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**INTEGRATED METHODOLOGY FOR ENERGY PLANNING  
IN EGYPT**

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## PREFACE

Planning for an adequate supply of energy has always been an important component of national planning in Egypt. The dramatic fluctuation of oil prices and the changes in the future energy supply and demand pattern call for a comprehensive approach to energy planning, with special emphasis on the medium and long term. Medium and long-term energy planning require a review of the past and present trends to enable decision makers to evaluate future development of energy demand and the possibilities of fulfilling that demand in various ways. Integrated energy planning centers on the identification of future targets and the procedure of how these targets can be achieved given the premises of consistency and balance among the elements of energy supply-demand, as well as, economy and socio-economy.

It is necessary, and rather essential, for Egypt to have a clear view of its energy policy options. Integrated energy planning has, thus, become a matter of urgency. The Institute of National Planning, therefore, wished to respond to this real need by sponsoring during 1985/1986 the programme of research-work on „Integrated Methodology for Energy Planning in Egypt”.



The main objective of this study is to present a conceptual framework for integrated energy analysis and making policy decisions in Egypt. This study gives a detailed guide to the methodology for collecting data on the country's energy system as such, namely the establishment of the national energy balance. In addition, it emphasizes the display of factors that describe the energy system in relation to its environment, both in terms of the economy and socio-economy. It defines in more detail and formulates in a comprehensive and dynamic manner the interrelation among these parameters using different analytical instruments (socio-economic indicators, techno-economic methods, forecasting techniques ... etc). Another basic characteristic which was aimed to obtain for this methodology is that it can be applicable at various levels of geographical aggregation. In other words, such a methodology would be equally suitable for application to disaggregated areas within the country (e.g. rural and urban areas), as well as for the national economy of Egypt or a group of countries within the same region (e.g. Arab countries or North African countries). Therefore, the proposed methodology attempts to identify the analytical approach and the tools to be used, disregarding the development scenarios which might be eventually considered as a particular case study. With this in mind, the approach adopted is one of simplicity and clarity, with preferential treatment being given to the practical aspects.

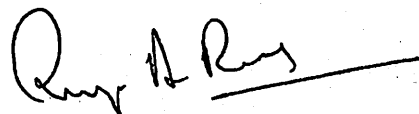
The main emphasis of this study is to:

- i) identify the conceptual framework for integrated energy planning and analysis;
- ii) define the data requirements for integrated energy planning and policy analysis, and recommend possible procedures for the procurement of these data,
- iii) identify the methodological approach to constructing national energy balance for Egypt;
- iv) review the quantitative methods for energy forecasting and discuss briefly the areas of possible application;
- v) formulate techno-economic approach to sectoral energy demand analysis;
- vi) discuss the unresolved issues on energy planning in Egypt and identify the areas of possible future development.

Finally it must be stressed that, the integrated methodology for energy planning in Egypt is not an end in itself, rather it is justifiable as a tool for the purposes of effective energy analysis and making policy decisions.

This study has been undertaken in the framework of the Institute of Planning research Program. I wish to record our sense of appreciation to the principal investigator of this study Dr. Ragia Abdin kheiralla, Senior Expert in the Institute of National Planning and Prof. Dr. Emad EI Sharkawi, the Chairman of the Egyptian Electricity Authority, for his valuable consultation.

I hope that the study, its designations and presentation of the subject, be of interest and a welcome aid to decision makers and energy planners.



Dr. Ragaa A. Rassoul

Director  
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Sept. 1986.

## CHAPTER 1

### METHODOLOGICAL CONSIDERATIONS FOR ENERGY ANALYSIS AND PLANNING

#### 1.1 Interlinkages Between Energy, Economy, Technology and Society

As a result of the significant evolutions of crude oil prices in 1973 and later 1979, a much more precise analysis of the energy sector is required in order to understand the driving forces of energy consumption, the impact on the energy supply and the multi-faceted interrelation of energy with the economy and the socio-economy.

The interfaces of the energy sector with other sectors of the economy are numerous. Energy consumption is ultimately determined by a multitude of influential factors, among which the economic development and the evolution of price are significant parameters. Other groups of exogenous parameters are the population, the availability of resources (capital, manpower, energy, etc.), the social development, technical knowledge and know-how, structural changes in productive sectors, etc.

Energy demand for a specific end use is very much related to levels of economic activity in that end-use sector. This, in turn, is closely related to levels and rates of growth of activity in the whole economy. In addition to such linkages from the economy to the energy sector, there are also feedbacks from energy to the economy, which should be recognized in a fully integrated energy analysis framework. Fig. (1) illustrates such an intersectoral relationship.

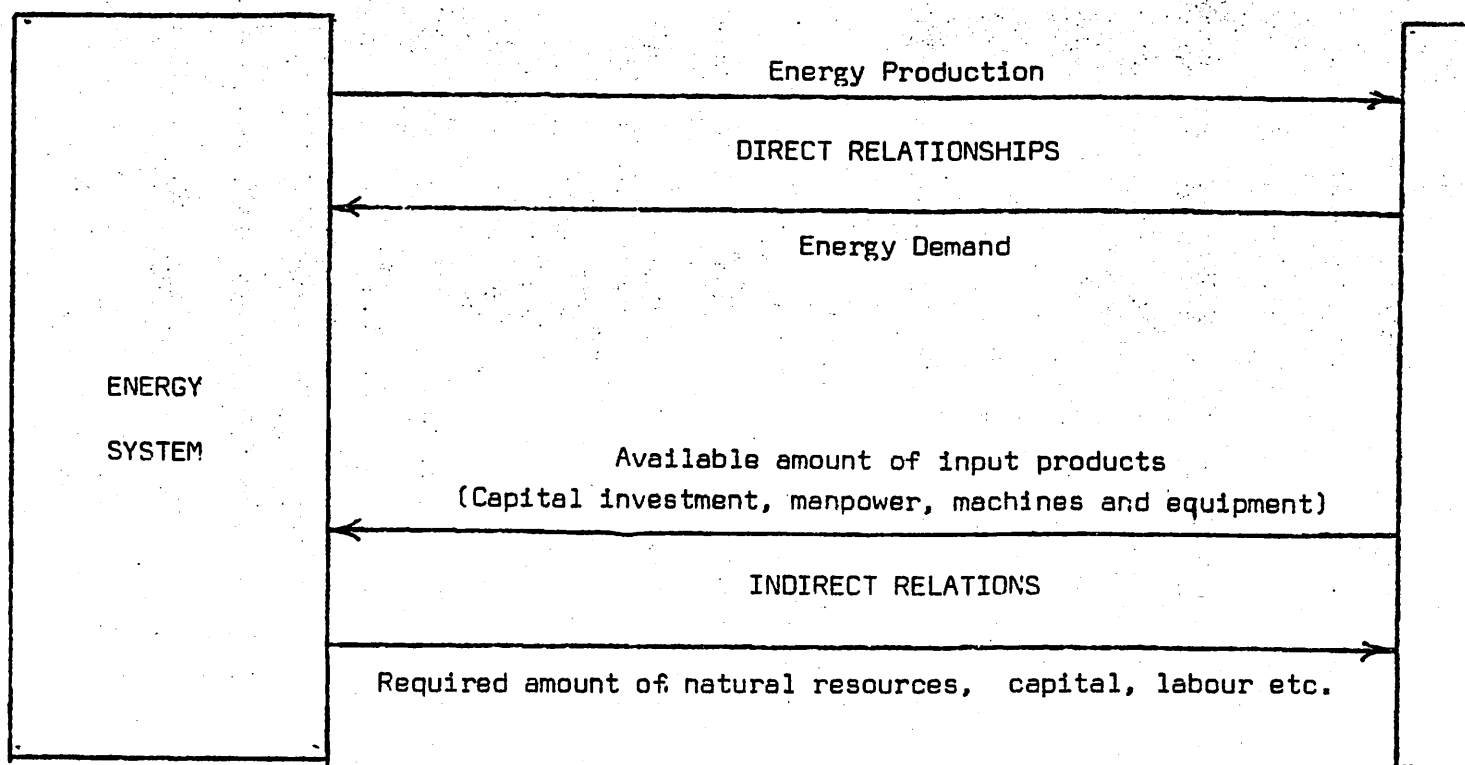


Fig. (1) Intersectoral Relationships

It is noticeable that the interrelationships between the energy system and all sectors of the national economy makes it virtually impossible to try to study the energy system in isolation.

Technology also, of course, contributes directly to a determination of fuel market shares by delimiting the extent of interfuel competition that is possible in any market at any time. It is clear that electricity has virtually insignificant role to play in road transport in Egypt with present state of the used technology. However, it is less clear that this will continue to be true over the next decades (e.g. the subway in Cairo & electrification of railways). Just as changes in technology impinge on energy demand projections by increasing the range of uses for a particular source.

Technological progress may also serve to extend the number of sources available for a particular use, both through the development of new sources and the design of appropriate delivery or conversion systems for existing sources. In addition, the energy intensity of the range of goods and services demanded and produced is a function of the state of technology as it is reflected in production processes.

These types of interconnections between energy, economy, technology and social systems should be taken into account in the process of establishing data base and carrying out energy analyses. Fig (2) illustrates the interrelationships between long-term socio-economic development and