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ENERGY MANAGEMENT: WHY IT IS REQUIRED?

I. Introduction

1. The sharp increase in the price of energy during the 1970s and the associated changes in the relative costs of alternative energy sources have imposed a colossal management burden on African countries.
2. The majority of African member States still rely heavily on imported oil and they needed to conserve energy and to replace expensive oil with cheaper sources of energy. This process of designing and carrying out strategies for the energy transition requires better management both within enterprises supplying energy and at the national level where there is a need to co-ordinate the activities of suppliers and to promote efficiency in energy consumption. The quality of management is the key to future investments; not only to identifying projects and implementing them successfully, but also to raising the finance for them.
3. In view of this, energy enterprises in African countries must be able to raise large amounts of foreign capital despite the difficult international climate in order to finance energy investments in the nearest future.
4. It would not be exaggeration to state that the energy sector in African States suffers from a weak and poorly co-ordinated institutional infrastructure. In some countries no one institution has been given primary responsibility for energy planning and policy formulation and areas of responsibility are divided among various ministries. Institutional issues involving co-ordination among parastatal, public and semi-public enterprises need to be resolved, particularly in the key energy subsectors.
5. The impact of the energy sector on the overall economy largely depends upon the successful achievements of the Governments in defining and implementing policy objectives. This will require an institutional set-up based on co-ordinating the action plans of the various agencies operating in the sector and consistent with the adopted strategy of energy development. Sectoral co-ordination is essential, since immediate decisions concerning fossil fuel development, adequate management and development of the electric power system, and the effective use of renewable sources of energy will affect not only individual subsectors, but also total balance between energy supply and demand.
6. In few African countries the institutional structure for energy management and development at the subsector level is in place and the enterprises are already staffed with technical personnel capable to take responsibility for promoting the energy policies and objectives.
7. Since all enterprises are associated with various levels of energy consumption, energy is for all practical purposes a fundamental ingredient of all human endeavor. Therefore, energy management should be present in all enterprises, should be as effective and efficient as possible in order to cope with the assigned goals.

8. Proper energy management in the developed world could be demonstrated by the programmes of energy conservation which continues to be an important component of energy policy. For instance in the Organization for Economic Co-operation and Development (OECD) countries since the early 1970s consumers, energy conservation service industries, energy supply companies and governments have taken a very active role in contributing to improved energy efficiency. The improvement was one of the main contributors to the current surplus of energy supply in some of OECD countries.

9. Many African countries have recognized weaknesses in their institutional structure and have established a specific organizations responsible for co-ordination and management of the energy sector. These organizations have often bi-level structures:

- (a) a directorate authorized to formulate policy and to make critical decisions concerning investment, prices, etc.;
- (b) a technical agency to monitor plan implementation in the various subsectors.

Ministries of Energy (or Energy and Mines) have been created in many African countries. In other cases interministerial commissions, a central ministry (planning, economics), or an executive level council co-ordinates the actions of the technical ministries.

10. In many African countries, there was a continuing need to strengthen institutional, managerial, training and staffing arrangements at all levels. In particular, there was a need to improve the framework for co-ordinating decisions on the management of the energy sector, including investment priorities, fuel substitution and energy pricing policy as these affect the activities of more than one agency within the country. These efforts were supported by many international organizations which is probably best illustrated by the Energy programmes executed by the UNDP and the World Bank.

11. The World Bank and the UNDP in 1980 jointly launched Energy sector assessment programme designed to provide a rapid diagnosis of the major energy problems faced by the developing countries and to evaluate the options for solving these problems. These assessments analyze the policies that would encourage greater production from indigenous energy sources and greater efficiency in the use of energy; they judge the investment priorities in the energy sector, and they provide a framework for multilateral and bilateral technical assistance in the sector.

12. By 1985, 33 reports out of 40 originally planned for Africa have been completed. The recommendations made in these reports cover a wide range of actions in the area of pricing, energy efficiency, interfuel substitution, institutional reforms and, most importantly, priorities for investment and preinvestment work.

13. In order to provide a rapid and flexible response to Governments who requested assistance in implementing the policy, planning and institutional recommendations in the Energy assessment reports the World Bank and the UNDP devised Energy sector management Programme. This Programme can finance:-

- (i) Assistance to improve a government's ability to manage its energy sector - by defining staffing and work programmes, evaluating management information needs, identifying sources of public and private finance and developing a medium-term investment plan;
- (ii) Prefeasibility work on priority investment plans especially those which will improve the efficiency of energy use and those which will provide enough affordable energy to rural areas;
- (iii) Providing specific short term assistance in institutional and manpower development.

The Programme aims to supplement, advance and strengthen the impact of bilateral or multilateral resources already available for technical assistance in the energy sector.

14. In recent years, the ECA Secretariat has organized a number of the regional workshops on various aspects of energy development in Africa. The workshops on energy planning and on energy demand and supply discussed inter alia some aspects of management of the energy sector in African member States. The Regional Workshop on aspects of energy management in Africa is the last one in the series of workshops on energy development and the ECA Secretariat hopes that it will be of interest to African energy co-ordinators and energy managers.

II. Scope of the problem.

15. There are several reasons why energy management is required at the national and enterprise level, and these issues tend to be complex in the energy sector. Not only are individual projects complicated to design and execute, but certain energy investments are complimentary with each other while others are mutually exclusive and decisions on energy are inevitably closely linked to almost every other aspect of development strategy. Moreover, these decisions have to be taken on the basis of imperfect information about the energy resource base and in an environment where future energy demand and relative prices are subject to considerable uncertainty.

16. Several peculiar characteristics made the planning and management of energy investments especially complex. These are as follows:

* Based on "Energy transition in developing countries", World Bank, 1983 P.59

- (i) The resource base is unavoidably uncertain either because its physical characteristics cannot be perfectly known before exploitation starts (in oil, coal, gas, geothermal energy and hydro power) or for other reasons.
- (ii) The technology is often new, rapidly changing and risky. Offshore exploration, deep drilling and enhanced oil recovery are difficult technologies to handle even for international oil companies who often rely on specialist contractors. The more sophisticated techniques of power generation, such as nuclear, require extraordinary caution to avoid technical and economic errors while underground coal mining presents continual environmental, health, accident and organizational problems.
- (iii) The investments are huge; single investment often amounts to several hundred million dollars and in case of some African countries are as large as the nation's annual GNP. Mistakes are expensive. The scale of investment can give rise to formidable problems in assembling the finance from several different sources, both external and domestic.
- (iv) Projections of energy demand are highly sensitive to macro-economic developments, which are difficult to predict.
- (v) Energy investments require a long planning horizon of 10 to 20 years. Over such a long period there is a wide range of possible patterns of growth and structural change and hence of energy demand. This may make it worthwhile to keep some strategic options open as long as possible. The risks of so doing must be evaluated along with the conventional least-cost analysis of options.
- (vi) Since energy investments tend to be large, their gestation long, and their benefits difficult to estimate precisely, projects have to be carefully planned and quickly executed. The cost of delay or failure can be enormous. A hydroelectric installation, for example, that happens to have a lower generating potential than planned or whose commission is delayed could seriously affect the viability of a number of other projects.
- (vii) Some investments in fuels, or equipment to use them, must be made before the markets for them are assured so that efforts are needed to promote their products, examples are improved woodstoves, liquefied petroleum gas for household or vehicular use; and charcoal, solar or other renewable energy sources.

- (viii) Because energy investments are both very risky and offer potentially high rates of return, it is often necessary and feasible to involve foreign equity partners. This requires negotiation of suitable arrangements to share the surplus.
- (iv) The limited extent of domestic private sector activity in energy production and supply in most African countries places an extra management burden on the public sector in this area.
- (x) Environmental considerations are also important. The development of a large hydro project could entail the inundation of settled rural area, coal-burning power stations or industries can seriously pollute the air unless appropriate equipment and controls are installed. These environmental effects have to be explicitly considered in the course of evaluating alternative energy investments.

17. Decisions on energy investments can rarely be made in isolation. The timing of hydropower investment, for example, depends on the projected growth of electricity demand, which often depends critically on a few large industrial users; the planning of a gas pipeline may be linked to the location and timing of a fertilizer plant; the design of a refinery may depend on the projected evolution of transport demand and the type of vehicles in use. Investments to supply alternative fuels to households may have to be judged on the basis of detailed market surveys and predictions of consumer behavior. Such decisions require the installation of extensive infrastructure (such as roads and pipelines) and equipment (refineries, processing plants, and compression stations) that is highly capital intensive. Choices among alternatives can be complex. If there is only one economic option for energy supply, its adoption is not open to question if its actual cost turns out to be significantly higher than estimated. But if there are several options whose estimated costs are close (for example thermal or hydropower in Kenya, diesel or geothermal power in Djibouti) it becomes much more important to ensure that the initial cost estimates are accurate. At the margin some of the options (some hydropower projects, coal mines, or enhanced oil recovery) may be more expensive to the economy than the import of oil. The evaluation of these projects must carefully consider the trade offs between cost of supply and strategic considerations such as achieving national self-sufficiency in energy.

18. Energy is an input or an output in almost all productive activity and consequently the linkages between energy and the rest of the economy are strong and intimate. Not only do energy investments compete with those in other sectors for scarce investible resources, decisions on them cannot be taken without careful consideration of their inter-relationships with policies and trends in the rest of the economy. These relationships have many dimensions. The impact of oil imports and exports on balance-of-payments

prospects is well recognized and for most countries trade in oil directly affects development prospects. In oil exporting countries, production arrangements and depletion policy can be rationally established only in the context at a long-term view of development priorities. In all countries industrial strategy is closely linked to energy demand and energy costs have a strong bearing on the profitability of different industrial options. The long-term impact of energy prices on industrial structure and efficiency is significant. The same applies to policies affecting the pattern of urbanization, transport, infrastructure and the relative emphasis on different modes of transport. Measures to increase the supply of fuelwood will involve changes in the management of forests and pattern of reforestation which in turn may conflict with existing agricultural practices. The linkages pose a special challenge for the managers in this sector. Though the developments outside the energy sector are largely out of their control, the latter have a great bearing on the success of their efforts.

19. Linkages are important not only in investment programming but also in decisions affecting the structure of prices. Energy prices not only influence the choice among fuels and the financial viability of energy investments and energy producers, they also have a direct impact on the distribution of real income, since energy is a significant item in household expenditures. Therefore, energy prices can have a significant indirect impact through their influence on the profitability of industries and services ranging from steel mills to biomass collection.

III. Problems of energy management in Africa

20. None of the African countries have coped with the challenges posed by the problems of energy development over the last decade. It is hardly surprising therefore that member States have management problems both at the national and enterprise levels. For example, in one country in coal industry poor maintenance and failure to plan for the availability of spare parts brought virtually to standstill the mining operations of major colliery. In other country there were huge technical transmission and distribution losses exacerbated by improper collection of revenues in power sector.

21. The most common weaknesses in energy management can be found in all types of public enterprises in African countries. These weaknesses include insufficient experience and training of the key staff, poor management practices and lack of familiarity with technologies and operating issues. They are compounded by poor infrastructure, a lack of specialized consultants and by generally low level of education and skills among the work force. They are also exacerbated by the tendency of enterprises to use their own scarce managerial and technical staff for tasks that could be subcontracted to private industry on a long-term basis. Where few technical staff are available, managers concentrate on crises to the neglect of training new staff and of preventive maintenance, leading to a vicious circle of new crises.

22. Because of their large scale and strategic importance, energy supply activities are generally managed by government or quasipublic enterprises. It is entirely appropriate that long term objectives and strategic issues be determined by a high political authority but within clear national guidelines, the operating enterprises must be free to make final decisions on operations. In practice, supervision by government ministries can sometimes extend to interference in routine decisions by civil servants who lack operating knowledge and may not share responsibility for failures. Under these pressures, even when enterprises are formally autonomous, key decisions may be delayed, unrealistic objectives imposed or enterprises' needs neglected. When these factors are combined with regulated wage and salary structures dictated by government, and time-consuming procedures for procuring and allocating funds the frequent result is a lowering of morale and a loss of experienced managers and skilled staff. These problems are generally most acute in the power and coal subsectors.

23. The task of managing energy enterprises is made more difficult by the diffusion of responsibilities at the governmental level. As many as a dozen ministries sometime make decisions and issue independent regulations bearing directly or indirectly on the energy sector. Various public or private organizations, such as industrial or agricultural development banks may appraise investments involving energy without referring to the ministry of planning or any other authority. There is thus an inherent risk of conflict in a crucial area of national economic development.

IV. Priorities for action in energy management

24. While the priorities for action in each African country will need to be determined within the specific context two areas which require widespread attention are the need to improve the quality and volume of preinvestment work and to strengthen the strategy formulation, overall management and manpower capability at both the enterprise and national levels.

25. The importance in the energy sector of good preinvestment work needs to be emphasized. To plan power generation, for example, it is necessary to identify the least-cost generation plan, which in turn requires a systematic survey of the hydropower potential in the country. Such surveys require hydrological records covering many years to determine river flow patterns under various conditions. Unfortunately such records are lacking in most African countries. On a smaller scale but equally important is preinvestment work in other energy subsectors: geological and geophysical studies to guide petroleum exploration; preliminary studies of the market potential for natural gas so that discoveries can be speedily exploited and the collection of site-specific data on wind speeds and insolation.

26. The organization of preinvestment work is only one aspect of a broader need to strengthen institutions in the energy sector. It is necessary to establish a working environment (including adequate salary levels) that will maintain the continuity of management and help to retain qualified staff and

to upgrade their skills. The latter will involve formal training and refresher courses as well as closer contact with experienced staff in international industry, consulting firms and lending agencies involved in project preparation and appraisal.

27. It is also necessary to ensure that major proposals concerning investments and pricing are analyzed with a broad perspective of the sector and the nation, rather than in an isolated unco-ordinated manner. This is particularly important given the uncertainties affecting the future evolution of energy demand and supply. To achieve these changes will require both staff devoted to long-run planning at the enterprise level and a small qualified group of analysts at the national level to advise the key decision makers on overall sector policy issues and on ways to strengthen the institutions operating in the energy sector.

28. The planning staff at the national level would be responsible for co-ordinating enterprise plans. That could be achieved by ensuring that enterprises make the same assumptions about the growth of energy demand for different fuels for power generation is consistent with the projected availability of these fuels. They would also be responsible for evaluating the effects of exogenous changes on the demand and supply prospects for individual fuels and for ensuring that subsector investment programmes and pricing policies were altered quickly to take account of these changes. A central energy secretariat may also be concerned with efficiency in energy use. It may oversee programmes to reduce energy consumption, promote research studies and experimental projects for improving efficiency in the use of energy, and disseminate information on how to save energy. It would ensure that adequate financial and managerial resources were being devoted in each of the subsector operating agencies to improving the efficiency of existing plant and operations. This is important even if the energy source is imported (for example, petroleum products). Significant reductions in the oil import bill can be achieved by switching to alternative sources or methods of supply. The location of the national energy policy staff will vary by country, depending on specific needs and institutional arrangements. The important requirement in all African countries however is that energy planning be an explicit element of national planning and public investment decisions and that the national staff should have adequate authority to review all proposals with significant energy implications.

V. Role of external assistance

29. The main effort to improve energy management has to come from the African countries themselves. In some vital areas for example, in the reform of the relationship between government ministries and public enterprises, external agencies can highlight the problem and advise on how it is being addressed in other countries. In other areas there is greater scope for external assistance in improving enterprise management structures accounting systems and procedures for billing and collection, operations and maintenance even though the social and political frameworks within which solutions must be sought are

fully known only in the countries concerned. International financial agencies can also help by preparing terms of reference for selecting and supervising the performance of consultants for pricing studies, in establishing priorities for preinvestment work identifying the manpower and financial requirements and mobilizing the funding. Through their joint Energy assessment and sector management Programmes, the UNDP and the World Bank are assessing the major energy problems in majority of African countries and helping to evaluate options for solving these problems and improving energy sector management.

30. Training in an areas where specific external assistance may be useful in several ways:

- Programmes within countries to train specialists in energy planning, economics, technologies, finance and environmental aspects; on-the-job management and technical training in energy companies.
- Workshops and seminars at which technical experts from African countries exchange ideas and experience.
- Overseas training courses in various specialities.
- Secondment of key individuals to foreign energy sector institutions and financing agencies.
- Reorientation of training and educational institutions and programmes in the country concerned.

31. Training should be carefully focused to benefit the country in areas where it is most needed and can be of lasting use. For instance, training in building sophisticated models of the energy sector is of little value in African countries where basic data and analysis of energy issues are still rudimentary. At the same time the benefits that accrue from a well designed and well administered training programme must be emphasized. The high rates of return for such training make its high cost well worth incurring and it is frequently a prerequisite for realizing the full benefits of far greater investments in plant and equipment.

VI. Conclusion

32. Improving management of the energy sector in African countries should be based upon the following:

- (i) careful analysing national energy sector issues and formulating overall sector development strategy;
- (ii) strengthening national energy institutions and developing an effective sector planning and management capabilities;

- (iii) selection, formulation and implementation of the national projects specifically devised to improve upon energy management in the enterprises;
- (iv) development of subregional and regional co-operation in the establishing the standard of energy management.

33. The absence of an effective management information system in African countries makes it difficult, if not impossible, for energy managers to make national decisions about the efficient running of the sector. There is an urgent need for a better management information system both for planning and budgeting and for monitoring the results of policy, pricing and administrative measures designed.

34. Demand and supply management policy should be strengthened. A demand management policy is needed to promote conservation, interfuel substitution and national energy use through appropriate pricing policies and fiscal incentives at the level of supply policy, economic, financial and social impacts of each energy source have to be thoroughly examined, especially for possible interfuel substitution.

35. In African countries, substantial energy investments will be required in future to provide for expansion or development of domestic resources and many of these investments will have to be made by external sources. However, the Governments should also encourage investments by the public and private sectors.