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SUMMARY OF THE NATIONAL REPORT SUBMITTED BY ROMANIA\*

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## NEW AND RENEWABLE SOURCES OF ENERGY IN ROMANIA

Romania's National Paper  
for

The United Nations Conference on New and Renewable Sources of Energy  
Nairobi, Kenya, August 1981

- Summary -

**Abstract:** The paper reflects the concept of and state of the art in the current Programme of Research, Development, Demonstration and Utilization of the New and Renewable Sources of Energy, initiated in 1972 at the request of the President of Romania, Nicolae Ceauşescu, along with the prospects of the new energies in the country's energy economy, indicated by the "Energy Research and Development Master-Programme for 1981-1990 and the Guidelines until the Year 2000", adopted in 1979. Several technologies in commercial use, in development or under study within a series of operative projects co-ordinated by the National Council for Science and Technology are presented and some of the factors influencing the process of implementation of alternative energy technologies in the established energy system of the country are reviewed. One attempts to substantiate the conviction that the new and renewable sources of energy make up a complementary, though necessary and important component of the national, regional and world efforts of adjusting in a balanced and effective way the energy economies to meeting better basic needs, improving life quality and environment, and that such a development can be achieved by merging countries' endogenous efforts into a wide and equitable international co-operation, which can and must stand for a sound model of co-operation in all other fields among all nations. Several suggestions are made to this effect.

Since three decades, Romania attaches a particular importance to elaborating, adjusting and applying a coherent national energy policy, basically featured by the following complementary trends :

(i) Growth of energy production, to support the overall economic growth :

	Year				
	1950	1960	1970	1977	1979
Overall output of					
- electric and thermal energy	1	4.3	23.0	42.0	46.0
- fuel	1	2.7	5.3	7.7	8.1

(ii) Efforts to keep control over and moderate this growth as against the growth of the national income, via enhancing the economic efficiency of the energy use :

	Annual average growth rates		Annual growth index				
	1961-1970	1971-1973	1974 vs. 1973	1975 vs. 1974	1976 vs. 1975	1977 vs. 1976	1978 vs. 1977
	1. Elasticity of overall energy consumption as against the national income	1.13	0.56	0,03	0,83	0,67	0.26
2. Elasticity of electric energy consumption as against the national income	1.93	0.89	0.69	1.10	1.06	0.62	0.73

Although during the last 15 years major concerns have been directed towards energy conservation, the growth of energy demand appearing from the rapid development of the basic

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industries and transports, advancements in agriculture, deployment of services and higher living standards, have resulted in a relatively high energy consumption reaching more than 4,100 kg e. c. and 2,900 kWh per inhabitant. Owing to the relative readiness of the domestic resources of hydrocarbons, the primary energy balance of the country has been gradually forced into a critical dependence upon these particular sources - as far as almost 40 %. Another striking feature regards the industry's clear predominance in the national energy consumption (more than 56 %), due to the fact that, in establishing its industrial infrastructure during the last 30 years starting from scratches, the economy had inevitably to develop primarily its basic, high energy - consuming sectors. At last, one has to notice the existence of a national electric power grid widely deployed, centrally dispatched and interconnected with the neighbouring countries' systems whose unceasing supply with primary resources and ever safer operation is of essence for Romania's economy and social life. These circumstances call for recognizing that Romania will further appeal to conventional primary resources such as coal, hydropower, oil and natural gas - to sustain and develop its established economy, industry and energy system. On the other hand, by interpreting the same premises in the overall context of the nation's development strategy one can consistently derive the necessity to undertake particular efforts to widen the ranks of energy raw materials, to diversify the energy sources.

Romania's lasting reputation of an oil producer and exporter is fading away since the country became to import substantial amounts of crude (half of the demand), which sharpened the concern to value better this raw material. The efforts of turning to account any available resource, from low-grade lignites up to natural gas and oil, together with the strive to save high quality resources proved, however, so far insufficient to hinder the negative effects of the energy crisis, at present Romania being given a full-size experience of the impediments resulting from the present energy constraints.

The next five years (1981-1985) open up a new stage in Romania's development concept: the nation has decided for a strategy of consolidating the economy, based upon the necessity of a substantial increase of the economic efficiency of production. Accordingly, while keeping up a pace of economic growth as high as around 6.3% in terms of social product, most investments are re-directed from expansion primarily to technology substitutions aiming in the long run at changes in the production pattern in favour of high-value products requiring minimal material and energy costs.

Giving expression to Romania's energy policy in the next two decades, an "Energy Research and Development Master-Programme for 1981-1990 and Guidelines until the year 2000" has been adopted in 1979, assigning the basic tasks towards increasing the national energy potential, developing the energy production - including the utilization of the new and renewable sources of energy - improving the electric energy system management and operation, cut-back on energy consumption and utilization of energy at a higher economic efficiency. The Programme also settles the role and responsibilities of the governmental bodies and economic-social units in the development and appropriate husbandry of the energy flow and outlines Romania's principles of action in the international co-operation in the field of energy.

According to the Programme, in view of diversifying the energy supply, the mix of Romania's primary energy resources is likely to undergo, in the medium and long-term, significant shifts to more substantial reserves, but, in general, more expensive and not free of problems. Leading challengers will be coal and bituminous shales, whose share in the electric energy output will have to increase from 40 per cent in 1980 to more than 55 per cent in 1985. Hydropower - a renewable source of energy of a traditional status in Romania, will be intensively developed in the next twenty years, such that, by the year 2000 the entire economic hydro-power potential of the country be exploited. Romania is also committed to a programme of erecting a number of nuclear power plants, sized according to its effective needs and possibilities. A particular stress is laid upon an ever larger utilization of the new sources of energy.

According to the meaning adopted in Romania "new" or "non-conventional" energies are those: (i) renewable through natural mechanisms : geothermal ; direct solar ; wind and

waves ; biomass ; (ii) renewable through economic and social mechanisms : industrial waste heat, refuses from farming, animal husbandry, food industry, communities (biogas and incineration), oil residues ; (iii) ignored so far owing to technical and economic reasons: coal deposits off the balance sheet, loaded in areas of rough hydro-geological conditions ; bituminous sands and shales ; natural reserves of lean mixtures of methane in carbon dioxide etc. The status of "new" energy technologies is assigned to the techniques associated to the exploitation of the above-mentioned reserves as well as to a number of other high-efficiency technologies, already demonstrated - such as fluidized-bed combustion, in process of demonstration - such as coal gasification and liquefaction, advanced electrochemical storage methods, or in prospect - such as MHD , cryogenic generation, storage and transportation of electric energy a. s. o. In Romania hydroelectric power is considered "conventional" in general. Admittedly the mini-hydropower is a "new" technology, strongly encouraged at present. All the while, the raw and auxiliary material policy tends to exclude the wood from energy utilizations, intending almost any sort of wood or wood scraps to processing into valuable products.

Expressing, at present, the Romanian option for a wide energy pluralism, the new and renewable sources of energy will probably be near expectations towards the end of the century:

	1970	1975	1980	1985	1990
Energy output, of which (in percent):	100,0	100,0	100,0	100,0	100,0
- hydro-electric	8,0	16,2	17,6	20,0	24,0
- nuclear-electric	-	-	-	-	17-18
- on coal and fuel shales	27,7	27,8	40,0	55,0	44,0
- on hydrocarbons	61,6	27,8	39,7	20,0	5-4
- on recovered energy resources, solar and other new sources of energy	2,7	2,7	2,8	5,0	10,0

Meanwhile, by 1985...1990 the new sources of energy are expected to contribute their share especially in the low temperature heat consumption (below 200°C) which will keep up the level of 23-25% per cent of the total primary energy consumption of the country. In time, research and development are expected to develop the technical and economic solutions required to approach higher temperature and power applications, particularly by recycling large amounts of waste heat resulting from the high energy-consuming industries, by producing synthetic fuels and, possibly, by some top solar technologies.

The diversification of primary resources introduces to the consumers low-grade, low-energy density and high-cost energy resources and technologies, which call for new practices of energy conservation. This, in turn, requires, iter alia, a rigorous reappraisal of the nature of demand and allocation of energy in the strictly necessary amount, form and quality. This operation, where technology substitution, investments and the authority of norms and rules are closely co-operating and which results both in clear cut-back on energy consumption and in substitution of higher quality, depletable resources for other low-grade ones, is one of the main connections through which the new and renewable sources of energy are involved in the Romanian energy conservation policy.

One can conclude that the Romanian concept on the research, development and implementation of the new and renewable sources of energy should be understood as part of the efforts to diversify primary energy resources, to utilize better and conserve energy and fuel, thus releasing the hydrocarbons from the energy uses, aiming at providing in the shortest possible time an energy pattern compatible with a status of potential energy self-reliance. This line will develop, at a national level and under a more convincing economic performance the incipient but encourageing experience gained over the last seven years in the use of new and renewable sources of energy. Based on a RD and D programme initiated in 1972, a trial inventory of first-generation technical solutions has been established, to support deployment of applications for the first years of the period 1981-1985. To guide the implementation process and avoid waste of time and means, sets of standard technical solutions have been

made available for use in different commercial projects and economic or administrative steps were taken to stir up their promotion. The standard solutions are compulsory as far as general norms to be observed in order to avoid excessive proliferation of hardware and mal-directed investments. At the same time, they leave the designer a large room of manoeuvre, thus observing, as far as possible, the inherent variety of the consumer requirements and stimulating the intervention in the process of the local economies. By the end of 1980 more than 100 major consumers in industry, farming, services and household put to work the prescribed solutions, using solar heat, geothermal waters and biogas to ease their hydrocarbon demand. For 1981-1985, the National Council for Science and Technology has proceeded to a reappraisal of the activities in the promotion of the new energies, based on the stipulations of the Energy Master-Programme, drawing up a series of operative projects of research, development, demonstration and utilization of non-conventional sources of energy.

The paper outlines some of the features of the techniques of utilization of the new energies in Romania, and/or gives indications on the standard solutions used or in preparation for applications regarding: hydro-power, including mini hydro; direct solar, mainly hot water and space heating in household; public, recreation and touristic facilities; industry, building sites, farming and animal husbandry etc; wind, mainly pumped water and small-scale electricity generation; biogas, from animal husbandry and urban refuses; urban solid refuses, mainly heat recovery from incineration; geothermal water, mainly hot water and space heating for buildings, small industries, agriculture, health and touristic resorts; low-temperature waste heat recovery via heat pumps. Prospective projects are reviewed, on oil distillation residues recycling; coal fluidized-bed combustion and gasification; conversion to methanol of some natural deposits of lean mixtures of methane in carbon dioxide; shale oil; energy biomass. Far reaching R and D on hydrogen, MHD topping cycles, electrochemical sources and other fundamental research are also mentioned.

Tackling the problem of the interest and commitment factors acting in the development in Romania of the new and renewable sources of energy, along with the motivations screened above a certain effort of adjustment is admitted, having to consider, inter alia; the contrast between the unit powers installed in the national power grid and those which can be achieved from new and renewable sources of energy, still sharpened by the contrast between the centralized, as against the disperse nature of the two systems; the relative limited share of the new energies in the energy supply of an ever more industrialized economy, requiring high quality power; the high cost of the substitution investments; the high initial material cost of the deployment programmes, connected with the initial crash supply of energy-intensive materials; the economic risk to invest massively financial means and materials in deploying first generation technologies; additional efforts to ensure a suitable manufacturing capacity for necessary equipments and materials.

Brief explanations are given on how motives and constraints interact in implementing the RD and D and application operative projects, in the framework of the centralized planned economy of the country. The deployment of responsibilities among various co-ordinating bodies and ministries is also indicated.

Romania looks forward to an ever more active co-operation and collaboration with all the world states, with the international organizations interested in the equitable and efficient solution of the problems posed to mankind by its needs for energy and the rational utilization of this energy. Co-operation will be intensified with the socialist countries, the developing countries, the developed industrialized countries regardless their social system, on the grounds of the principles of observing the national sovereignty and independence, non-interference in the internal affairs and the mutual advantage. Aware of the part and contribution the United Nations Organization and its specialized

bodies and institutions can and must have in the development of international co-operation in the energy field, Romania will participate in the implementation of joint research programmes sponsored by the United Nations as well as in regional and/or any other appropriate cooperative actions, aimed at solving the energy problems.

It is believed that the field in formation, not yet eroded by noxious practices and biasing precedents, of the promotion by co-operation of the new sources of energy, can and should be a good example of all states - developed and developing - readiness and willingness to imagine and turn together into reality a new conduct in international economic, technical, scientific and political relationship, aiming ultimately to a gradual achievement of a new, viable, long-lasting energy order, to everyone's satisfaction. Adoption of a sound concept, practical steps and action which should lead to these ends should represent the main concern of the UN Conference for New and Renewable Sources of Energy. The following aspects should, inter alia, be considered: (i) recognizing the new and renewable sources of energy as one of the long-term, complementary, necessary components of the energy policies of all states, as an important driving force in the transition process towards a fair and better general energy order; (ii) subscribing the efforts to turn into account the new and renewable sources of energy to the general effort to provide each nation with enough energy to meet fully the needs rationally determined, as far as quantities, forms and quality; (iii) creating in co-operation an adequate space of action for the new and renewable sources of energy which would imply, inter alia, a systematic inferring of the technology inventory for the utilization of new sources of energy from the actual needs of the consuming entities; assuming by the affluent countries of adequate responsibilities in developing performant, accessible and efficient technologies; formation of capital flows and qualified personnel; assistance to the developing countries; early commitment in the development of the new energy technologies of endogenous efforts of the developing countries; eliminating the traditional constraints of commercial restrictions or/and political embargoes in the field of technology transfer; adoption of coherent national energy policies compatible with the requirements of a better energy order etc.; (iv) securing a climate favourable to the promotion of the new sources of energy by realistically and fairly balancing the raw material prices, including the energy, against those of the processed goods, including the technologies. Specific actions are sought, inter alia, for: (a) ensuring an adequate correlation between the conventional sources and the new and renewable ones; (b) development of technologies suitable to an efficient utilization of the new and renewable sources of energy; (c) setting up fast mechanisms for the acceleration of technology transfer in the field of the new and renewable sources of energy towards all interested countries; (d) R and D expansion on the utilization of the new energies and ensuring a fair dissemination of results; (e) formation of qualified personnel; (f) ensuring adequate financial resources for development and deployment, especially by increasing the funds allotted in this respect by the developed countries et al.; (g) development of co-operation between the developing countries in the field of the utilization of the new and renewable sources of energy.

One expresses the view that the Programme of action to be adopted by the UN Conference on New and Renewable Sources of Energy should reflect these and similar topics, to contribute efficiently and directly to the development of the international co-operation in the field of the new energies. It is sought that the Programme of action assign an essential part to the United Nations Organization, pertaining, inter alia, to: establishment of the necessary framework to debate and adopt operative action in compliance with countries' interests to develop the utilization of the new and renewable sources of energy; mustering of increased financial resources for the purpose; elaboration of pertinent studies, programme and project proposals at a national, sub-regional, regional and international level; establishment of a suitable co-ordination of the activities in the field of the new energies entertained by different specialized institutions of the UN system; establishment of adequate mechanisms to monitor the and ensure implementation of action agreed upon at the international level in the field of the new and renewable sources of energy.