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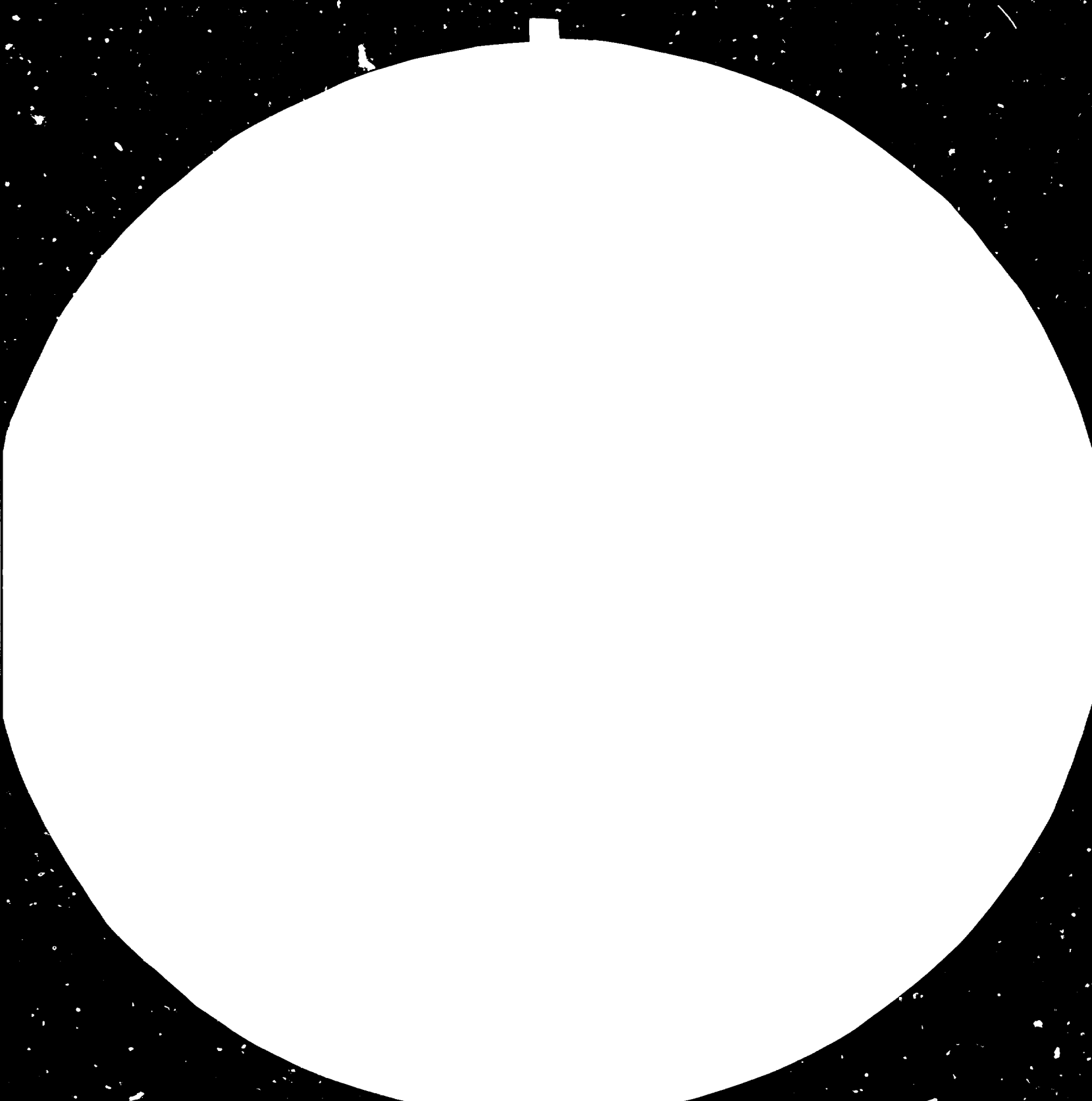
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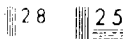
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**HIGH-LEVEL  
EXPERT GROUP MEETINGS  
PREPARATORY TO THE  
FOURTH  
GENERAL CONFERENCE  
OF UNIDO**

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**UNIDO'S ENERGY DEVELOPMENT  
AND INDUSTRIALIZATION PROGRAMME**

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1. Introduction

The major purpose of UNIDO is to accelerate the industrialization of the developing countries as a contribution to their social and economic well-being. In support of that role, UNIDO performs a spectrum of functions which include technical assistance, technology development and transfer, industrial sector studies, industrial studies at country, regional and global levels, investment promotion, a system of consultations, co-operative activities among developing countries, assistance to the least developed countries, co-ordination and liaison within the UN system, with governments, inter-governmental and non-government organizations and other institutions, and the dissemination of public information.

Since its inception in 1967, UNIDO has carried out energy-related activities, but the importance and urgency of such activities became particularly apparent after the "oil emergency" of 1973-74. Since then the energy dimension in UNIDO's activities has broadened and intensified rapidly. The reasons can be found when we examine the energy/industry interface and the energy implications of the Lima target. This is the target set at the Second UNIDO General Conference on Industrialization, held in Lima, Peru, in 1975, stating that by the year 2000 the developing countries should produce at least 25 per cent of the total world industrial output.

2. The interface between energy and industry

The energy/industry interface is a subject of special attention in UNIDO. Industry is both an important consumer of energy and a producer of items which require energy for their utilization. Industry also produces the necessary equipment for the production of energy, exhaustible or renewable, conventional or not. The energy demand for the operation of the industrial sector as such represents a sizeable share of the total energy demand, i.e., about 35%. However, the energy needed for use of the capital and consumer goods delivered by industry to other sectors of the economy amounts to another 50% of total energy consumption. In other words, industrial activity is directly or indirectly responsible for the use of some 85% of the total energy consumed in the world.

Energy consumption and the rational and efficient use of energy can therefore be seen as mainly governed by the creativity and productivity of the industrial sector through the continuous technological development of energy-efficient processes and products. Accordingly, the interface energy/industry must be at the centre of every discussion on energy problems.

3. Energy dimensions of the Lima target

Clearly, one essential prerequisite for achieving the Lima target would be the availability of energy. It has been estimated that achievement of the Lima target would require a three-fold increase in the energy consumption by the developing countries.

To indicate an idea of the progress towards the Lima objective, the developing countries' share of world industrial production in 1979 was around 10%. It is estimated that, if present trends in manufacturing production continue in both the developed and developing countries, the latter's share will reach only 14% by the year 2000.

Further, it has been recognized that the shares of developing countries are particularly low in energy-intensive sectors such as iron and steel and non-ferrous metals. Substantial increases of these shares will therefore have a considerable impact on the energy demand of the developing countries.

Another point of interest is that the share of developing countries in total world consumption of commercial energy is rather small (about 12% in 1980), but it grew relatively sharply between 1970 and 1980. In absolute terms their consumption of commercial energy nearly doubled in this period.

As is well known, the main problems for the developing countries are the heavy dependence on (imported) oil and the production of sufficient amounts of electricity for industrialization. The fact that most developing countries have to cover their oil consumption through imports causes heavy financing and balance of payments problems.

In the process of development and especially of industrialization, the input of electricity becomes increasingly important. It can therefore be expected that in the developing countries a growing share of primary energy will be used for the purpose of electricity production.

Industry in developing countries consumes, in general, approximately 50% of total energy, while 30% is used by the transport sector. Obviously, the share of manufacturing in energy consumption varies not only according to its relative size in the total economy, but also according to the structure of the manufacturing sector. Industrial branches, such as chemicals, iron and steel, non-ferrous metals and paper, consume relatively high amounts of energy per unit of value added. In the course of industrialization in developing countries the share of heavy industry tends to rise, which means that the manufacturing sectors as a whole become more energy-intensive. This shows that the aspect of energy intensity is of main importance in designing structural policies.

Even now, irrespective of the requirements of the Lima target, the cost of energy is a drain on the financial resources of the developing countries, where sixty per cent of the commercial energy used is imported, compared to thirty per cent in the industrialized countries. Thus, those countries which can least afford to pay for energy imports are spending



most. Those financial resources could be used for other purposes such as education, social welfare, health care, transportation systems and industrial development. Thus, there is a strong case for the developing countries to strive towards increased self-sufficiency with regard to energy. The need is therefore obvious for an aggressive energy development in the industrialization programme.

#### 4. UNIDO's conceptual approach

In its energy-related activities, UNIDO gives special consideration to three essential aspects of the energy/industry interaction, namely, "energy for industry", "industry for energy", and "industrial energy management".

##### 4.1. Energy for industry

"Energy for industry" has to do with the development of industrialization patterns appropriate to and consistent with the local patterns of energy availability; it includes development or adaptation of energy-efficient and/or energy-appropriate processes and products; it will necessarily include non-conventional processes and products and it also comprises full use of comparative advantages, such as the use of abundant and cheap hydropower for production of aluminium.

There is a strong correlation between the pattern of energy availability including the type, quality, location, cost, etc., and the corresponding industrial pattern that can be established such as the sector, size, location, export potential, processes, etc. Among the options available to the developing countries are, of course, the exploration and development of indigenous fossil fuels such as oil, gas and coal. UNIDO's role in such instances is on the industrial aspect but not the exploration of the resources themselves.

In addition, increased attention is being focused on new and renewable sources of energy. These include, of course, wind, solar

energy and geothermal. If a country is fortunate enough to be endowed with these, these energy sources should be developed, but in our view, they are location-specific and purpose-specific and therefore cannot have a pervasive impact among the developing countries.

In this regard, we see two major opportunities among the developing countries for new and renewable sources of energy. Hydropower is, we believe, a primary option. The technology is well-established. There are no pollution problems associated with this energy mode. Electrical energy is ideal for industrial and social purposes and among the developing countries only 9% of the hydro-electric power potential has been developed. For comparison, the industrialized nations have developed approximately 80% of their hydro-electric potential. There are, of course, potential adverse consequences associated with each energy mode and in the case of hydro-power, this includes questions of land use, the possibility of displacing families from their homes, problems associated with the location of dams for hydro-power. Another disadvantage of hydro-power is the high initial capital cost. Here, the effect can be moderated by an increased participation within the country itself in the construction and manufacture of the facility.

The second primary option for developing energy for industry is biomass. Biomass really is a generic subject since it includes a broad array of processes. The raw materials include agricultural, forestry, and municipal wastes and aquatic biomass, and the products include a spectrum of solid, liquid and gaseous fuels such as charcoal, alcohol, methane and producer gas. Here too, we have a mix of established technologies such as making alcohol from sugar cane and new technologies including the applications of genetic engineering. Since so many developing countries lie in the green belt, this option represents another major opportunity.

It is an interesting feature of both hydro-power and biomass that they are suitable for both centralized large-scale facilities and decentralized types of operations and both types of development can and should be encouraged.

#### 4.2. Industry for energy

"Industry for energy" is concerned with industry as a supplier of inputs and services to the energy sector. It has to do with the development of the capital goods industry and of the industrial engineering services required for the development of energy sources in general and of new and renewable sources of energy, in particular. The activities include production of equipment and special materials for projects in the energy sector such as petroleum exploitation, coal mining, hydro-power stations, transmission lines, etc.

Another critical contribution of industry to energy development is in the area of processing of primary fuels or special raw materials for production of secondary or special fuels such as petroleum derivatives, petrochemicals, coal, charcoal and so on.

All these activities imply the development of a full scientific, technological and industrial capacity in the developing countries to handle research, design and engineering in order to develop or to service the large spectrum of capital goods needed by the energy sector.

In the two primary energy options mentioned above, an opportunity for developing countries is to develop the equipment and machinery for hydro-electric power production rather than merely import that equipment from the industrialized world. Further, in the case of biomass, there is an opportunity for developing countries to manufacture the many simple, small-scale equipment items related to biogas production and biomass conversion.

#### 4.3. Industrial energy management

"Industrial energy management" is concerned with the creation of the capability to plan effectively energy production and use, from national level to plant level, in order to ensure maximum self-reliance and efficiency of the local industry in so far as the energy input is concerned.

This third segment of UNIDO's programme consists, in turn, of three key aspects.

First, there is the need to integrate national energy planning with national industrial planning. Energy is a means and not an end and thus new energy generating installations must be related to industrial and other uses. Energy planning must be seen as an integral part of the national industrial plan and not an isolated function.

Secondly, there is energy planning at the plant level, including considerations of energy conservation and substitution, energy-efficient processes and equipment optimization and operating schedules and similar activities. Here, there is an opportunity to make an impact on energy consumption in the near term. Whereas, most of the UNIDO's programme on energy development and industrialization is geared to the long-range problems, the use of energy at the plant level and considerations of energy conservation and energy substitution offer a short-term relief to the problems of the developing countries with regard to energy. Usually, it is possible to accomplish 20% savings on energy consumed in industry. The first 10% is usually achieved by simple changes which do not require a capital investment or any large expenditures. The next 10% requires some investment through changes in processes and equipment which will affect savings of a continuing nature. Still more savings can be achieved but with major investments through drastic changes in plant and equipment with large capital investments associated with such revision.

Thirdly, there are the supporting functions for energy management including scientific and technological development, training and education, adequate financial support to promote and sustain the energy industry development and the legislative, fiscal and promotional framework to provide incentives and mechanisms for expansion and improvement of energy production and consumption.

5. Scope of UNIDO's energy-related activities

UNIDO provides technical assistance in the following areas:

(a) Enhancement of the planning capabilities of developing countries, with identification of energy strategies appropriate to their industrial sectors;

(b) Promotion of research into energy-related industrial technologies to stimulate the development of novel processes and products best suited to the requirements and resources of developing countries;

(c) Establishment or expansion of local capabilities to produce the capital goods needed for the energy sector;

(d) Efficient utilization of energy in industry encompassing effective energy management at the national, sectoral and plant levels;

(e) Expansion or establishment of technological institutions and related training schemes in order to develop the technical and managerial capabilities essential to the optimum utilization of energy in industry and to the production of related equipment;

(f) Industrial production of fuels and feed-stocks derived from biomass and hitherto unutilized raw materials such as shale and tar sands.

These technical assistance activities are complemented by the conduct of studies on specific aspects of the energy/industry relationship. Particular attention is devoted to the analysis of newly emerging patterns of industrial energy supply and to the projection of industrial demand for energy, in terms of types and quantities, so that the developing countries may have at their disposal the information they need to adapt to far-reaching changes in the pattern and pace of energy availability. These also serve as a basis for the developing countries to seize the opportunity to establish or expand their industrial capacities with use of their great potential in new and/or renewable sources of energy.

The organization has published a number of guides to information sources, reports on industrial technology for various energy sources and has prepared a manual for mini-hydropower engineering. It has also organized technical consultations among developing countries on large-scale biogas technology and study tours in the field of operation, manufacture and maintenance of medium- and small-scale power plants. A number of technical assistance projects in the field of new and renewable sources of energy have been implemented by UNIDO. Technical consultation and study tours are being organized at the interregional level.

As for pipeline activities, UNIDO is considering implementation of a series of projects dealing with production of specialized equipment for and with the promotion of utilization of new and renewable sources of energy.

In accordance with the UNIDO terms of reference, the organization has intensified its co-operation with United Nations agencies and national and international organizations in energy-related industrial problems and opportunities, especially in the areas of biomass, hydropower and other sources of new and renewable energy.

Within the scope of this paper, it is not possible to discuss the numerous projects being supported by UNIDO in the field of energy, but suffice it to say that the technical assistance programme covers all of the geographic areas with priority to the developing countries of Africa and to the Least Developed Countries.

## 6. Conclusion

In conclusion, we believe that the physical resources exist to solve the problem of energy for the developing countries. The degree to which we solve this problem is dependent upon our will to do so and our skill in mobilizing our human and financial resources. We further believe that it is essential for each country to devolve its own industrial and energy strategy based on its natural resources and capacities coupled with other developing countries and with the industrialized world. Increased self-sufficiency of the developing countries will reduce the pressure of demand on the world supply of energy which will be beneficial to all consumers and hence, the UNIDO programme is not only of interest to the developing countries but also serves the interests of the industrialized world. Further, internal political stability as well as international peace can be significantly influenced by energy considerations such that the industrialized nations and the developing countries have a common interest in energy development and economic growth.

