2017
Informal Report

BNL 21874

A brief description of
THE DEVELOPING COUNTRY ENERGY PROJECT

October 1, 1976

—NOTICE—

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Energy Research and Development Administration, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

MASTER

Policy Analysis Division
National Center for Analysis of Energy Systems
Brookhaven National Laboratory
Associated Universities, Inc.
Upton, New York 11973

under contract No. EY-76-C-02-0016 with the
UNITED STATES ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Energy Research and Development Administration, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

I. SCOPE AND INTENT

The objective of the Developing Country Energy Project at the Brookhaven National Laboratory is to assess the role of new or adapted technologies in addressing the energy problems of developing countries. This objective is pursued through activities ranging from historical economic analyses of the role of energy in development to assessments of individual technologies carried out in support of research and development planning. The project, which was started in 1975, carries a particular emphasis on the energy problems and technologies appropriate to rural development. A firm tenet of the activity is, however, that the role of individual energy technologies can be understood only through an integrated view of the entire energy system and the way in which that system meshes with the economic and cultural structure of a society.

The Developing Country Energy Project (DCEP) is carried out within the Policy Analysis Division of the National Center for Analysis of Energy Systems at BNL. The programs of the National Center include policy studies, economic modeling and analysis, energy technology assessment, studies of health and environmental impacts of energy technologies, and extensive supporting activities in data and information systems.

A number of these programs are carried out in support of planning and policy making in the U.S. Energy Research and Development Administration although support is also received from a number of other federal, state and private institutions. The geographical scale of consideration in these programs extends from the local to the urban and regional, the national and international. In the international area, the National Center is carrying out, with the participation of representatives of seven other countries, a major portion of the International Energy Agency's assessment of R&D priorities. It is also active in the international Workshop on Alternative Energy Strategies. The DCEP draws on the staff of other Divisions and Groups of the National Center as required by individual studies. As with other

activities of the Center, the DCEP also profits from the collaboration of a number of groups and individuals at other institutions.

The next sections describe briefly some of the current activities in the DCEP. The program is currently a modest one; an awareness is growing, however, that insufficient attention has been given to the question of energy and development and to the technological and policy issues which we are beginning to address. Thus we expect that over the next year the activities of the DCEP will change and expand; nevertheless, our current activities serve to indicate our perception of the problems of energy in LDCs and the approach we take to these problems.

II. MAJOR PROGRAM AREAS

A. Economic and Energy Framework and Projections

The entire group of LDCs are being examined to develop a better understanding of the role of energy in development and to project the energy requirements of those countries under alternative growth patterns. A computerized data base has been established including social, economic and energy information on all developing countries. This system was based initially on two principal sources: the U.N. Series J energy data and the World Bank World Tables on economic information. These data are supplemented with information on specific countries based on other specialized sources. This data set is now being used as the basis for studies of historical (time series and cross sectional) relationships between energy use in specific sectors and economic development. Conventional sources of information contain, almost exclusively, data on only commercial (coal, petroleum, natural gas, uranium) sources of energy. The critical importance of non-commercial energy sources (wood, dung, crop residues) creates an urgent need for that kind of information to be included in the data base. Work has been initiated to fill that gap.

B. Country Studies

This general area is intended to include studies carried out in collaboration with individual countries of particular technological developments or overall energy planning. Initially the activity has

concentrated on the construction of detailed supply-demand structures of a number of representative countries that can be used as the basis for generic energy technology assessment. Seven countries were chosen as an initial set for analysis based on their representing a range of levels of development, climate, resource base, etc. These countries were India and Kenya (in the low, less than \$200 per capita, income group) Ghana and South Korea (in the intermediate income group) and Chile, Brazil and Greece (in the upper, greater than \$550 per capita, income group). In constructing energy supply-demand models for these countries we have placed emphasis on incorporating data on noncommercial energy use wherever such information is available.

The representations of the energy systems and their projections are developed in sufficient detail, including conversion efficiencies, so that technologies can be substituted and effects on the overall energy system can be analyzed. Using these representative countries and this sort of process-oriented analysis a bridge can be built between specific technology assessments and conclusions that pertain to a broad category of LDCs.

C. Energy and Rural Development

As mentioned above, considerable emphasis is being placed in the program on the role of new energy technologies in rural development and agriculture. The Developing Country Energy Project is participating with the U.S. Agency for International Development in the design and implementation of a series of in-country studies of energy use in agriculture. The intent of this series of studies is to create a better information base on the use of energy in alternative agricultural systems as a basis for the design of development and aid projects. The agricultural systems of approximately four developing countries will be studied in this program by groups in this country in collaboration with groups in the particular LDC. The Brookhaven DCEP is collaborating with groups at Tufts University and Cornell University in providing the technical overview and the overall systems and policy analysis for this series of studies.

D. Energy R&D Assessment

The central and complex problem of evaluating energy R&D priorities for LDCs is being approached from a number of directions. The basic

approach is to consider the various energy technologies (solar, wind, biogas, oil, etc.) and the different uses or functions of energy (irrigation pumping, cooking, transportation, etc.) as comprising a matrix, each element of which represents a specific end-use of a specific technology. The assessment of particular technologies in the context of the developmental needs and goals of individual countries or groups of countries can then be achieved by focusing on particular elements or sub-arrays of elements of this matrix which highlight the significance of each technology in relation to the particular function for which it is used. As an initial example of the use of this approach, focusing on a functional end-use, a study has been carried out of competing technologies (solar, wind, biogas, and diesel) for powering devices used in lift irrigation from ground-water sources. As an example of an analysis across the technology vector a study is in process of the use of biogas systems in providing the energy to a rural village. A computer code has been written to investigate the effect of the variation in the design parameters (load factors, temperature dependence, retention time, input composition, dilution, etc.). The computer program will also form the basis for analyzing the role that such a plant plays in meeting the diverse energy needs of a village.

In addition to further assessments of individual technologies, this area of activity will include, in the near future, a survey of research and development programs being carried out in the United States, in other countries, and in international organizations relevant to LDCs. These various studies will then be used as a basis for identifying the most important needs for research and development and for technology transfer. The emphasis on problems of rural development will be maintained in these assessments.

E. Other Activities

Through discussions with the staff of international monetary and aid organizations plans are being formulated for a training program in energy planning and assessment for planners from LDCs. Such a training program would include courses and seminars in development economics, energy technology characteristics, resource evaluation, project evaluation, etc., and collaborative experience in the DCEP

activities. In a collaborative program with the World Bank and the Intermediate Technology Development Group, a survey is being carried out of currently available energy conversion devices for rural use in LDCs. In support of a number of the other project areas we are also carrying out a study of the applicability of energy planning and assessment models to developing countries. This entails, in part, a linkage of energy systems models, including descriptions of the rural sector, to more classical developmental economic models. A number of these latter activities are based on the contention that many LDCs could benefit from a greater capability to evaluate systematically their own energy future.