

Study Week on:

# ENERGY FOR SURVIVAL AND DEVELOPMENT

organized by the  
Pontifical Academy of Sciences  
with the collaboration of ENEA

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## CONCLUSIONS



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## PRESENTATION

The problems of energy have already been the subject of one of our most successful meetings, the one held in November 1980, organized by our Academician André Blanc-Lapierre. The new Study Week was done with the collaboration of the ENEA and organized by Prof. Umberto Colombo, to whom I wish to express our deepest gratitude. The papers presented at the Study Week will be published in the near future in the Academy's collection *Scripta Varia*. In the present booklet its conclusions and recommendations are published.

The issues which were discussed during the Study Week are the most significant ones for development and for the establishment of the conditions of peace and progress, which will help the spiritual values to overcome the social crisis in which we live and thus insure the survival of humankind.

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## CONCLUSIONS AND RECOMMENDATIONS

### 1. INTRODUCTION

1.1 - The poverty in which over half of mankind lives and the persisting gap between the rich and the poor is not only a human tragedy, it is one of the greatest problems of our time. It is, in its daily manifestations, an economic problem, and in its essence, a moral problem relating to the right to human dignity on the part of the poor. We believe it puts in question the survival of the world, involving the inheritance to be passed on to future generations. A problem from which the rich countries cannot isolate themselves.

1.2 - Underdevelopment and the contrast between life styles of industrial and developing countries is a major underlying cause of economic, political and military tension and crisis. In such a climate it is easy to predict that difficulties and obstacles in the way of solving survival and development problems will flourish and further aggravate hostility rooted in other factors.

1.3 - Indeed this situation is perhaps most strikingly reflected in the vast amount of resources: financial, scientific, technological, industrial, now devoted to armaments. This drain has major implications. It critically reduces the flow of these resources, so essential to development; it impedes international cooperation and keeps it from growing into true partnership.

1.4 - The gap between rich and poor countries has its parallel within countries, especially within the poor ones where a strong middle class has not as yet developed and where small élites, with products and consumption typical of technologically advanced industrial societies live surrounded by a sea of poverty. Given the spread of information through television and

the other mass-media, the poor majority have daily before their eyes the living model of what is possible with development, yet which cannot for them be reached in practice. This compartmentalisation is unacceptable. It ignores the fundamental interdependence of rich and poor countries and rich and poor people. It can only lead to increasing discontent as well as inefficient use of effort and resources.

1.5 - Once we have understood the implications of the issues, it becomes obvious that any solution demands a long term approach involving a positive trade-off versus short-term and narrow minded interests. It also requires cooperation between the rich and the poor, increasing interaction between North and South, within the South itself and, most importantly, general recognition of the real significance of this crucial insight.

## 2. THE ROLE OF ENERGY

2.1 - In the condition of underdevelopment everything is scarce: food, shelter, clothing, medical services, education. So is energy, an indispensable and pervasive ingredient of almost all other essentials for living and a precondition for widening people's options — one way of describing progress. Because of its sudden, steep increase in price over the past decade, energy has justly attracted especial attention. Nonetheless, one must keep in mind that lack of energy is only one, albeit important, aspect of underdevelopment and poverty. It is a consequence — not a cause — of poverty, though its scarcity in turn contributes to difficulties and impedes development. Moreover, most developing countries are experiencing high population growth rates, a factor which adds to energy demand whilst keeping the per capita gap between rich and poor countries from narrowing.

2.2 - Energy problems are many-sided, involving scientific, technical, managerial, as well as political, economic, social, cultural and ethical factors. To look exclusively at the economic aspects, generally the most pressing, leads to a faulty perception of reality and in turn to mistaken policies.

2.3 - There is great diversity among developing countries, and among different income groups and different regions within each country. Generalisations have their usefulness as first approximations, but remedies

must be tailored to fit specifics. That is to say, there is no generally valid solution, or set of measures, in the energy field. Plans and projects can be successful only if they are addressed to the solution of specific problems.

2.4 - There is a widespread lack of solid, detailed, tested information on energy use, let alone needs, within developing countries. This is particularly true in relation to non-commercial fuels, such as the fuel-wood which is estimated to fill more than half the energy demand in many developing countries. Thus, one must regard with reservation any claims to precision put forward for comprehensive information, or all-embracing assertions made in the absence of reliable data.

2.5 - As a result of inadequate knowledge, it is difficult as a rule to assess energy needs for development, or to evaluate the most suitable forms in which energy may be supplied. Effective energy planning thus becomes a complex and difficult endeavour. This is not to say, however, that efforts aiming at the setting up of energy planning systems in developing countries should be neglected.

2.6 - In many developing countries, urbanisation is accelerating rapidly. This raises the demand for commercial fuels, many of which are usually imported. The cost of these imports, especially of oil, constitutes a serious economic burden to many developing countries. For the majority it slows economic growth, particularly when it is coupled with a debt service burden, that at the prevailing high interest rates requires continuing large foreign exchange outlays or, if obtainable, additional borrowing. The latter of course only tightens the vicious circle: higher debts — larger borrowings — slower or no growth.

2.7 - The urgency of short-term needs and problems (heavy debt burden; oil import costs; economic recession; unemployment, and others) cause long-term energy choices to be neglected. Prominent among these are prevention of deforestation; the search for alternatives to oil; the production and utilisation of natural gas; the use of renewable energy sources; the indigenous exploitation and/or conversion of coal; the modification of the country's transport system; a transition toward greater stress on energy-saving, etc.

2.8 - Energy is scarce in many developing countries. At the same



time, what there is is very often used inefficiently, largely because plant and equipment used are old, often poorly maintained, and not designed originally to be energy-conserving. Thus, the potential for energy conservation, that is to say greater efficiency, is very large, for both exhaustible and renewable energy sources. There is equally much room for a more efficient management of energy systems, all the way through from assessment of needs to putting into practice new initiatives.

2.9 - While the raising of consumer energy prices to the level of costs is a difficult matter for governments even in the industrial world it should be realised that it is many times more so in developing countries. Even though the merit of market pricing may be recognised, the economic and social impact on consumers must be taken into account in the formation of energy policy.

2.10 - Regional cooperation amongst developing countries, often referred to as "South-South" cooperation, can be highly effective not only for research and development, but for energy trade and the exploitation of energy sources, particularly in border regions (an example is hydro), or in instances in which one country's demand is too low efficiently to sustain a given energy facility.

2.11 - Development strategies often include plans for the establishment of energy-intensive industries, such as primary metals, chemicals, cement, either to substitute imports, or to exploit local natural resources for exports. The upheaval in energy costs has made it incumbent on developing countries to re-assess such plans so as to determine whether sufficient benefits can still be reaped.

2.12 - In many LDCs industries, transport and the more affluent segments of society dominate the demand for commercial fuels and electricity, and this leads to higher oil imports. The poorer strata still depend largely on non-commercial fuel, such as wood, dung, crop residues, etc., the dependence on which is creating increasing problems.

2.13 - Technical and managerial skills are inadequate and poorly distributed in most developing countries. This deficiency acts as a strong brake on energy planning and practices which could improve the utilization and management of energy.

### 3. SOURCES OF ENERGY

3.1 - Many developing countries have the geological potential for the eventual discovery of oil and/or natural gas resources. At the same time, however, investment to discover and exploit these occurrences is lagging. There is substantial controversy over the reasons for this situation, except that political conditions seem to have decreased in importance as an inhibiting factor. Few oil-importing developing countries have the capital to invest in exploration, and so reliance is placed on private, foreign risk capital and on international lending agencies, including the World Bank. International oil companies stress the importance of fulfilling on contracts once stipulated, and point out that tax régimes must be such as to make investment both attractive and safe. Developing countries expect, in their turn, to exact the highest return from potential investors for the exploitation of what they consider to be their national patrimony. Also, in view of the low odds on discovering really large fields, major oil companies are usually only mildly interested in exploration, while the host country looks at all future discoveries in terms of their relevance to its domestic needs.

3.2 - Sudden and violent changes in the price and availability of oil can have unsettling effects on both consumer and producer countries. While oil-importing developing countries are hit by rising costs which aggravate poverty and slow down development, oil-producing LDCs, as events in the recent past have demonstrated, can face social and political tension resulting from the sudden arrival of oil wealth, especially when such changes sharply accentuate an already unequal distribution of income. Conversely, major reductions in national income due to variations in price and/or export volume, create problems for the implementation of development plans. There is little doubt, however, that the local production of oil and gas is one key to development, and that careful planning can alleviate social problems.

3.3 - Natural gas, although it is a relatively recent energy source even in the industrial countries, can be regarded along with oil as a main source for development. Most developing countries at present lack the necessary infrastructure to transport, distribute and use natural gas. On the supply side, more stress has to be put on exploitation efforts, which have been focussed on oil as, in contrast to natural gas, oil is more readily exportable. Natural gas can replace oil in many uses and even small

fields can be significant in terms of local markets. There is no reason why exploration and development of gas fields in developing countries cannot be pursued with the same logic and determination applied for oil.

3.4 - Coal is one of the major sources likely to replace oil in many developing countries in the foreseeable future. It is not, as such, an alternative to oil in many sectors and uses, such as transport; however, it is an alternative in other sectors, such as process heat and electricity generation. Some developing countries have significant coal reserves, and certain of these could produce a high-quality coal, with low sulphur content, which would be easily saleable on the international coal market. But few of these coal reserves have been exploited to date. Nor could exploitation be expected to happen either rapidly or generally, as coal, whether imported or produced domestically, calls for a massive cooperative effort both nationally and internationally, between industrialised and developing countries. The urgency to undertake that effort is great.

3.5 - The greater diffusion of coal use requires substantial investment, in order to overcome technical and financial problems related to the lack of mining and transportation facilities, including railways, roads, and ports; the absence of conversion projects to switch to coal from oil the existing power plants and other oil burning facilities; the need to acquire the technical know-how to handle the disposal and/or the utilisation of coal ashes, and to select and operate whatever pollution abatement equipment is required.

3.6 - Electricity has long been regarded as the most attractive and "modern" of all energy sources, but its spread in developing countries is still inadequate. Obstacles to this are the high initial investment required; the need for transportation and distribution installations plus the consumer equipment to utilise electric power; and the need for a large and sufficiently concentrated network of users so as to contain unit costs. Electricity can be a catalyst for development, in the sense of permitting rapid increases in living standards — including education, health, safety — and in productivity in both agriculture and industry. Governments, therefore, have long assumed the considerable responsibility for electrification, and for the taking of electricity to rural areas where it would otherwise not arrive because of excessive costs.

3.7 - Rural electrification represents a major element in energy strategy by developing countries; but it is not a panacea. In fact, unless it forms part of an integrated approach toward rural development and goes hand in hand with the provision of a complex of other inputs for development, it is bound to disappoint both its advocates and its intended beneficiaries.

3.8 - There exists a widespread assumption that rural electrification will make country life sufficiently attractive to contain migration towards urban areas. This may well be true in the long term, but it can also be argued that the opposite can happen. That is, having experienced the advantages of an "electrified" life, the younger people especially may be motivated to look for more of the same in towns and cities. Although the latter preoccupation should not be a reason for slowing down the rural electrification process, its implications should be assessed in order to establish policies to deal with them.

3.9 - There are several primary sources for centralised systems of energy production, alternative to oil. Whenever possible, priority should be given to local resources such as hydro (both large and small units), coal, natural gas and geothermal. Nuclear energy too could prove an important medium- and long-term option.

3.10 - In the exploitation of hydro potential it is necessary to develop appropriate planning, to match the size of the installation and the demand for electricity. Very large installations require solid firm commitments by big customers before construction, lest they become financial loss for the country in which they are located. The utilisation of small hydroplants, on the other hand, offers to many countries interesting possibilities for development, especially for rural electrification schemes.

3.11 - The development of nuclear reactors smaller in size than those now being built for use in industrial countries is seen by some experts as a viable solution for developing countries. This is, however, a hotly debated issue, in view of the diseconomies of scaling-down our present large nuclear stations, and the lack of recent experience on the safety of reactors of this size.

3.12 - Disregarding the size issue, there are several problems that the proponents of nuclear energy for LDCs have to face. These are related not only to the huge investment required, with relatively long payback times and the consequent necessity to resort in most cases to foreign financing; even more important is the local availability of trained manpower, of efficient and well interlinked infrastructures (government, industry, safety and regulatory agencies) in order to cope with the organisational and management complexity of nuclear power. Furthermore, the signing of non-proliferation treaties by developing countries should be encouraged and the use of nuclear energy for peaceful purposes linked, as it should be whenever nuclear power is exploited, with the acceptance of IAEA safeguards on all nuclear installations.

3.13 - It is often said that roughly half the world's population derives its energy from biomass. Whether or not this is the best estimate matters less than the fact that enormous numbers of people largely in rural areas have in fact to rely for their energy needs on fuelwood, crop residues and dung, with dire consequences for the preservation of forests and for agricultural productivity. The situation is especially grave for fuelwood, which is getting increasingly scarce, so that it takes greater and greater efforts largely on the part of the women-folk to gather it. These are costs which do not appear in any statistical compilation, but which cannot but impede economic and social progress. The fuelwood problem is complex, affecting adversely the forest régime and those involved in collecting wood, and it is posing the problem of ever-increasing energy scarcity for rural consumers.

3.14 - Renewable energy sources besides fuelwood, — other biomass, wind, solar energy — seem to have limited possibilities of making a major contribution to the energy needs of LDCs over the immediate future. There are a number of reasons for this. Such sources require considerable individual initiative, on both the supply and demand side. Their technologies, even though simple, must be handled by their users, to make and to repair the plant. In some cases, these technologies are still in the development stage. Unit costs are usually higher than those of conventional sources. Nevertheless, the development of these energy sources via greater research and development efforts, publicisation, and demonstration must be pursued in both industrialised and developing countries given their vast long-term potential.

3.15 - The numerous draught animals in developing countries contribute significantly to the needs of agriculture and transportation, and constitute an asset to these countries. A drive to replace these animals with motor vehicles should be evaluated with extreme care: it would mean the elimination of a major source of energy, which is both reliable and simple, to which its users have long been accustomed. On a national scale such a drive would cause large financial strains both for capital investment and increased oil requirements.

#### 4. RECOMMENDATIONS

##### *General*

4.0 - The following recommendations have been drawn from above consideration: they are specifically addressed to the governments of developing countries, as well as to those of industrial nations; to international organisations; to energy companies; to centres of research and education, and to energy consumers. We have not come to the conclusion that there has been no progress. Indeed, there has been. Developing countries have increasingly realised that the energy problem needs to be taken seriously into account by governments. In some countries, subsidies have been increased, energy management programmes have been established, the acquisition of skills and knowledge from outside sources is under way, and in several countries there has been increased receptiveness to foreign investment for the development of domestic resources. In parallel, the industrialised countries have put in motion programmes to contain their own energy consumption. They have increasingly used multinational lending agencies to assist energy development and management in developing countries, even in oil and gas sectors where action had been quite limited in earlier years. The industrial world is paying increasing attention to the practical meaning of interdependence.

In extending these Recommendations, we kept in the forefront of our minds the great importance of agriculture to most developing countries. Agriculture, in fact, represents for many of them the main production system around which the life of the majority of people is organised. Greater development of agriculture is an imperative so as to reduce and then overcome malnutrition and starvation, which afflict too many people in the world. Industrial countries must do all they can to help LDCs build modern and efficient agricultural systems, as the basis for all further development.

Energy has an important part to play in foresting development, not only as such but also as a component in fertilizers and pesticides, for transportation and distribution, electricity supply. If the report emphasises the rural electrification issue, this is because the role of governments here is perhaps most obvious, and the chances of error greatest, but other facets of agriculture should not be ignored.

Two other problems besides energy should also constantly be kept present as they have a marked effect on development and cooperation between industrialised and developing countries. The first is the rapid pace of population growth, absorbing much of the benefits of higher investment, improved productivity and technology. The second is continued rearmament which, even if catastrophes can be avoided, drains the world, including the Third World, of scarce financial, scientific and managerial resources. Both these issues give an additional sense of urgency to the needs that we have addressed in the more limited area of energy for survival and development.

4.1 - Energy planning is important but is not a target in itself. It must be considered as a continuous activity, integrated with wider economic and social development plans.

4.2 - This activity must basically be the responsibility of nationals of the countries involved. Assistance from outside experts can be helpful, provided a country's specific situation — including its cultural and social characteristics — is taken into account.

4.3 - Building up energy self-sufficiency in developing countries is in most cases a long-term goal. It minimises import dependence and foreign exchange needs, strengthens supply security, provides employment opportunities, and favours the development of those energy sources most suited to local conditions, thus avoiding the imposition of ways of life alien to the country and its people. At the same time, care must be taken not to make self-sufficiency an overriding goal, regardless of cost. This could be a bad short-term bargain.

4.4 - The investment capable of ensuring an acceptable energy supply to the developing countries is so enormous a sum that the actual level of public and private concern dedicated to it is wholly inadequate. While the World Bank has aggressively moved into supplying both funds and

know-how for the development of the energy sector, it would be useful further to raise the level of financing, to set up a special section in the World Bank for energy activities, and also to mobilise additional aid from other multinational and national development agencies. Private investment in increasing national energy production needs to be greatly expanded, especially for oil, natural gas and coal. Special efforts need to be made by LDC governments to create a favourable cost-reward structure, including profit- and production-sharing, cost recovery, and investment incentives, especially concerning taxes. At the same time, foreign companies should attempt to adapt their policies and operations to the needs and special conditions of those developing countries which have not been significant producers in the past.

4.5 - Technology transfer, training and education aimed at the development of local manpower capabilities are of vital importance. It is necessary, however, to move away from the idea of "transfer" or "access", towards one of partnership. As a first step, joint project teams (including experts in technical, sociocultural, and economic problems from industrial and developing countries) should be formed to study this problem in specific instances. Joint pioneer projects, based on a real partnership between industrial countries and receptive, action-oriented local teams should also be launched, based whenever possible on the use of locally available resources and using equipment that can be maintained and possibly manufactured locally, equipment which is of a capital-intensity. Throughout the human element needs to be emphasised.

Technology transfer must be first of all a transfer of knowledge and skills if an efficient pool of leaders and operators is to be built up, and this goes for engineers, technicians, economists, managers, etc. Joint efforts by university and research organisations in both developing and developed countries should always be pursued in a spirit of active partnership. These include, but are not limited to, exchange programmes, hosting of trainees, and a more efficient flow of information.

4.6 - Conservation is typically a convenient and often quick way of coping with energy problems. Developing countries need to make conservation a top priority, while industrial countries must strive to share their own experience here with the developing countries. Technology has a major role in energy conservation. Therefore, greater efforts should be made to promote applied research activities in developing countries, so



that they may develop the specialised human resources they need, and be able to study — and solve — the particular problems they face.

4.7 - Partnership should not be limited to cooperation between industrial and developing countries. There is presented to us a great opportunity with "South-South" cooperation. This should be accentuated so as to diffuse knowledge and experience among countries having similar characteristics and problems. There are already a number of such initiatives in different parts of the world. Energy concerns should be made part of their agenda.

4.8 - Excessive differences in the distribution of wealth and energy use, both between rural and urban areas and within each of them, give rise to difficult economic, social and political issues. Different sectors of the population exert pressures on different forms of energy. Apart from generating more information here, policies must be developed which are addressed to this problem and which, in particular, are designed to assist those at the bottom end of the income range.

4.9 - Energy planning cannot go far without information and assessment of needs. This is a field in which international agencies can be, and actually have been, helpful. Increased emphasis should be placed on early completion of needs-assessment studies and analyses, as well as on continuous improvement of information especially with regard to non-commercial sources and uses of energy.

4.10 - Both demand and supply decisions are greatly influenced by prices. Artificially low energy prices will encourage consumption, discourage production, and distort the relative development of energy sources and technologies. While governments everywhere are tempted to keep prices below levels set by the market, this is especially true in developing countries faced with large numbers of very poor consumers. Nonetheless, governments must at all times try to allow prices to reflect actual or expected cost — to an extent compatible with the maintenance of social and political harmony.

4.11 - Migration represents a major problem in some developing countries. One form of migration is internal, from rural to urban areas; another is external, from one country to another. Migration embraces

mobility of people in search of employment, but may also be caused by attempts to escape from conflict and violence. The ensuing instability of population creates serious problems for energy planning. Policies designed to manage both types of migration in an effort to improve the labour distribution and the living conditions in developing countries may well in addition contribute to ease the energy problem. One should not overlook, however, that increased availability of energy in rural areas could reduce the need for migration.

### *Specific*

4.12 - Since oil and gas will remain important energy sources for many years to come, it is important to encourage exploration and development of hydrocarbons, especially in countries which now depend heavily on oil imports. A programme to identify the conditions which now hinder exploration is an urgent need, in order that remedial action may be taken. Many factors are involved. These include the governments of developing countries and the local enterprises they have set up; the governments of industrial countries, as well as groupings of such countries; the international oil companies, together with prospecting, engineering and other specialized firms. All parties must be encouraged to establish terms and conditions that will permit local production to expand. International lending and development agencies are urged to continue to widen their role as catalysts in this process.

4.13 - Coal exists in significant quantities in many developing countries. It does however require an elaborate infrastructure, which may take a long time to put into place. Developing countries are urged to give prompt and serious consideration to this matter. Given the substantial initial investment in production, transportation and use, both planning and financial assistance from abroad should be made available to overcome not so much the technological as the financial and institutional obstacles.

4.14 - Given the importance of electricity as a flexible high-quality energy vector, priority must be given to enhance electricity production in developing countries. Local resources, whenever available, should be considered first, in particular hydro. The size of electricity-generating plants should be planned so as to match the pattern of evolving regional demand.

4.15 - In countries lacking indigenous energy sources for electricity, the possibility of building nuclear power plants should be seriously considered, especially where it is possible to build up the requisite high technical, managerial, and organisational skills within industry, the utilities and the public administration. At the same time, adequate regulations and operating procedures must be adopted to guarantee that peaceful uses of nuclear power are pursued with respect for safety considerations and in the full respect of non-proliferation safeguards.

4.16 - Renewable energy sources, in particular firewood, are bound to continue to supply a large, if not the major, portion of energy demand in many of the less developed countries. In this context, forests must be protected to fulfil their many functions, of which provision of energy is only one. But time is not on our side in safeguarding the forests in those parts of the world where firewood demand is most insistent and uncontrolled. A multifaceted action programme is urgently needed, consisting of: a) the provision of alternative energy sources; b) schemes to ensure the use of firewood more efficiently; c) the search for ways to increase the supply of firewood through innovative schemes involving both new species of trees and new social and organisational arrangements, on the individual or community level.

4.17 - There is a great need to develop a realistic perspective for a more major role for solar energy to play in developing countries. Misallocation and excessive dispersion of scarce resources should be avoided. Developing countries should look for those special occasions in which new technological development in such areas as photovoltaics, biogas or wind can play a critical role in raising standards of living, particularly in rural areas. Some of these technologies can help provide the minimal quantities of electricity, instrumental in supporting in villages a television set to provide basic education, a refrigerator to cool vaccines or perishable drugs and so forth. Solar and wind energy can help to increase agriculture production by pumping and desalination of water, and drying and refrigeration of crops. Matching the characteristics of emerging technologies with specific applications is a high priority.

4.18 - The end of constant oil price increases from the beginning of the 1980's has led to the abandonment of much energy research and development. Research especially in renewable resources has slowed down in

several industrial countries. At the same time, very few of the developing countries have the financial and technological capacity for carrying on an adequate R&D programme. It is therefore of vital importance that the industrial countries continue their R&D without hesitation preferably in close partnership with developing countries. This long-term need must not be allowed to languish.

4.19 - In the important drive to exploit domestic energy resources, all feasible care must be taken to safeguard environmental values. This is of especial importance in the very fragile and often little-explored natural environment of the many developing countries. Experience in the industrialised countries has shown that the added costs are more than offset in the long run, as accumulation of pollution problems and the high cost of repairing the damage are avoided or minimised.

4.20 - Conscious of the theme of the Study Week, we cannot close the list of Recommendations without the most profoundly felt appeal to all countries to do everything in their power to ensure better life conditions to those most in need. While considerations of cost, technology and political feasibility are very important, even more important is the constant reminder that we are "our brothers' keepers" and that we can best unite mankind by persuading men to build together. Thus we urge all we are able to reach with this message to keep ever present the development of the less developed countries. Energy plays a primary role in this, and our work in this Study Week has shown it, also to be a problem with a major spiritual dimension.