supply become intensified, or almost (as it will be for the next fifteen years and probably even longer) with the problems relative to the availability of hydrocarbons.

It is on these problems and, more in general, on the problems of future availability of main primary energy sources that I wish to dwell, also to give better understanding of the problems of a financial, environmental and political order which I will mention at the conclusion of the present report.

d) Supply prospects of the main sources of energy

The problem of outlining the long term supply prospects of

the principal sources of energy is without a doubt more arduous than that relative to individualizing the trends of demand. Factors influencing supply, in fact, may be of a technical or economic nature but may also be political situations whose developments are difficult to predict.

In regard to the prospects of oil supply, the discussion has lately been based upon the adequacy of existing reserves for satisfying the foreseeable growth in consumption.

It is necessary to state in this regard that this is a complex subject not easy to judge. This is due to the fact that many important elements of a quantitative nature which would be necessary for precision are lacking. Also not to be overlooked is that the discussion of the so-called "energy crisis" originated in the United States, partly generated by preoccupations intrinsic to the American situation.

It is well-known that American oil and natural gas reserves are sufficient to cover expected production for a limited number of years, much below that worldwide situation. This situation was also the consequence of the policy pursued by the American authorities who, it must be recognized, found themselves facing a dilemma not easy to solve.

A country endowed with enormous reserves of energy in general

including also oil and gas, the United States, always sensitive to the problem of security of energy supply, also saw this as a problem of political-military security. At the end of the 1950s the authorities found the U.S. needing to protect domestic oil production from oil coming from other areas at lower prices. Considering the alternative of choosing between greater importation with the result of causing a stoppage of new exploration and production activities in many areas and increasing dependence on foreign countries, and greater security resulting from domestic production at higher costs and prices than the international average, it is certain the United States will favor the latter solution. In this way it has rapidly accelerated the rhythm of exploiting domestic resources which exploration activity, although intense, in traditional areas and new areas (like Alaska for example) has not been able to restore to an adequate level.

In the natural gas sector the fact that in the United States insufficient reserves exist for covering foreseen consumption for an adequate number of years has been determined both by a rapid rhythm of exploitation of reserves and by a price policy which has not encouraged exploration for new reserves.

This briefly summarizes the situation in which the United States finds itself. It is to be observed that the discussions on

the "energy crisis" may have also been stimulated by motivations of an instrumental character, tending, that is, to create the premises for further interventions in favor of the energy industry by providing facilitations and incentives, even more consistent than those already practiced, to stimulate intensification of domestic petroleum exploration.

On the general level the United States does not appear to be in a situation where an "energy crisis" of vast dimensions is to be feared. After all, official reports and studies prepared by various companies and bodies, advise us that considerable quantities of hydrocarbons exist in its territory in both schists and bituminous sands from which one day it should be possible to obtain oil, and large deposits of coal from which to obtain synthetic natural gas. For this reason (while short and middle-term tensions are not to be excluded) it seems realistic to believe that, in the long-term, with a suitable energy policy, this situation of feared scarsity of reserves may be overcome.

Naturally the possibility of making available oil obtained from schists and bituminous sands and synthetic natural gas from coal presupposes a financial and technological commitment of considerable dimensions at high cost with consequent higher prices for the products.

The problem of economic conditions and that is of the cost at which oil will be available in the future has, therefore, a relevancy equal to if not greater than the problem relative to adequacy of reserves in relation to future needs. In the world important oil reserves exist the level of which is believed by many sufficient to satisfy needs up to the time when nuclear energy will begin to be substituted in an incisive measure for other energy sources. Furthermore it is necessary not to underestimate the possibility of finding new reserves, thanks to a growing commitment in oil exploration and to the utilization of improved equipment which, both onshore and on the continental shelf, should allow extension of exploration beyond current limits. A further possibility of increasing oil availabilities may derive from development of techniques for the so-called secondary recovery, which would permit raising the current low level (25-30%) of recoverable reserves in respect to the total of reserves in place.

Therefore if it is reasonable to suppose that the oil industry is in a position to find further reserves, the question of cost remains as the central problem of oil supply for the next fifteen years.

The oil agreements which go back to the end of 1970 relative to Libyan crude and some crudes from the Persian Gulf; the well-known February-March 1971 agreements of Teheran and Tripoli; that of Geneva in

January 1972 and that recent but not yet accepted by all the producer countries relative to "participation", have started a new phase in the oil industry. A phase in which the trend of the preceding twenty-year-period of substantially decreasing prices, is now clearly reversed. The minimum increase relative to the period up to 1975 may yet be determined on basis of the agreements just mentioned.

In regard to the years beyond 1975 the uncertainties are numerous for making a prevision on the entity of future increases. However it appears reasonable to believe that further development of the current situation is leading to a consolidation of tendencies toward increased oil prices and, more in general, in energy prices.

The cause of this, first of all, is due to the policy of producer countries which, after having for a certain time aimed at increasing income by increasing quantities sold, are now orienting themselves towards an increase in unitary profits. There is no doubt, that having passed from a buyer's market — which was that which characterized the oil industry from after the war to all the 1960s — to a seller's market, the oil producer-exporter countries very probably will intend to profit in full from the control acquired over an energy resource of such huge economic and strategic value as oil, not replaceable with others, at least in short and medium terms.

Furthermore, there will be an ever more consistent supply of oil coming from areas in which the cost of exploration and production is higher than in traditional areas, where production costs are technically very low; and this cannot but have effects on the average level of international crude prices.

It is finally reasonable to assume that future prices will be influenced by all those factors of tension present in the already mentioned "energy crisis", and, that is, the steady increase in energy demand at the worldwide level which must be affronted with an enormous effort for exploration and utization not only of oil resources but also of other energy sources.

It is evident that if the international oil industry — both in its present structure and in a structure in which there were greater direct intervention of producer countries — should not succeed in maintaining a high investment capacity, the level of supply would suffer, provoking an inevitable increase in prices.

In regard to the prospects of natural gas supply it may be said that important resources exist in different world areas among which in particular those of Africa and above all the Middle East, where the growth of domestic demand will only limitedly influence the availabilities destined for the international market.

Other reserves of considerable entity are located in North America (Canada for example), in the Soviet Union and also in Western Europe, particularly in Holland and the North Sea. In these areas, however, domestic consumption is already high and no doubt will develop further in future, so that quantities destined for the general international market will represent only a more or less marginal part of production. Therefore increasing recourse will have to be made — as is the case of the United States for example — to the international market to integrate a domestic production now insufficient to satisfy increasing requirements. The United States today already imports important quantities of natural gas from Canada and Mexico through natural gas pipelines; it has already stipulated contracts for importation of liquefied natural gas transported by ships from Algeria; in the immediate future it could turn to other production areas such as western Africa and the Soviet Union.

In large energy consumer areas, or countries, the use of natural gas reaches different shares of coverage of total energy demand. At present for example the natural gas share of total consumption is one third in the United States, slightly less than one fifth in the Soviet Union, but scarcely 1.8% in Western Europe and only 1% in Japan.

Among the major natural gas purchasers on the international market will be Western Europe whose domestic production is clearly insufficient to satisfy both present and potential consumption and Japan which is completely without natural gas. Flanking them will be the United States.

The growing demand for energy sources, the particular characteristics of natural gas and the ever more stringent regulations in the matter of pollution of industrialized countries, shall therefore determine a very considerable increase in the worldwide natural gas consumption, also favored by the remarkable progress which is being made on the economic-technical level in long distance transport of natural gas itself.

Considered a dirty, cumbersome and difficult fuel to transport, coal has lost ground in comparison with oil and natural gas since the 1950s. This does not mean however that coal consumption in absolute terms has diminished everywhere. Among the large consumer areas, in fact, only in Western Europe has it registered a net decrease, while in the United States, in planned-economy countries and also in Japan its consumption has increased at a more or less high rate. In the future coal consumption in absolute terms will continue to increase particularly in the United States and in planned-economy countries even though

the incidence of coal sources on overall energy balances will not be likely to increase.

Thanks to important coal reserves existing in their territory, countries which are heavy consumers of this energy source will not have problems relative to supply. On the contrary a high enough margin remains for export to those countries of Western Europe and Japan which — though also having reserves of a certain importance — have higher production costs or show a deficit in particular types of coal.

The prospects of increasing tensions in the energy market and the necessity of using domestic energy resources, seem to orient the United States and Western European countries, having coal resources, towards reconsideration of past policy in regard to this fuel.

Greater recourse to coal — also through introduction of in-place regasification processes — is today considered as a possible solution to the problem of integration of the energy balance, specially in the United States where resources of solid fuels are huge in respect to the present volume of production.

Although only in outline, we have seen the prospects relative to supply of principal energy sources which we define as "conventional" today. To complete the analysis, I will mention some considerations on

the nuclear source of a very general nature, inasmuch as the subject will certainly be brought up more fully by other reporters.

The conditions of energy supply may improve both economically and from the viewpoint of security, if ample recourse may be made to nuclear fuel.

From the economic view it is important to observe that use of nuclear fuel in place of conventional fuels will permit a tangible decrease of the incidence of fuel cost on the cost of electric power and this will bring, among other things, positive effects to the commercial balance, specially for a country like Italy which — it is seen — depends almost completely on imported energy.

From the viewpoint of security of supply, it is to be observed that recourse to uranium, present in many politically stable countries different from those which hold major hydrocarbon reserves, allows for importantly diversifying the source of the imported energy raw material.

It is also to be underscored — with particular reference to energy supply security — that there is also a problem of having available an adequate uranium enrichment capacity for giving this source the isotopic composition required for its use.

Prospects in this regard, at least for the short and medium period, are not without problems for countries which, like Italy, lacking

their own uranium enrichment capacity, are forced to turn to those countries where this capacity exists. And the conditions under which the countries having such capacity are disposed to supply the enrichment service seem to become progressively more costly. Therefore it appears desirable to arrive as rapidly as possible at creation of Europe's own uranium enrichment capacity, in a position to improve for this area (and therefore also for our country) the security of supply conditions of this "strategic" source for development of the nuclear sector, of which enrichment is an indispensible factor.

This initiative, to which our country will be able to give a considerable contribution, entails a heavy commitment both from the technological and financial viewpoints; a commitment which, moreover, is required also by the exploration and production of uranium minerals and by the necessity of building up in Italy a nuclear fuel production capacity adequate to the foreseen needs.

If the financial commitment is considerable for the nuclear industry it is equally so for other sectors of the energy industry.

And it is on this aspect that I wish to dwell as I begin proceeding towards the conclusion of my report.

e) Problems of a financial nature

From the preceding it emerges that the future shall be

characterized by further growth in demand which the energy industry will be able to meet even though in a changed general context and under different economic conditions from the past.

From the considerations made it also emerges, however, and evidently enough, that the energy problem is to be placed in a wider context since today it can no longer be analyzed only in its industrial aspect but must take into account all the conditions which may arise, even caused by external factors.

In particular, the possibility of developing new energy sources, of finding additional reserves of traditional sources, of finding new ways of utilizing already known sources, just as the possibility of transferring on the market the quantities of energy necessary to satisfy requirements, could be conditioned by obstructions of a financial nature.

In order for the energy industry to accomplish its tasks it is necessary, first of all, that it have available adequate financial resources. This problem does not arise, obviously, only for oil for which the investment requirement is particularly high due to the importance of this source, but also for the other energy sectors.

To have, for example, an idea of the entity of the financial commitment which the oil industry would have to bear to make available

the amounts of oil necessary for satisfying demand in the 1970-1985 period, and to find new reserves in an amount adequate to guarantee coverage of future needs for a certain number of years, some data may be cited from the Chase Manhattan Bank report, which follows the oil industry's financial problems with particular attention.

According to studies made by the bank, to meet the growing demand for oil during the 1960s, the worldwide oil industry (excluding communist countries) invested 140 billion dollars in all phases of the industry. For the 1970-1985 period, investments foreseen for exploration activities and for installations and equipment in all the other phases could amount to 550-600 billion dollars.

In the past, the international oil industry has financed its own growing volume of investments, by resorting mainly to internally generated or self-financing. During the last few years, however, a certain reduction in the availability of self-financing to cover investment needs and the international oil companies have resorted in an increasing degree to the capital market.

The high profits of the mining stage which in the past have characterized the oil industry, and to which is to be attributed the high rate of self-financing of the industry itself, are now being taken over in ever increasing degree by the oil producing countries. They

now and still more in the future, will have enormous financial means available which however may not be reinvested in the oil industry, since there are various necessities of the producer countries for making huge investments in different economic sectors.

The considerable financial need foreseen for investments to be made in future years in the oil industry and the difficulties which could be met in the finding of such financial resources, have suggested therefore to some the opportunity for reinstating (through an action on prices) the high levels of self-financing which characterized the oil companies' growth in past decades.

It is politically doubtful if such action of raising prices would be a practical means for achieving this aim. It should be better to first of all try to prod the oil companies into seeking within their own organizations for existing cost reduction possibilities.

The oil industry finds itself in a situation in which the increase in some costs (for example crude reduction and fiscal costs) is difficult to hold down, while there exist other operating costs (those in the so-called "downstream" stages) which it should be possible to reduce through a serious effort toward rationalization. It is absolutely indispensible and urgent to make such rationalization effort.

When rationalization of "downstream" activities is spoken of

(and referring in particular to our country) the first thought is that of roadside fuel marketing. It is known that in this sector — for various motives it would take too long to examine here — there has been, in Italy as in other European countries, an abnormal development. In Italy, for example, there are 40,000 fuel sales outlets with an annual average sale of 250 tons of products, and therefore an extremely low productivity which is translated into high marketing costs.

Space for decisive rationalization exists also in the stage of crude transport from the terminals of arrival to refineries. This is a sector in which the process of rationalization could be carried out through creation of an organic and united system of oil pipelines.

In the refining sector, too, there is space for rationalization of the system both from the economic and the ecological-territorial viewpoints. Refining activity — which in Italy is carried on by an excessive number of plants, often badly located both from the ecological and product marketing viewpoints — must be concentrated in a more limited number of plants, well located both in regard to connections with crude unloading terminals and in regard to areas of consumption, as well as in regard to ecological problems.

Duplication of equipment and high costs exist also in transport of petroleum products from storage centers to final users, or to

roadside fuel sales outlets. A rationalization of this transport activity, which today is managed by each oil company independently, would lead to a considerable reduction in use of transport and to a tangible reduction of uselessly long travel requirements. Economy on this phase of costs is easily imagined.

This discourse refers in particular to the Italian situation but may be reasonably applied to the entire world oil industry.

The potential economies attainable thanks to a broad process of rationalization in various phases of the oil industry would of course be important, such as to partly compensate the increase in other costs. They could never be however sufficient to make up for the high margins of self-financing obtained in the past because — as already said — the situation of high profits in the production stage is rapidly being modified under the effects of actions of producer countries which, through higher taxes and other initiatives, tend to do away with that income which in the past the international oil companies could depend upon.

In this situation the problem of financing new investments (which are indispensible if it is wished to avoid the risk of the physical scarsity of energy) is seen in all its importance. If the oil companies, for the aforesaid motives, shall no longer be in a position

to internally generate the enormous financial resources for growth and if the oil producer countries will not reinvest in the sector a considerable part of their important financial availabilities, it becomes indispensible to make the necessary resources come from elsewhere — through capital markets or by public action.

3) PROBLEMS OF THE ENVIRONMENT

In a conference on energy problems which might have been held several years ago, considerations of an ecological-environmental nature would not likely have been brought up. Today on the contrary it would be surprising if such problems were not adequately emphasized. Is this a passing fashion or are the problems of environmental protection really important in the energy picture?

Over and above manifestations which are certainly those of exaggerated fear, although often inevitable, I believe that they who look at the energy industry as an industry — but not the only one — whose uncontrollable growth may have negative effects on the environment, are quite right.

The foreseen increase in energy consumption means growth in primary energy production, greater quantities of energy to be imported into countries which have none, new oil refining capacity, new steam

power and nuclear power centers, expansion of domestic transport systems; in a word, it means an enormous growth of a complex of installations and equipment whose effect on the environment cannot be overlooked.

To remain on the subject of the oil industry, I believe that its relationship with the environment may be considered from two points of view: a) on a par with every other industry insofar as the effects its processing system has on the environment; b) as an industry which produces particular goods which, in the process of utilization by other industries and final consumers, may damage both the environment and mankind.

From the first point of view the problems essentially regard location and structure of ports for crude oil reception; systems of transport of crude to refineries and products from refineries to storage farms and final consumers, and finally the location of refineries, tank farms and fuel marketing outlets.

We are dealing with installations and equipment which certainly affect considerably the environment with which they come in contact, effects which may be negative. The fact that such a possibility exists need not lead necessarily to the conclusion that these installations must be banished, since they are indispensible for supplying the

country with the energy it needs, that is for feeding its processes of economic and social growth. What must and may be done, on the contrary, is to prepare a sector-development plan in which due importance is given to considerations of an ecological-environmental character. I am convinced that the oil industry may continue to develop without the expansion process upsetting and destroying those values of an environmental nature which are the priceless heritage of our country and which oblige each one of us — industrial operators or not — to respect and protect.

I am convinced in fact that clean refineries may be built just as I am convinced that it is possible to avoid pollution of the sea with hydrocarbons. For this latter problem it would be sufficient to prohibit loading those ships which in coasting traffic arrive at loading terminals with empty tanks, a sign that during the trip from the unloading terminal to the loading terminal they had washed their tanks, discharging the oily wash water into the sea.

But in addition to not directly causing damage to the environment and to mankind, the oil industry — on a par with the other energy industries — has the obligation of preventing such damages from being caused by the consumers of its products. The industry may meet this obligation by supplying the market with non-polluting products.

One may mention, for example, low lead content gasolines or low sulfur content fuel oils.

In conclusion, the energy industry is often put on trial for real or presumed ecological misdeeds. The reply which may be given to accusers is that, if more energy is wanted, it is inevitably necessary to also accept new plants for its production, transformation and distribution. To this statement must be added immediately, however, that increasing such installations and equipment does not necessarily mean a progressive deterioration of the environment. The energy industry is in a position to be developed without causing damage to the environment: it is necessary that this objective possibility be made operative through issue of rigorous regulations which must be enforced with extreme severity.

4) ENERGY POLICY

From what has been previously described some summary considerations in form of a conclusion may be drawn and some starting points pointed out for a future energy policy for large-consumer industrialized countries.

The first consideration is that, even though on many sides the philosophy of economic development is being placed in doubt, it

appears certain — or at least very probable — that in the next 15-20 years (and probably even beyond) the world economy will continue to develop at steady rates. But in order that this may occur it will be necessary to make available to humanity ever increasing amounts of energy. The first objective of the energy industry is therefore that of supplying, in adequate quantitative and qualitative terms, the energy necessary to sustain a high rate of economic and social development. To achieve energy supplies on basis of the considerable needs forecast it will be necessary to further develop both traditional sources (in particular crude oil and natural gas) and new sources (in particular nuclear energy). All this requires enormous scientific, technological and financial effort.

The fact that the industry is potentially in a position to assure the physical availability of energy sources sufficient to meet demand does not necessarily mean that this situation of potential availability may always be turned into actual availability to the consumer, inasmuch as factors of a political character could render unavailable even an energy source which is potentially abundant in nature. This is particularly true for oil, whose reserves are concentrated for the most part in countries different from those in which oil is consumed. It is entirely possible that due to measures which might be

taken by producer countries, based upon strategies of a commercial or political nature, the potential availability of oil could as a matter of fact, become unavailable to consumers.

This is why to guarantee oil supplies, the indispensible technical and financial effort required for exploration production of oil fields must be accompanied by establishment of an appropriate policy with regard to oil producing countries.

It is proper in this regard, to ask oneself who has the responsibility for formulating and actuating such policy and what should be its principal content.

In regard to the first question it is by now evident that the definition and also the actuation of oil policy may no longer be left — as in the past — only to the operators in the sector. And this not so much for lack of confidence in the industry as for the conviction — which finds confirmation in recent events which have taken place in the sector — that the problem of oil supply today has implications such as to go well beyond the capacities of single operators to cope with, if for no other reason than their diminished negotiating power in confrontations with oil producer countries. An oil policy must, rather, directly involve the responsibility of consumer country governments, whose indubitably complex duty it is to insert

such policy in coherent frameworks of foreign and commercial policies. Now is the time for consciousness of the fact that for countries which are large oil consumers and importers, oil policy must be qualified as a component — and certainly not one of minor importance — of their foreign policy.

We have seen, however, that the entity of the energy and oil problem also requires coordination on the international level. At the least the situation requires that on the part of Europe — and also in a wider geographical context — there be a coordination of its own energy policy.

It is therefore desirable that the European Community in particular rapidly arrive at definition of a community energy policy which shall represent, among other things, a coherent framework of reference for the actions which each individual country will wish to make in the sector.

In regard to the contents of such policy it seems evident, from what has been described previously, that the fundamental objective shall be that of guaranteeing supplies to consumer countries.

To assure that this hoped-for situation of security finds concrete fulfilment, there is the particular necessity for closer collaboration with oil producer countries. This includes industrial,

commercial and technical assistance agreements, not limited exclusively to aspects of the petroleum industry.

The terms and formalities of such policy which — it is well to repeat — cannot be only a policy of companies but must be a policy of governments. Such terms and formalities are indubitably complex and to attempt further comment here would force me to abuse your patience, perhaps more than would be permissable.

I limit myself to repeating once more the conviction that action along these lines must take place without hesitation and delay.