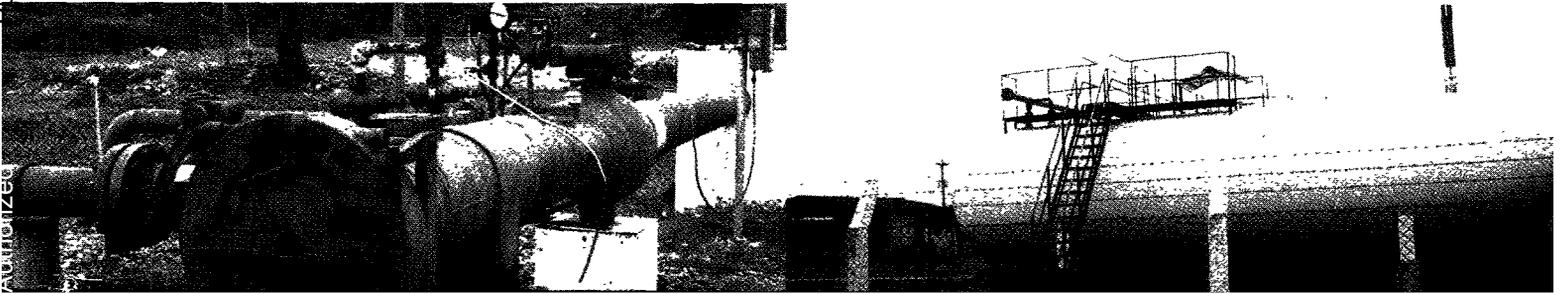


ESMAP

Information and Status Report September 1990



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Cover photos illustrate several of the subsectors considered in the Guatemalan energy assessment. Shown are the powerplant at La Laguna, the gasoline terminal and mothballed refinery at Puerto Barrios, a young woman producing parts for an improved stove, the primary forest with its sinkholes in the northeastern part of the country, the pipeline in the Rubelsanto oil fields, a rig in the Peten oil field, and crude storage tanks and an LPG tank near the depot in Escuintla.

ESMAP

**World Bank/UNDP/Bilateral Aid
Energy Sector Management Assistance Program**

*Information and Status Report
September 1990*

**Energy Strategy, Management and
Assessment Division**

Industry and Energy Department

The World Bank
1818 H Street, N.W.
Washington, D.C. 20433, U.S.A.

**Division for Global and Interregional
Programmes**

United Nations Development Programme

One United Nations Plaza
New York, New York 10017
U.S.A.

Managing Editor:

Jean Becherer Hanan

Associate Editor:

Ghislaine van Lookeren Campagne

Desktop Publisher/Graphics:

Carol A. Hafey

Word Processing/Copy Editing:

Carole-Sue Castronuovo

Feature Stories:

Jean Becherer Hanan

Willem Floor

Charles McPherson

Jayne Porto-Carreiro

Photographs:

Robin Broadfield

Michel del Buono

Jean Becherer Hanan

Mecki Kronen

Josef Leitmann

Jayne Porto-Carriero

Robert van der Plas

Giovanni Zappalá

The ESMAP program represents a cooperative international effort of energy and environmental assistance in the energy sectors of developing countries. It has been supported by the World Bank, the UNDP and other United Nations agencies, the European Community, OAS, OLADE, and a number of countries including Australia, Belgium, Canada, Denmark, the Federal Republic of Germany, Finland, France, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Sweden, Switzerland, the United Kingdom, and the United States.

For further information on the program or to obtain copies of selected ESMAP reports contact:

Robert J. Saunders, Chief

Energy Strategy, Management and Assessment Division

Industry and Energy Department, PRS

The World Bank

1818 H Street, N. W.

Washington, D. C. 20433

U.S.A.

TABLE OF CONTENTS

I. BACKGROUND	1
II. FEATURES	3
The Energy Assessment Program Ten Years Later	3
Industrial Biomass Residues as Environmental and Economic Energy Alternatives	11
Helping Poland Reform Its Energy Sector	21
III. IMPLEMENTATION OF ESMAP RECOMMENDATIONS	27
Financing of Recommended Investments and Technical Assistance	28
Latest Implemented Recommendations	29
Implementation of Recommendations in Selected Countries	31
Latest Follow-up Opportunities	45
IV. FINANCIAL DATA	49
Funding Opportunities	49
Funding Received by Donors	49
ESMAP Sponsors and Other Funding Agencies/Units/Sources	51
Ongoing Activities (Category)	53
Prospective Activities (Category)	61
V. STATISTICAL DATA	65
Summary of Activities (Region)	65
Summary of Activities (Category)	66
Completed Activities (Region)	67
Ongoing Activities (Region)	73
Prospective Activities (Region)	77
VI. SUMMARY ACTIVITY DESCRIPTIONS BY REGION	79
Completed Activities	79
Ongoing Activities	113
Prospective Activities	134
APPENDICES	
1. Opportunities for Developing Countries	
2. Opportunities for Consultants	
Roster of Consultants	
Specially Needed Consultant Skills	
Consultant Profiles	
Consultant Profile Form	
3. Publication Request Form	

Background

The Energy Sector Management Assistance Program, better known by its acronym, ESMAP, was launched jointly by the World Bank and the United Nations Development Programme in 1983 to complement the Energy Assessment Program which had been established three years earlier. The assessment program was designed to identify the most serious energy problems facing some 70 developing countries and to propose remedial action. ESMAP was conceived, in part, as a preinvestment facility to help implement recommendations made during the course of assessments.

Today, ESMAP is carrying out energy related preinvestment and prefeasibility activities in about 60 countries and is providing a wide range of institutional and policy advice. The program plays a significant role in the overall international effort to provide technical assistance to the energy sectors of developing countries. It attempts to strengthen the impact of bilateral and multilateral resources and private sector investment. The findings and recommendations emerging from ESMAP country activities provide governments, donors, and potential investors with the information needed to identify economically and environmentally sound energy projects and to accelerate their preparation and implementation. ESMAP's policy and research work analyzing cross-country trends and issues in specific energy sub-sectors makes an important contribution in highlighting critical problems and suggesting solutions for dealing with them.

The program's operational activities are managed by three units within the Energy

Strategy, Management and Assessment Division of the Industry and Energy Department at the World Bank. These are the Energy Efficiency and Strategy Unit, the Household and Renewable Energy Unit, and the Natural Gas Development Unit.

The Energy Efficiency and Strategy Unit is engaged in energy assessments, energy sector strategy development, strengthening sector management, efficiency improvements in energy supply, and energy use, training, and research.

The Household and Renewable Energy Unit carries out strategy studies, prefeasibility studies, pilot activities, technology assessments, seminars and workshops, and policy and research work in the areas of household and rural energy, traditional fuel supplies, and alternative energy.

The Natural Gas Development Unit is charged with the promotion of natural gas development and utilization in developing countries through preinvestment work, formulating natural gas development and related environmental strategies, and research.

A small group within the Energy Strategy, Management and Assessment Division also provides central services to the program such as budget, donor relations, and public relations.

UNDP's Division for Global and Inter-regional Programmes jointly manages ESMAP in collaboration with program colleagues in the Bank. The UNDP pays particular attention to the scope and direction of ESMAP work, the undertaking of new initiatives, financial management,

and donor relations.

UNDP resident representatives play an important role in the conduct of ESMAP activities by providing suggestions, support, and advice to missions, facilitating contacts within recipient countries, and extending financial support through IPFs (Indicative Planning Figures).

At the November 1989 annual donor consultative meeting, it was agreed to undertake an evaluation of how ESMAP can best position itself to address the emerging developing country energy problems of the nineties. The importance of energy sector problems confronting the developing countries and ESMAP's capacity to help in their resolution would form the framework for the evaluation exercise.

The task was entrusted to a group of distinguished development experts. They include Dr. Edward Ayensu, President, Pan-African Union

for Science and Technology; Dr. Nyle Brady, former Senior Assistant Administrator for Science and Technology, U.S. Agency for International Development; Mr. Timothy Lankester, Permanent Secretary, Overseas Development Administration, United Kingdom; Mr. Farooq Ahmad Khan Leghari, Federal Minister for Water and Power, Pakistan; Mr. Quincy Lumsden, Director, Petroleum and External Affairs, International Energy Agency; Mr. Wilfried Thalwitz (Chairman), Senior Vice President, Policy, Research and External Affairs, the World Bank; and Mr. Carl Tham, Director General, Swedish International Development Authority (SIDA).

The commissioners have held meetings in April, May, and September. Their conclusions will be presented at this year's annual meeting in November.

The World Bank

Anthony A. Churchill

Director, Industry and Energy Department

Robert J. Saunders

Chief, Energy Strategy, Management and Assessment Division

Alastair McKechnie

Chief, Energy Efficiency and Strategy Unit

Ernesto Terrado

Chief, Household and Renewable Energy Unit

Afsaneh Mashayekhi

Chief, Natural Gas Development Unit

Zia Kalim

Donor Relations Manager

United Nations Development Programme (UNDP)

Timothy Rothermel

Director, Division for Global and Interregional Programmes

Thomas S. Cox

Senior Programme Officer
Division for Global and Interregional Programmes

THE ENERGY ASSESSMENT PROGRAM TEN YEARS LATER

On the tenth anniversary of the Energy Assessment Program, it is apropos to review its progress and adjustments to meet a changing world and the changing energy needs of developing countries. As the energy sectors of the third world changed, ESMAP altered its program to match their requirements. Presently, the assessment program, which was integrated into ESMAP, not only assesses the issues and options to help countries further develop their energy sectors but also provides assistance to ensure governments have adequate guidance to formulate national energy strategies.

The Energy Assessment Program was the precursor to ESMAP. As oil prices rocketed in the 1970s, developing countries looked for assistance to help their energy sectors adjust. The World Bank and the UNDP jointly formed the assessment program to offer energy policymakers a cohesive view of their energy sector and to focus on the necessary key policy and investment decisions. The program soon gained the financial support of a large segment of the international donor community.

The first energy assessment (the titles of assessment reports are "Issues and Options in the Energy Sector") completed was for Indonesia in November 1981. In the succeeding four years, the number of assessments produced

rose to 50. By 1983, the year ESMAP was started, the program began to issue status reports demonstrating progress on implementing ESMAP recommendations as well as the general development of the energy sectors of the represented countries. To date, there have been assessments completed for 66 countries with 20 status reports.

Currently, there are four assessments and three assessment updates underway. The former include the Central African Republic, Dominican Republic, Guatemala, and Mali, and the latter are Burundi, Rwanda, and the Solomon Islands.

The assessment program has undergone changes over the last decade. The metamorphosis, however, has been evolutionary rather

than abrupt. Perhaps the most significant change in the program has been a move beyond assessments into strategy oriented technical assistance work.

The Basics of an Assessment

The objectives of an energy assessment are to provide a swift diagnosis of the major energy problems facing a developing country and to evaluate and prioritize its options for solving them. Each assessment reviews the particular economic and financial position, population and country needs, resource base, management capability, technology base, and institutional structure. The relationship between energy and the economy is important to every assessment. Generally, all energy subsectors are scrutinized to a greater or lesser degree.

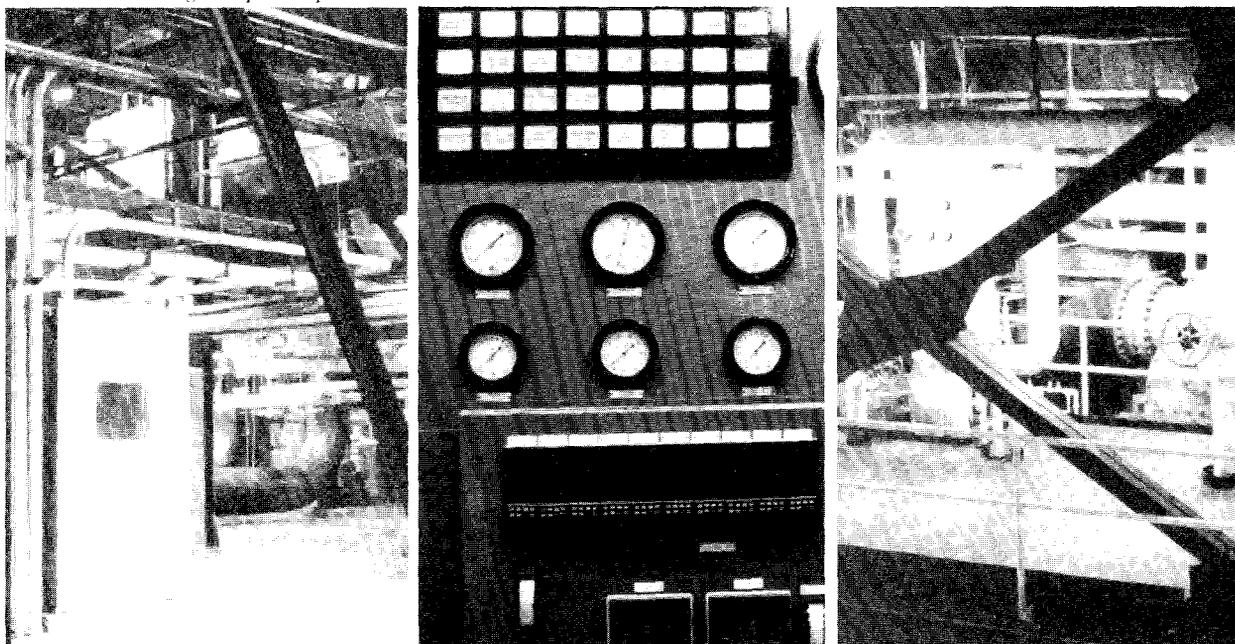
Employing historical user trends, economic outlook, and options for policy adjustments, an assessment estimates prospective demand and calculates the potential supply of

commercial and traditional fuels. It gives the present and forecasted energy balance.

Assessment recommendations can be for investments, government actions, or further study. Investments may range from building a gas distribution system to rehabilitating power stations to making briquettes from agro-industrial residues. Recommendations for government action may range from developing better policies on pricing, taxation, and subsidization to promoting interfuel substitution and conservation. Assessments often recommend technical assistance, the introduction of improved technology, and training.

The criteria for an assessment to be performed for a country are that (a) the energy sector poses a major constraint on overall economic development, (b) the country in question requires technical assistance for viable long-term development of its energy sector, and (c) the government is committed to undertaking the necessary policy and institutional reforms. An assessment begins with a review of current data

Inside the La Laguna powerplant in Guatemala.



to preliminarily identify the major sector issues. This also helps to avoid duplicating previous efforts and to recognize where further data gathering is needed.

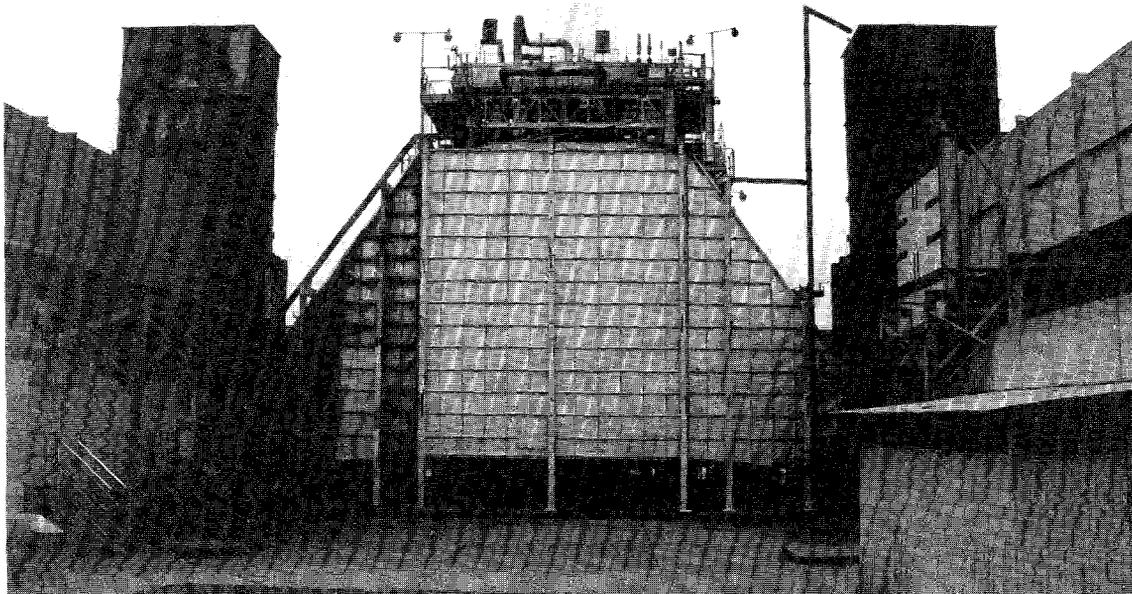
The Guatemala assessment, for which a final report should be issued by the end of this year, is a fitting example of the method by which a current assessment develops. The Government of Guatemala approached ESMAP about conducting an assessment of the country's energy sector to complement its preparation of a national energy plan. Preparatory meetings were held in Guatemala with government officials and energy agencies and enterprises to familiarize them with the assessment process and to reach agreement on priority issues, the scope of the work, and the depth of analysis to be performed. It was an opportunity to confirm the commitment of the government, particularly the Ministry of Energy and Mines, to the assessment and subsequent follow-up. Part of the visit was dedicated to identifying counterparts and initiating data collection.

A pre-mission issues paper was prepared which further delineated objectives, subsectoral issues to be investigated, and types of consultants to be used and provided an outline for the assessment. An economist was sent to Guatemala to help gather information on identified issues as well as to construct and test a computerized model for Guatemala to enable linking of energy policies with macroeconomic variables.

In mid March 1990, the assessment mission was in Guatemala for a four week stay. With the arrival of a new government late in the year and its need for impartial input coupled with greater energy and environmental problems besetting the country, the assessment became more opportune.

A draft assessment report is currently being prepared. It will be based on the discussions, data collection, field observations, and the analysis of consultant reports. For Guatemala, two upstream and one downstream oil specialists, two power engineers/economists, an

The La Laguna combined cycle unit.



environmental/household expert, forestry/fuelwood specialist, and two energy economists were involved. Before it is finalized, the report will be discussed with the government. Necessary amendments will be incorporated, and an action plan jointly developed.

An Evolving Program

With the exception of Portugal, the early studies, while selective in scope and content, often provided across-the-board energy assessments. Today, an overall review of every subsector is not necessary.

Into the third year of the assessment program, the need for greater attention to the household subsector became profoundly evident. Although development of the energy sector generally means turning to conventional fuels, biomass and other traditional fuels remain the major source of energy in lesser developed countries. Without adequate attention to these fuel sources in national energy planning and decisionmaking, dramatic scarcity could lead to

irreversible damage. ESMAP has made the household subsector and nonconventional energy integral parts of every assessment.

There has also been a growing call for focusing on rural areas. The lack of resources in these areas cannot attract the degree of attention given to urban power shortages. To encourage developing countries to assess rural energy needs has become a priority in most assessments.

The emphasis on the demand side in assessments continues to burgeon. There has been more work done on demand management, particularly energy efficiency and conservation. Recommendations have concentrated on such measures as formulating national policies and programs, reducing power losses, and generating savings in the transport and industrial sectors.

Energy institutions in developing countries needed to be strengthened to initiate conservation programs. Moreover, many institutions required restructuring and the development of

The oilfields in the Peten region of Guatemala.



stronger managerial capability. Greater regard for institutional performance, therefore, persists.

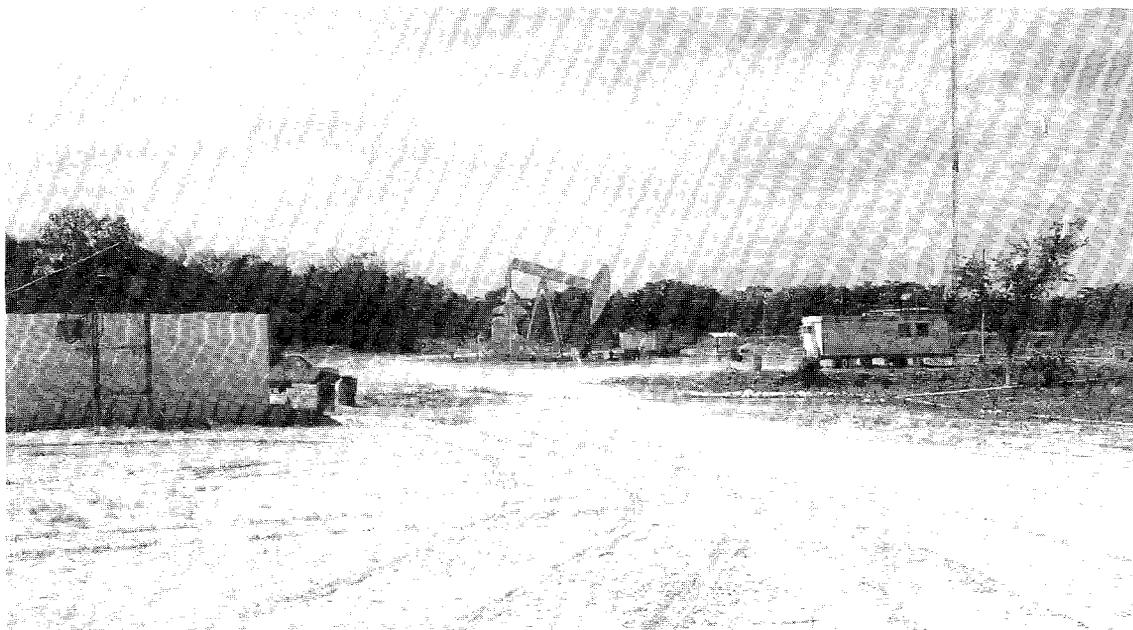
The consequences on the environment, health, safety, and quality of life in order to meet growing energy demands play a significant part in an assessment. While considering the impact of the energy sector has always been pivotal to assessments, more attention has been given to ensuring clear reflection in every subsector.

Again, Guatemala can be used to illustrate the current program, particularly the focus of assessments. A major objective of the assessment was to examine the energy/macroeconomic link; therefore, close attention was given to investment priorities and the impact of alternative pricing policies on public revenues, solvency of energy enterprises, and energy demand. Certain subsectoral issues in fuelwood, power, and hydrocarbons were selected as vital to the assessment. Demand management was a particular focus for these three subsectors. Another primary issue was energy institutions, their proficiency at policy development and operational planning.

The Guatemala assessment will be making recommendations concerning the current legal and institutional environmental framework. The assessment looked at legal ambiguities, institutional jurisdiction, protected areas in hydrocarbon rich areas, atmospheric emissions, powerplant effluents, road and maritime transport of crude and petroleum products, and deforestation. The assessment also examined safety in LPG production and transportation.

Some of the recently completed assessments can further exemplify the program's evolution. The Gabon assessment, which was completed in mid 1988, focused on the petroleum and electricity subsectors, which were the most affected by the oil price decline during the last decade. In the 1989 Angola assessment, only the issues of pricing, taxation and regulation of the industry were covered for the petroleum subsector, whereas all important aspects of the power subsector were addressed.

In addition to the two examples above on subsectoral focus, others can also demonstrate the course assessments have taken. The 1987



Sierra Leone assessment recommended better demand management by significantly raising power and petroleum prices and developing a cohesive demand management policy. The 1988 Congo assessment outlined a strategy aimed at strengthening energy sector management and identified institution building including planning and training in hydrocarbon production and distribution, electricity rehabilitation, and charcoal development and its production. Because the primary forest depletion in the Comoros has progressed to the point where the mountain tops are the only areas still exhibiting vestiges of original tree cover, the 1988 assessment recommended new legislation to involve the population in sound forestry and land conservation practices to be enforced on both private and state land.

Since ESMAP was conceived and continues to facilitate the implementation of recommendations made during the course of assessments, each one of the aforementioned program developments is reflected in the overall ESMAP program. Over the years, the quantity of demand

management, energy efficiency and conservation, household and rural energy strategy, institutional structure and performance, and environmental assessment activities have increased. This can be easily visualized in the functional categorization of ESMAP activities in Section IV of this report.

Assessments and Strategy Activities

The assessments are not without their limitations. Many proposed recommendations are costly and must be weighed with the demands of other sectors. Some recommendations can become obsolete quickly, particularly in response to swings in oil prices. Cultural and political situations, while taken into account in assessments, can make recommendations ineffectual. Assessments must rely heavily on available data with investigatory and research work often confined to limited country visits. The assessments cannot provide sufficient direction for developing a national energy strategy.

Nevertheless, the assessment program has



Tortillas being prepared on an improved stove in Guatemala.

been highly successful. The success can be measured by the demonstrated response of the recipient countries as well as the donor community and local and international investors with their follow-up to the assessment recommendations. But with 70 assessments completed or ongoing, there are fewer countries requiring and qualifying for assessment assistance. Countries which have been assisted are seeking help in formulating appropriate strategy based on the assessment recommendations.

The noted constraints have been minimized over the course of program development. To step beyond the assessments' policy oriented approach and further alleviate encumbrances, the program has migrated to a strategy oriented product.

The strategy activities are in many ways akin to current assessments. Whereas assessments will help developing countries in formulating coherent energy strategies, their main purpose remains to provide a snapshot of the energy sector and its major issues and options for future development. Like assessments, the

strategy activities were designed to provide guidance to governments in carrying out their policy decisions. Their major objective, however, is to evaluate previous policies, strategies, and commitments and to reorient energy policies and strategies so that they coincide with current and future sector needs as well as macro-economic objectives. While the assessments rely on input from the government, state enterprises, and local groups and consultants, the strategy work is developed by a national and international team.

The 1986 Colombia energy strategy paper inaugurated the new product. The exercise was carried out by a group of Colombian consultants in conjunction with ESMAP and World Bank staff. The resulting study delineated the implications on the sector of past policies and suggested a basis for which a strategy could be formulated. The interplay and contribution of Colombian and national experts led to a high quality product and an all-around commitment to formulate and implement policies.

By mid 1988, the first phase of an energy

The Texaco refinery in Escuintla, Guatemala.



strategy for Ecuador was completed. It provided short- and medium-term policy guidelines and defined the repercussions of its proposed measures on the economy. The National Energy Institute coordinated the study, which was prepared by a group of Ecuadorian and international consultants.

For Zambia, an energy assessment, status report, and energy strategy study have been generated. The strategy study, prepared jointly with the authorities, delineated energy policy and investment strategy through the year 2000. It identified priority investment for rehabilitating energy supply systems and conserving energy use. It also recognized key policy changes such as appropriate adjustment in energy prices.

Currently, there are energy strategy studies in Cameroon, Peru, and Zimbabwe. In Zimbabwe, there is a joint effort with the Department of Energy Resources and Development in carrying out an energy strategy evaluation that will determine investment requirements for the

next five years in the power, petroleum, and coal subsectors. The final strategy will focus on investment decisions, policy options, and institutional issues.

Zimbabwe and Peru are additional examples of countries where a strategy study followed an assessment. The strategy study for Peru will look at the macroeconomic consequences of energy sector reforms. The work is being performed with the recognition that none of the suggested reforms will be effective without an overall economic adjustment.

The strategy oriented work is an opportunity to work from the inside rather than the outside. It requires that the government and energy enterprises participate fully to ensure dedication, agreement, coordination, and follow through. ESMAP's strategy study experience has complemented and enriched the assessment program. Together, the assessments and the strategy studies continue to be a significant part of the backbone of ESMAP work.

Outside the LPG depot in Escuintla, Guatemala.



INDUSTRIAL BIOMASS RESIDUES AS ENVIRONMENTAL AND ECONOMIC ENERGY ALTERNATIVES

An increased rational production and consumption of agro-industrial residues can have a beneficial impact on a country's economic and environmental well-being. Due to carbon storage in its roots, sustainable harvest biomass is the only energy resource that has a net negative value for CO₂ emissions. Its use can reduce balance of payments burdened by oil imports, decrease open air burning of residues, require no additional land for plant construction, and contribute to better forest resource management. While industrial biomass residues as an energy source are not viable alternatives in all developing countries, with government policy incentives and private sector involvement, they are fuels that warrant more serious consideration.

Many developing countries face increasing energy demands to fuel their development programs. The major source of global CO₂ emissions is the energy sector which in LDCs is less efficient than in industrialized countries resulting in higher than necessary environmental pollution. Given global concerns over CO₂ emissions, it is surprising that biomass energy resources are scarcely used in commercial energy production processes. Biomass resources emit CO₂ when combusted, but renewable biomass recaptures the same quantity of CO₂ during its growing period. As a result, the net effect on the CO₂ present in the earth's environment is negative (Table 1).

Of all renewable energy resources,

biomass (ligneous and herbaceous crops and agricultural and municipal wastes) is potentially the largest, most diverse, and readily exploitable. Biomass residues are often available in large quantities, in particular, agro-industrial wastes.

Recuperation, more efficient production, and more rational use of biomass residues that are not used for other purposes could make many industries producing these residues energy self-sufficient as well as provide additional energy to the economy in general.

There are several economic benefits to biomass resources. The need for hard foreign currency in the debt ridden developing countries obliges them to look for indigenous, cost effective fuel substitutes that reduce the need for oil imports. Falling agricultural prices also en-

courage governments to increase the value added to their agricultural production through the conversion of its residues into energy. Furthermore, developing countries may find it difficult to obtain external financing for coal, hydrocarbon, and hydro energy projects.

If it is such a good idea to use biomass residues why has it not been used in a more systematic fashion and on a larger scale than is now the case? Some of the reasons are:

- Relatively low oil prices made alternative energy resources noncompetitive
- Agro-industrial crops are seasonal; therefore, their availability is sporadic
- Physical and chemical characteristics of residues for fuel are poor (low density, high ash content) and most require special handling and combustion equipment
- Logistical (handling, transport and storage) costs can be high due to remoteness of production sites vis-à-vis the potential market
- Availability of cheap, noneconomically priced woodfuels for energy purposes
- Lack of information, familiarity, and ex-

perience with biomass residues conversion technology.

The Energy Potential of Agro-Industrial Residues and Surplus Availability

This article considers only biomass residues produced by five agro-industries: sawmills, palm oil processing industries, and rice, coffee, and sugar mills. ESMAP has had significant experience with these agro-industrial residues and has solid data to make an economic and environmental case.

Converting the total available surplus of residues produced by these five industrial subsectors would produce 8000×10^6 GJ (giga-Joules: 42.74 GJ = 1 ton of oil equivalent (toe)) (Table 2). Palm oil processing generates four types of solid residues—empty bunches, fibers, shells, and debris. In addition, a large amount of organic material is produced on palm oil plantations. These include palm tree fronds (10 tons/hectare annually), which are available on a regular basis, as well as 75 t/ha/yr of tree trunks and 15 t/ha/yr of fronds which are generated during clearing and replanting operations.

Table 1

<i>CO₂ Emissions of Power Generating Technologies (tons CO₂ per GHw)</i>				
<i>Technologies</i>	<i>Fuel extraction</i>	<i>Construction</i>	<i>Operation</i>	<i>Total</i>
Coal plant	1.0	1.0	962	964
Oil fired plant	-	-	726	726
Gas fired plant	-	-	484	484
Geothermal steam	0.3	1.0	55.5	56.8
Large hydropower	NA	3.1	NA	3.1
Biomass (sustainable harvest)	-1509	2.9	1346.3	-159.8

Sawmills produce two types of residues—chips/sawdust and solid residues (slabs, off-cuts, rejects). Coffee mills produce one main residue, coffee husks, in addition to parchment. Rice milling generates three types of residues, rice husk (including straw and other dockage), bran (broken rice), and rice meal. Finally, sugar mills produce bagasse as their main residue. Generally only stalks are processed by sugar mills and produced as residue bagasse. Tops and leaves are often burned in the field, although their volume is twice that of bagasse.

Although the available quantities of agro-industrial wastes are considerable, not all are available for additional energy production. Some of the residues are already used to generate power and heat or are used for non-energy purposes. The remainder are treated as worthless refuse. In many countries, potentially valuable residues are unused and constitute an environmental hazard in the areas surrounding mills. Often, mills must pay for haulage to a disposal area. The disposal cost of sawdust in Ghana was estimated between \$80,000 and \$125,000 for 1986. Similar costs are incurred in the Côte d'Ivoire for the disposal of rice husks.

Direct use of oil palm residues is limited. Only plantation residues are directly and com-

pletely recycled to the soil. This is necessary for maintaining the soil humus content as well as for the recycling of plant nutrients. Empty bunches and debris could be used as soil conditioner, in mulched form or as a compost, but significant handling and transportation costs are involved and plantation soils have a satisfactory humus content due to undergrowth and dropped fronds.

Empty bunches usually are slowly incinerated in a primitive furnace or in an open field adjacent to the mill. Ashes are collected, bagged, and recycled to the plantations. The ashes contain 33 percent K_2O and 4 percent MgO , and as the oil palm crop requires a regular high dosage of potassium and magnesium fertilization, this procedure reduces the expenditure for chemical fertilizers.

While village women collect small quantities of the ashes for traditional soap production, palm oil mills often dump their wastes in the rivers. These factories not only forego a profitable activity but are a major source of environmental pollution. In Indonesia and Malaysia, palm oil waste is the most significant source (about 45 percent) of water pollution. In some countries, the palm oil mills use anaerobic digestion as a primary treatment of the effluents.

Table 2

<i>Annual Residue Production Level and Residue Energy Content</i>		
<i>Residue type</i>	<i>Quantity (t/yr)</i>	<i>Energy content (GJ/yr)</i>
Palm oil residues	1.955×10^6	25.4×10^6
Sawmill residues	700×10^6 m ³ /yr	7875×10^6
Coffee husks	2.1×10^6	35.3×10^6
Rice husks	80×10^6	80×10^6
Bagasse	261×10^6	8×10^6

However, in very few cases is biogas generated by this process used to produce power and/or heat.

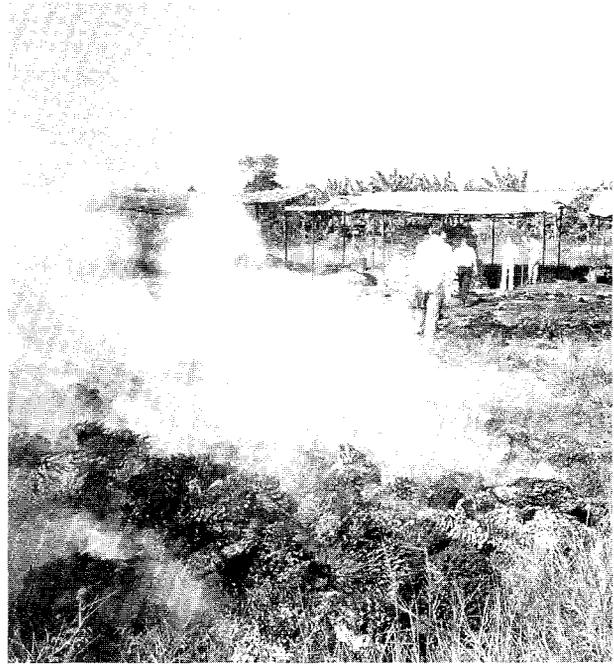
Most coffee mills do not use their residues for internal heat and power generation. While coffee residues are either dumped and incinerated, some are made into briquettes for sale in the household market. Some of the husks may be collected at no cost for soil conditioning purposes, for example, by the banana farmers of Côte d'Ivoire.

Many sawmills use part of the wood processing residues for internal steam and process heat raising purposes including cogeneration of steam and electricity. In Ghana, 27 percent of residues is consumed within the mills, while another 50 percent is sold for use outside the mills (charcoal, sawdust, briquettes). The balance is burned or dumped. The situation in the Côte d'Ivoire, however, is entirely different. There is hardly any off-site use of residues.

Most rice mills do not use their rice husks. Because they are too bulky to store, rice husks are usually burned on the spot or hauled to a disposal area for burning, sometimes at considerable cost. In some countries, char/ash is sold for use in a number of commercial operations and commodities such as sweeping and floor cleaning, fertilizer anti-caking agent, steel ingot insulation, mulch media for surface control, and filler material grit toothpaste. It is not clear, however, whether there is considerable scope for additional use of rice husk ash for these and other applications. The char/ash that remains often is an environmental hazard.

Sugar cane mills are designed to produce enough bagasse to be energy self-sufficient but sometimes require additional petroleum products. Small surpluses are usually sold as boiler fuel, while large quantities are used as feedstock for paper mills or to produce particle board and other cellulose products. Another application is the production of ethyl alcohol

While palm oil is being used in Côte d'Ivoire as an energy source, palm bunches are burned in the field.



through hydrolysis of bagasse, a process that is currently in the industrial development phase.

Energy Options for Residue Utilization and Improving Availability

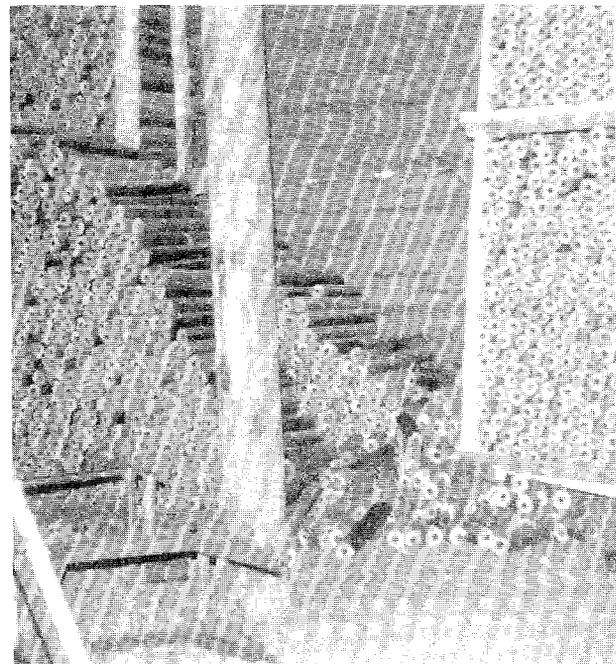
Residues can be used on-site or off-site. On-site utilization is limited to raising power and heat. Significant economic gain can be realized through on-site generation of process heat for drying and product treatment. Similarly, cogeneration of electricity, using residues, can be economically beneficial. Off-site utilization of residues include direct utilization of residues in various industrial oil-fired or wood-fired combustion systems, improved charcoal production, and production of briquettes or other densified materials.

The economics of substituting unprocessed residues for oil fuels in industrial or commercial combustion systems differ per country and per plant depending on oil prices and combustion

equipment. In Côte d'Ivoire and Mauritius, the highest internal rates of return were found in substituting fuel oil in industrial boilers. Similar conclusions were drawn in the case of Ethiopia. In Ghana, however, the use of unprocessed sawdust and solid residues as a substitute for oil was uneconomical.

Because current production systems are often inefficient residue producers and/or consumers, there is considerable scope for the production of additional quantities of agro-industrial residues. Expanding the supply of surplus residues requires an integrated three-pronged approach: (i) augmented industrial plant energy efficiency, (ii) increased steam and power production from a given quantity of residues, and (iii) higher energy value of residues through drying and densification. Making each plant more energy efficient requires an energy audit, a determination of possible residue savings and supply based on existing plant configuration, and analysis of the most

In Ghana, sawdust from the wood processing industry is made into fuel briquettes.



cost-effective modifications to each mill that would reduce energy consumption and increase surplus residue availability.

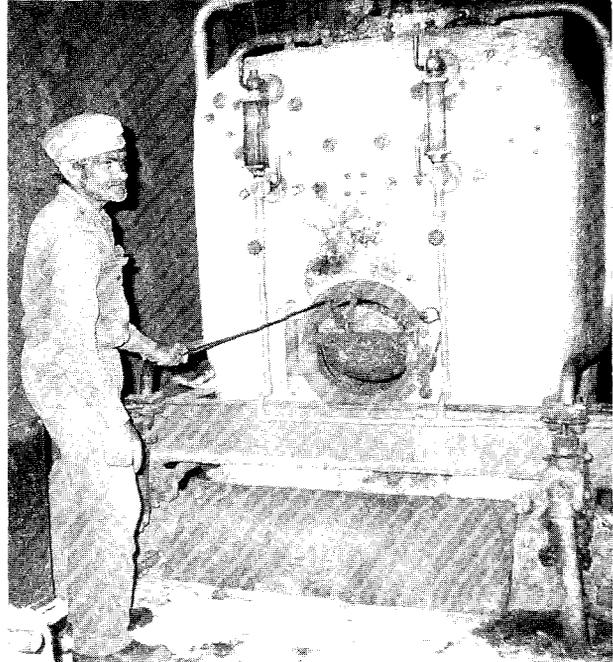
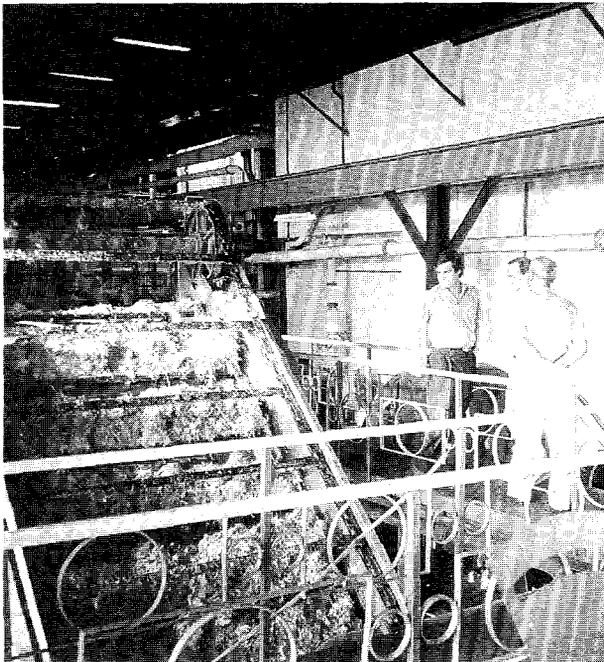
The problems of year-round availability and seasonality as well as of transport and storage cost can be reduced through drying and densification of the biomass residues. The resulting higher density of the residues not only permits long-term storage but will also make any mandatory transportation a more feasible option. Such densification and/or drying will even be necessary when these residues are converted on-site. Existing equipment for wood combustion is in most cases off-the-shelf technology with which the staff of the industrial producers of residues are quite familiar.

A look at the rice mills and sawmills gives a picture of technical options for improved residue availability. Rice husk utilization technology is dependent on the size of the milling operation. In all cases, the use of unprocessed rice husk is the cheapest solution. In large mills,

a fluidized bed combustion system seems to be the best solution to generate power for both on-site use and for sale to the grid. For medium-sized mills, fixed-bed gasification would seem to offer the best technical solution. For small village mills, there is as yet no good technical solution. However, small dedicated gasifiers are under development which may overcome the inadequacies of the current available systems. One such option is the ferrocement gasifier, developed in Thailand and successfully operated with charcoal. With Dutch financial assistance, ESMAP will try to adapt this technology for the use of rice husks at the village level in Indonesia.

Both sawdust and sawmill solid residues can be used to generate heat and power on-site and to the power grid. The use of screw press briquetting plants appears to be the best technical solution for loose sawdust. These briquettes can also be carbonized as a household fuel, a proven and widely practiced method in Japan

Bagasse drying and pelletizing plant in Mauritius. Baled bagasse used as a boiler fuel in a tea factory.



and Taiwan. Solid residues can be used for charcoal production, preferably using high efficiency kilns as well as firewood by households and commercial establishments.

Possible Impact on Selected Countries

As ESMAP has discovered from its various studies on biomass utilization, the potential role of agro-industrial residues will vary with the size of the energy sector and the availability of surplus residues in each country. In the Côte d'Ivoire, ESMAP determined that available selected agro-industrial residues can economically supply 151 GWh (236,000 toe) or almost 10 percent of Côte d'Ivoire's annual energy consumption. Since most residue end uses would substitute for petroleum based power and heat, nationally produced residues could replace a significant portion of fuel imports. The potential role of agro-industrial

residues can be even higher in the Côte d'Ivoire, because only three residues were taken into consideration—palm oil, sawmill, and coffee residues. The role of bagasse was not assessed, due to the uncertain future of the sugar industry in Côte d'Ivoire at the time of ESMAP's study. The potential role of other residues such as coconut husks, rubber trees, and cacao residues were also not considered, although all warrant further study.

In Mauritius, the potential role of bagasse was to substitute 55 GWh of the existing production of 390 GWh or 13 percent of total annual power consumption. Since the surplus bagasse would replace thermal capacity fired by imported coal, the environmental and balance of payments benefits are considerable.

The potential role of bagasse in India was studied by ESMAP in detail for the state of Maharashtra and in more global terms for India.

Coconut tree leaves stacked on the roadside in the Comoros and coconut husks being used for the distillation of ylang ylang.



The economic use of bagasse is respectively 100 MW for Maharashtra and 750 MW for India. This represents only 1.5 percent of total power consumption in India. However, the surplus bagasse would replace thermal coal fired power which would be environmentally more beneficial as well as help overcome chronic power shortages.

Finally, in Malaysia, the total potential energy from the solid residues of the entire palm oil industry has been estimated to be 1,126 GWh, which represents 10 percent of total electricity production in that country.

Constraints and Related Solutions to Agro-Industrial Residues Utilization

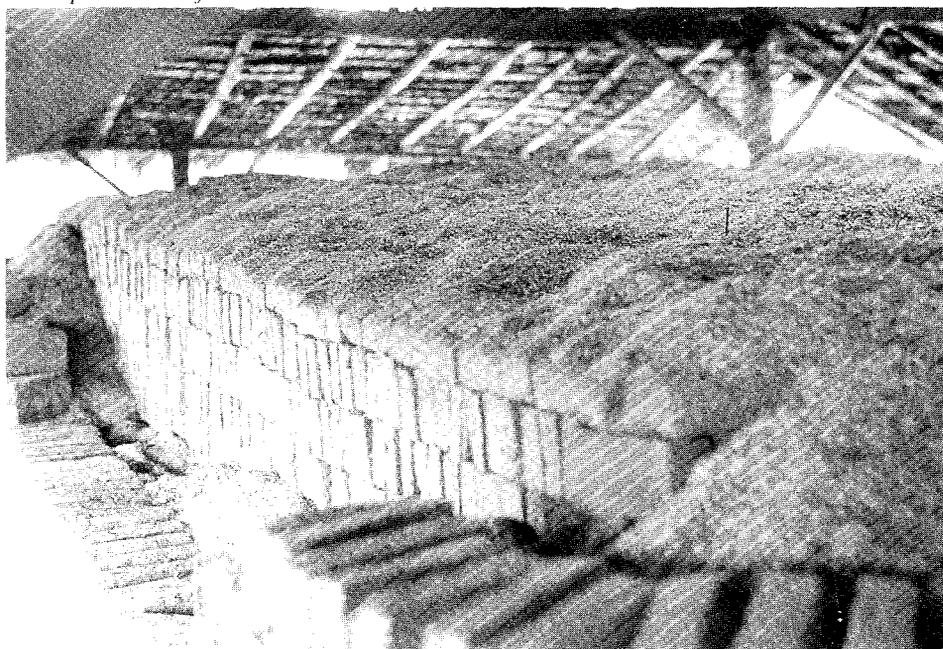
Despite the energy, economic, and environmental advantages resulting from the use

of agro-industrial residues, most countries do not yet avail themselves of these advantages. The reasons are three-fold. First, existing policies, both with regard to pricing and power generation, discourage investments in cogeneration. Even when governments adjust laws and allow or stimulate cogeneration, there are still institutional problems to overcome. In many countries, for example, the electricity tariff does not reflect long range marginal cost.

Second, the public and private sectors are often unaware of the feasibility of the biomass option. Third, even if they are aware of this option, energy officials and industrialists are wary to be an agent of change with a technology that is unknown to them, or worse, may have an unjustified bad reputation.

The above residues are produced by industries that are mostly owned by the private

Brick production from rice in Indonesia.



sector. Given the sizeable constraints on public sector investments there is a potentially greater role to be played in energy development by the private sector. Where local resources can be mobilized, the prospects of the private sector participating in the development and delivery of cost-effective commercial energy represent an alternative which can help satisfy national energy needs, promote regional development, and, at the same time, represent savings in public sector resources. There is a need to develop a framework for encouraging private sector investment in the generation of energy.

Willingness by the private sector to cogenerate electricity or produce other forms of energy such as briquetted boiler fuels will be influenced by three factors: potential profitability, availability of technical assistance, and access to investment capital possibly on incentive terms.

The profitability will depend on the changes in the price of alternative energy sources, in particular, petroleum products (diesel) and electricity. A downward change may reduce or

eliminate the economic benefits of cogeneration. The decision to begin a cogeneration program should be based on the existence of long-term negotiated contracts with the national power company for the purchase of electricity at a price above the marginal cost of its production.

Technical assistance will be required to train the staff of the factories concerned in the operation and maintenance of new equipment. This is needed to help overcome resistance to change and innovation as well as prepare the plant's technical staff for the new task ahead. In particular, the plants' staff need to be prepared for an additional dimension to their normal industrial operation, that of an energy producer. This requires that the cogenerating plant respects the requirements of the power company in terms of reliability of operation.

The risk involved in taking the decision to cogenerate needs to be minimized. Governments could provide incentives to those plants willing to participate in a cogeneration program with assistance in obtaining concessional loans as well

Collection of coffee and corn residues for household fuel in Ethiopia.



as by waiving import tariffs on energy equipment or granting a tax holiday to participating plants. Governments should formulate and carry out a clear energy policy that will provide the

framework in which cogeneration and production of biomass fuels will become an attractive option for agro-industries.

HELPING POLAND REFORM ITS ENERGY SECTOR

Never has ESMAP had so many activities ongoing in one country as it does today in Poland. ESMAP will be assisting the government in its efforts to increase the supply of natural gas and reduce the impediments to its use. The combined activities represent a large portion of the total work of the ESMAP Natural Gas Development Unit. The assistance being provided by ESMAP's Energy Efficiency and Strategy Unit, focuses on restructuring of the coal, power, lignite, and district heating industries.

Poland is in the midst of a major internal reform program designed to address the country's severe economic problems. The energy sector is one of the largest sectors in the Polish

economy and is a natural focus of attention. In the context of preparing a significant energy resource loan signed by Polish authorities and Mr. Conable, President of the World Bank, in Warsaw in June, government representatives and the World Bank identified the need for a number of energy sector studies. The Ministry of Industry, which has been given the task of defining a program for the revitalization of the energy sector, asked the World Bank to assist in the preparation of these studies through the ESMAP program. The requested studies will address several issues in the natural gas sector and the restructuring of the coal and power industries.

Natural Gas

Many of the Polish Government's planned initiatives in the energy sector are directed toward the increased production and use of natural gas. Natural gas is Poland's second

largest domestic energy resource, but it remains largely untapped due to a shortage of investment funds and inadequate incentives to explore for and develop new gas supplies. At the same

time, gas demand, while growing steadily in recent years, has been inhibited by a cumbersome central allocation system and a traditional emphasis on coal. The government hopes to reverse this situation, and the ESMAP gas studies underway are expected to play a key role. There are five ongoing ESMAP natural gas activities: the natural gas development plan, environmental assessment, pricing and tariff study, restructuring study of the Poland Oil and Gas Company (POGC), and legal and contractual framework study and training program.

The *natural gas development plan* will examine, in detail, patterns of gas supply, demand, transmission, and distribution. Recommendations will be made on investment priorities and strategic options.

Domestic gas production has declined rapidly, from an annual rate of 8.0 billion cubic meters in 1978 to 5.4 billion cubic meters in 1988. Currently, 56 percent of Poland's total gas supply is imported from the USSR. The World

ESMAP Activities in Poland

Natural Gas Development Plan
Environmental Assessment
Natural Gas Pricing and Tariff Study
Restructuring Study of the Poland Oil and Gas Company
Legal and Contractual Framework Study and Training Program
Restructuring Program for the Hard Coal Subsector
Restructuring Programs for the Electricity, Lignite, and District Heating Subsectors

Bank's energy loan is premised on the belief that domestic natural gas production can be sharply increased with appropriate investments in new technology and equipment. Given Poland's high prospects for natural gas, more intensive exploration efforts applying current technology could add significantly to gas reserves. Increased demand could require both increased domestic production and additional imports of gas. With respect to the latter, it will be important to develop alternatives to existing import sources.

The natural gas development plan will:

- Evaluate existing gas resources and the potential for reserve additions;
- Assess production potential, profiles, and costs;
- Appraise import options;
- Determine the economic value of gas in different uses and the potential for changes in gas demands by consumer groups;
- Examine the potential for improvements in the efficiency of Poland's gas transmission system; and
- Prepare a plan for investment in the op-

timal development and use of gas, including recommendations on the sequencing and financing of investments.

As a complement to the natural gas development plan, ESMAP was asked to conduct an *environmental assessment*. This study will address the environmental costs and benefits of alternative sources of energy, including natural gas.

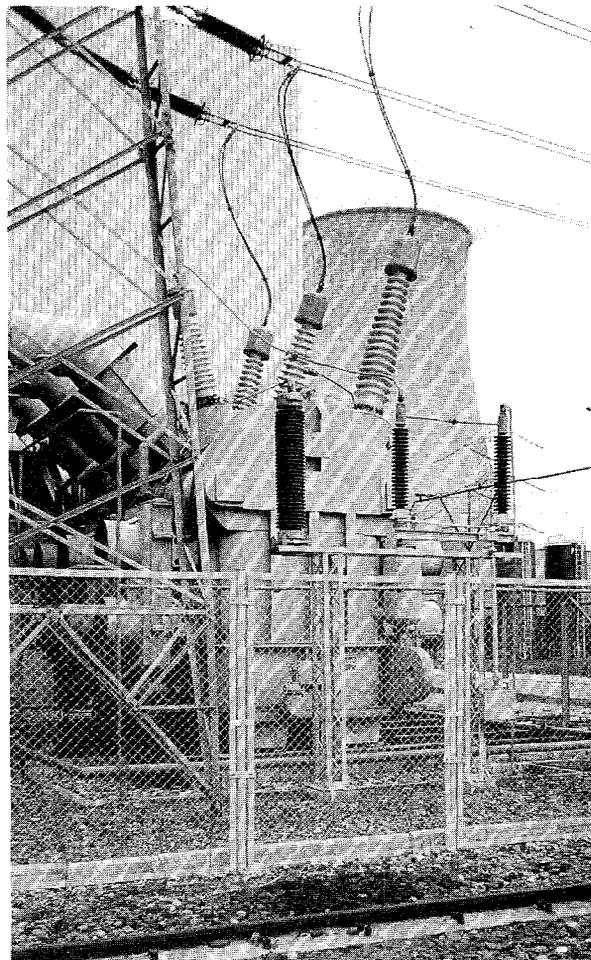
Appropriate gas pricing and tariff policies will be fundamental to the development of an expanded gas subsector in Poland. Currently, gas prices to consumers are centrally determined and are not related to cost. They bear little relation to the value of gas to consumers, the prices of alternative fuels, or the marginal cost of the gas consumed. For all consumer groups, prices are significantly below international border levels. The consumer pricing system is very complex, and administration is correspondingly difficult. There are no explicit producer prices or transmission/distribution tariffs in Poland since these functions are controlled by POGC, which is also responsible for final delivery of gas to consumers. This pricing system not only has resulted in major inefficiencies in the allocation of resources to production and in the use of gas but has also caused financial losses for POGC.

The *natural gas pricing and tariff study* will address a number of crucial issues. The study will begin with a critique of existing pricing. There will be recommendations made regarding efficient gas pricing by consumer category and location and on appropriate tariffs for the transmission and distribution of gas. There will also be recommendations on the future pricing of imports from various sources. A plan for transition from current prices to optimal prices, taking into consideration the price level of other fuels and the need for equity, will be developed. An assessment will be conducted on the impact of current and future pricing on the financial viability of POGC. Finally, recommendations will be made for the simplification and improvement of the administrative and regulatory framework for gas pricing.

Meeting the challenges of improved natural gas production capability, increased inputs, demand, transmission, and distribution requirements in Poland will require a significant restructuring of the gas sector and POGC in particular. Today POGC, headquartered in Warsaw, is a vertically integrated structure with 22 semi-autonomous companies engaged in all aspects of the oil and gas business—exploration, production, transmission, distribution, manufacturing, and engineering. The level of state supervision and intervention is high.

To prepare POGC for a dramatically changed environment, the *restructuring study of the POGC* will:

- Critically review the existing structure management and procedures of POGC and of the overall sector;
- Evaluate alternative organizations, including options involving the private sector or outright privatization, and make recommendations;
- Recommend improvements in management techniques, accounting, planning and financial functions, and staffing procedures;
- Recommend new sources and procedures for financing projects; and



The Bełchatów power station, the largest powerplant in Poland, is fuelled by lignite.

- Provide a detailed plan for phased implementation of recommendations on restructuring.

The Government of Poland is keenly interested in attracting private sector funds and technology to the domestic gas sector. To do this, it will have to establish an appropriate legal and contractual framework for investments.

The *legal and contractual framework study and training program* has four major objectives. It will develop an internationally acceptable legal and contractual framework including a hydrocarbons law and a model contract between

the state and private parties for hydrocarbon exploration and production. Particular attention will be given to provisions relating to gas and to the elaboration of specific gas agreements such as a model gas sales agreement. Recommendations will be forthcoming on an appropriate fiscal and financial framework, addressing the need, if any, for additional resources including new taxes and such specific investor needs as stability and the right to freely convert and repatriate profits. There will also be training

relevant to the framework including contract negotiations.

The gas development plan, gas pricing study, and the POGC restructuring study began in mid May. Preliminary results and reports were presented to Polish officials and ESMAP in Warsaw in mid July. The legal and contractual study was underway by mid summer. All studies will be completed, following a series of reports and meetings among consultants, the government, and ESMAP, by mid November.

A Restructuring Program for the Hard Coal Industry

The restructuring project will concentrate on creating favorable conditions for the development of the coal industry by addressing the main issues affecting the subsector, namely:

- **Production** *Studying the economics of the coal industry and identifying mines that are clearly uneconomical and should be phased out, mines that are potentially economic and should be the target of cost reduction programs, and the investment program for maintaining economic production in the long run.*
- **Organization** *Improving the subsector organization to promote efficiency through such measures as divestiture of manufacturing and services and merger or regrouping of coal mining activities.*
- **Finance** *Ensuring that coal mining and associated enterprises will be able to run their operation on a financially sound basis and to mobilize capital resources both from internal sources and local and international capital markets.*
- **Labor Force** *Ensuring that the enterprises will be able to adjust their work force to their needs, attracting and retaining skilled human resources at all levels through competitive wages and benefits, and establishing adequate arrangements for reallocating workers.*
- **Prices** *Proposing a timetable and steps for an orderly transition from regulated and subsidized prices to market determined prices to encourage the efficient use of coal.*
- **Environment** *Improving environmental protection through appropriate regulations and investments.*
- **Regulatory/Legal Framework** *Changing legislation and regulations, where needed, to allow the efficient functioning of the coal industry.*

Coal

The Polish authorities recognize that a broad ranging review of energy sector institutions is required to promote efficiency and accountability and to mobilize the needed investment finance against a background of rapid economic reform and severely constrained resources. The ESMAP program is currently assisting Poland in its restructuring with studies for the coal, power, lignite, and district heating industries.

The Polish hard coal mining sector is a mainstay of the national economy, providing the country's largest single export product (currently 12 percent of total exports) and contributing a significant share to GDP (13 percent) and national employment (about 5 percent). About 190 million tons per year of relatively good quality steam and coking coal are produced which find a

ready market domestically and internationally. However, the sector increasingly suffers from serious problems, including deteriorating geological conditions, high cost mines, low prices, considerable subsidies, lack of funding for investments, and growing public concern about the industry's negative impact on the environment.

Pragmatic steps are needed to promote efficiency and competition. There appears to be a prima facie case for considering the decentralization of the hard coal subsector, but the optimal grouping of mines into independent and competing companies, the transitional arrangements, and a program to alleviate social consequences need careful consideration. Divestiture of manufacturing and service companies in all energy subsectors could be desirable in an improved economic environment. A clear regulatory framework is needed for the public

The Bełchatów lignite open cast mine is one of the largest lignite mines in the world.



utility subsectors to define obligations related to sales, customer relations, quality of supply, obligations to serve, competition, pricing, etc.

ESMAP is supervising a consortium of consulting companies which are presently in the field. Their purpose is to prepare a program for the restructuring and institutional reform of the hard coal subsector. The main objectives of the study are to assist the ministry in (a) maintaining, to the extent possible, net convertible foreign exchange earnings from hard coal exports; (b) producing coal efficiently and encouraging the efficient supply and use of coal in domestic markets; and (c) controlling environmental damage caused by coal mining.

Power/Lignite/District Heating

In 1989, the installed electricity generating capacity in Poland amounted to 31,996 megawatts, about the same as in Sweden. Losses in distribution and transmission networks are high at around 11.8 percent and have been rising from about 8.5 percent in the 1960s. Other indicators of power system efficiency—plant availability, reliability of supply, labor productivity—have also shown a downward trend.

Lignite production in 1989 was 72 million tons. The giant Bełchatów open cast mine alone produces 38 million tons per year. Most of the lignite is consumed by the power subsector in generating plants situated at mine mouth, constituting a relatively inexpensive fuel when environmental costs are not considered. However, lignite mining in Poland has environmental impacts on land use, ground water, surface water, air quality, and noise. New environmental standards will also affect lignite use by requiring flue gas desulphurization at power stations and the avoidance of toxic wastes from lignite drying.

Steam and hot water, much of which is piped from central heating stations, account for more than 20 percent of final energy consumption. The proportion of heat produced from com-

bined heat and powerplants, which is effectively the recovery of part of the waste heat inherent in thermal electricity generation, has been increased steadily to 62 percent of total heat production. Although precise figures are unavailable, heat losses in district heating networks are believed to be high, at about 50 percent, because of leakage, corrosion, and damaged insulation. Operation of heat production facilities does not make use of modern controls and much consumption is unmetered. Plant breakdowns have occasionally left households with inadequate heat in winter.

The Government of Poland proposes major institutional changes to improve the electricity, lignite, and district heating subsectors. A consortium of consulting companies is presently in Poland to study and prepare a program for restructuring the three subsectors.

The restructuring program will concentrate on promoting the efficient and reliable energy supply and efficient use of energy. It will also try to ensure that the public utilities have clear objectives and adequate autonomy and can be held accountable. The mobilization of adequate internal and external financial resources, including those from local and foreign private sources, will also be a focus as will reducing the environmental, health, and safety impacts of energy production and use at acceptable cost. Finally, very important to the program will be developing the capability within Poland for the analysis of such issues.

Consultants are in place for the hard coal and power/lignite/district heating restructuring studies. As agreed, both studies are being developed in two phases. A first phase will evaluate the options for the institutional structure for each subsector, which will conclude with a workshop to discuss the interim report with the Ministry of Industry. A second phase will develop and detail the structures selected by the Polish authorities, including recommendations for their implementation.

III

Implementation of ESMAP Recommendations

Primary responsibility for coordination of follow-up action to ESMAP recommendations rests with the government concerned. In the case of some activities, public or private sector investors can orchestrate follow-up. ESMAP can assist governments by informing potential investors of opportunities that emerge from program activities.

Section III lists three classifications of implemented follow-up to ESMAP recommendations, providing readers with some insights, both quantitative and qualitative, into the role that ESMAP has played in assisting governments. First, the latest figures are presented by region on the total value of follow-up investments and technical assistance recommended by ESMAP, funding secured, and funding still being arranged. These figures indicate

that over US\$800 million of investments recommended by ESMAP have already been funded, with funding currently being arranged for a further \$2.8 billion. Second, for 21 activities undertaken in the past two years, descriptive information is given on key ESMAP recommendations which have been implemented. Third, in six of the countries in which ESMAP has been most active, a listing is given of major recommendations arising from ESMAP strategy and policy studies and the status of follow-up action.

Section III concludes with information on follow-up opportunities recently identified by ESMAP for which the governments concerned are still seeking financing.

FINANCING OF RECOMMENDED INVESTMENTS AND TECHNICAL ASSISTANCE

Data on follow-up investments and technical assistance presented in the table below was gathered by ESMAP staff with the help of World Bank regional offices and UNDP representatives. The data is not fully comprehensive, since it is likely that not all investments undertaken by the private sector have been included in the table.

The table covers over 100 activities undertaken since 1984. The investments range from US\$50 million for power efficiency improvements in Bangladesh to \$95,000 for a solar water heating retrofit scheme in Gambia. The table presents by region the total estimated cost of recommended investments and technical assistance and identifies amounts already funded, funding currently being arranged, and amounts for which funding has not yet been identified.

All amounts are presented in millions of US dollars.

	Identified Follow-up	Funded	Funding Being Arranged	Opportunities Remaining
<i>Sub-Saharan Africa</i>	4,092.45	458.8	140.65	3,493.0
<i>Asia and the Pacific</i>	1,012.30	220.2	742.50	49.6
<i>Europe, Middle East and North Africa</i>	2,316.80	37.0	1,295.00	984.8
<i>Latin America and the Caribbean</i>	1,692.10	85.7	676.10	930.3
TOTAL	9,113.65	801.7	2,854.25	5,457.7

LATEST IMPLEMENTED RECOMMENDATIONS

Presented below is a sampling of recent follow-up to ESMAP recommendations.

Ghana

Industrial Energy Rationalization Study Phase I

Under the activity, energy audits were carried out in three industrial firms. The annual energy conservation potential was evaluated at about \$450,000. The firms have started to implement recommended measures. One has already saved about 30 percent on its energy bill. Over the next year, the firms are expected to save a total of up to \$350,000 per annum amounting to some 30-40 percent on their energy bill with an investment cost of less than \$250,000. The activity's technical services were provided by an international consulting firm in association with a local firm and individual Ghanaian consultants. The local expertise (about 50 staff/weeks) amounted to roughly half of the total expertise involved in the activity. The Ghanaian consulting firm is now supplying energy conservation services to industrial firms and to the National Energy Board of Ghana.

Haiti

Assistance to the Energy Sector

In late 1989, ESMAP began a household and biomass energy strategy study in conjunction with OLADE (Latin American Energy Organization) and UNDP. At the same time, a forestry and environmental protection project was being prepared by the government. Through sharing of data, reports, and staff, ESMAP was able to design a \$725,000 energy component for the IDA credit. This component seeks to promote more efficient cooking equipment.

Mauritania

Household Energy Strategy Study

The activity to design a household energy strategy for Mauritania was considered as a priority area for improving the energy situation in the country. The operational division of the World Bank has included three components of the ESMAP recommendations (a total of \$440,000) in a newly appraised Technical Assistance Credit to the Government of Mauritania. There are three components. The first is to accelerate the use of LPG. Based on a market study for LPG, a development plan will be prepared to attain the projected levels of LPG utilization. Further technical assistance would be provided with special emphasis on maintenance and security issues as well as training for staff. A publicity/sensibilization campaign will be organized to promote the safe use of LPG throughout the country. The second component calls for disseminating and commercializing the use of improved charcoal stoves. Until now, improved charcoal stove activities have been research oriented. This should move toward a commercial approach to disseminate these more efficient stoves as quickly as possible. The proposed activities include hiring a local technical specialist to provide technical and financial assistance to existing stove producers/artisans and to launch promotional activities which could be linked with similar activities under the LPG component. The last component will seek to strengthen the "Direction de l'énergie". This consists mainly of technical assistance to improve the in-house planning and analytical capacity and providing logistical support.

Senegal

Industrial Energy Conservation

Under ESMAP sponsorship, 25 in-depth energy conservation audits of Senegalese industrial firms have been conducted. A recent assessment shows that the industrial firms have effectively followed up on the recommendations. The implementations have resulted in over 45 percent conservation realized at financially profitable conditions.

Tanzania

Industrial Energy Efficiency Technical Assistance

The activity was designed to assist the government in improving the energy efficiency of Tanzania's industrial sector through institution building, training, and energy audits. ESMAP staff and consultants paid two visits to the country during October/November 1989 and May/June 1990 to carry out ten walk-through energy audits and two detailed audits of industrial firms. They also conducted two seminars for senior government officials, and industrial specialists from the parastatals and private sectors, and development banking specialists. As a part of the activity, engineers from the Tanzania Industrial Research and Development Organization (TIRDO) were sent to the industrial energy efficiency training course in April 1990 in Sweden.

IMPLEMENTATION OF RECOMMENDATIONS IN SELECTED COUNTRIES

Over the last year, ESMAP has been reviewing its policy and strategy work in 25 of the countries in which the program has been most active with a view to identifying implemented investments or policy changes which were recommended by ESMAP.

A selection of findings from this review are summarized below for a sample of six of these countries (two each from sub-Saharan Africa; Europe, Middle East and North Africa; and Latin America and the Caribbean). The lists of recommendations and follow-up are not comprehensive nor are they presented in any order of priority. There is no intention to claim that the follow-up actions listed took place solely as a result of ESMAP's recommendations. Rather, the aim is to illustrate the correlation between the recommendations and subsequent activities.

COTE D'IVOIRE

Issues and Options in the Energy Sector (April 1985)

Recommendation: *Expand the hydrocarbon reserve base, encourage continued exploration efforts, and design a long-term hydrocarbon production program.*

A long-term hydrocarbon development policy and production program was never designed because the Ivorian continental shelf turned out to be more difficult to exploit than expected. During the second half of the 1980s, oil exploration and drilling came to a virtual standstill. With the collapse of world oil prices, exploitation of the country's small, fragmented deep water oil fields became financially unattractive. Crude oil production declined rapidly. Exxon announced the closing of the Belier field in early 1989. In the December 1989 \$100 million energy sector adjustment program, the World Bank provided for, *inter alia*, the development of a new contractual framework for hydrocarbon exploration and development for the current environment. The government currently has a promotional campaign to resume oil exploration. A consortium of international oil companies recently announced that a new offshore oil and gas field would be developed on the basis of the revised fiscal terms.

Recommendation: *Perform a management audit of the Société Ivoirienne de Raffinage (SIR) refinery which includes economic viability and constraint assessments and a comprehensive evaluation of restructuring options.*

The government undertook a diagnostic study of the refinery in 1986. An organizational restructuring of the SIR operation was carried out in 1988. Surplus capacity was reduced through the closure of an 800,000 tons per annum distillation unit, and further diversification of exports increased the utilization of the remaining capacity. The SIR took over procurement and marketing activities from the Société Nationale d'Opérations Pétrolières de la Côte d'Ivoire (PETROCI), and

refinery management was streamlined. Staff was reduced, and improvements were made in budgeting and cost control.

Recommendation: *Design strategies to prevent power shortages.*

A number of approaches were adopted to prevent the power shortages caused by prolonged periods of drought. The rehabilitation needs of the Vridi steam generation plant were addressed by an ESMAP power system efficiency study in 1987, which also covered distribution losses. The diagnosis of Vridi subsequently became EECI's guideline to implement a major program of repairs that is still in progress. Presently, ESMAP is engaged in an energy sector technical assistance activity which is oriented to improving the efficiency of EECI. The work will concentrate on network rehabilitation, power flow management, hydroelectric reservoir optimization, training, and planning. The total cost is \$3 million, and CIDA (Canadian International Development Agency) is financing the project. Following a World Bank financed study of power system operation and expansion, EECI has resumed multiannual operation of hydro storage to ensure security of supply.

Recommendation: *Maximize exploitation of existing gas reserves as a feedstock for power generation before engaging in new capital investments in hydroelectric facilities.*

During the mid 1980s, gas exploitation plans were adjusted because lower oil prices dampened the government's earlier desire to substitute gas for oil to fuel power generation. Because of declining oil production, there was marked downturn in the utilization of associated gas. After several years of negotiations on development of the offshore Foxtrot gas fields, the leader of the consortium withdrew in early 1989. Subsequently, the government has sunk a delineation well in Foxtrot to evaluate known deposits.

Recommendation: *Promote the use of woody biomass wastes.*

This particular issue has in part been addressed by the ESMAP study on utilization of agro-industrial residues which was published in 1987. The activity included projects to use wood, palm, and coffee residues. The government is still considering other options as part of a national biomass study. An example of a multilateral effort was the 1987 ILO (International Labour Organisation) project, New and Renewable Sources of Energy in Rural Communities. Resources were made available to investigate the role of, *inter alia*, biomass residues in energy generation.

Recommendation: *Develop an integrated fuelwood and forestry policy which involves regional strategies and management.*

The government elaborated a number of forestry policy initiatives. In 1987, the government announced that it planned to accelerate the reforestation program. It declared 1988 the year of the Ivorian forest and announced a ban on timber exports to take effect once its finances improved. As part of this policy, the government launched an education campaign in 1989 to increase awareness among rural dwellers of the dangers of uncontrolled felling of trees. Previously, the government had introduced a plan to withdraw forestry licenses from nonviable logging firms.

Recommendation: *Study energy efficiency in industry and public lighting and promote high efficiency air conditioners and discourage use of other cooling systems.*

Energy inefficiencies are being tackled in a number of ways. ESMAP's current energy sector technical assistance activity, for instance, includes a proposal for improving energy efficiency in modern buildings. Some of the components such as training, preparation of regulations, appliance labelling, and preparation of various energy efficiency standards will be implemented with the aid

of ESMAP. Another example is support by the Government of France for the creation of an energy conservation organization. The project cost \$133,000.

KENYA

Issues and Options in the Energy Sector (May 1982)

Recommendation: *Realign diesel and other petroleum fuel sales taxes and prices.*

In dialogues between the World Bank and the Kenyan Government during the first half of the 1980s, the government was encouraged to pursue a pricing and taxing policy designed to reduce the distortion between retail prices for gasoline and diesel oil. The Ministry of Finance has, in the meantime, incorporated a pricing formula into the annual budgetary process and continues to work on its pricing policies. At the beginning of 1988, the World Bank tabled the outline of its Energy I project for the fiscal 1992 lending year which includes a comprehensive pricing study for the energy sector. The study will recommend pricing policies for electricity, petroleum products, and household fuels.

Recommendation: *Perform a power generation cost benefit analysis.*

Power generation cost benefit analysis became a part of the 1987 ESMAP power master plan. The plan recommended \$7.5 million in investments in support of a national power generation and transmission strategy covering the period 1986-2006. It identified the general direction that investments should take and specific projects to meet anticipated growth in power demand in the short-term. The proposed World Bank Energy I project also includes plans to assist Kenya in expanding its generating capacity at least cost through utilization of indigenous hydro and geothermal energy resources.

Recommendation: *Defer ethanol investments until a detailed cost-benefit analysis has been prepared.*

In 1984, the government halted all new investments in ethanol production facilities. The Kenya Chemical and Food Corporation (KCFC) plant was put into receivership, but no liquidation took place. The Riana plant proposal for the Lake Victoria area was shelved.

Recommendation: *Study the potential of bagasse, wind, and biogas energy.*

The potential contribution of these renewable energy resources has been addressed by numerous bilateral and multilateral agencies. A component of the 1984 "Special Energy Project" financed by the German Agency for Technical Cooperation (GTZ-SEP), for example, involved the allocation of funds for wind, biogas, and solar technologies for rural applications.

Recommendation: *Expand geothermal exploration at Olkaria, Eburru, and Lake Bogoria.*

Geothermal exploration and development has been an ongoing activity. The 1983 World Bank follow-up project to the first 1978 Olkaria geothermal engineering project covered technical assistance. Moreover, exploratory drilling began in 1986 in Olkaria West where the Kenyan Power and Lighting Corporation (KPLC) hoped to find better reservoirs than in Olkaria East. The government also began exploring Eburru to spread investment risks, with the Ministry of Energy

and Regional Development (MOERD) looking at additional sites in the Central Rift Valley. By 1986, the development of Olkaria East was nearing completion. The KPLC intended to monitor reservoir performance over a number of years before making a decision on production expansion by drilling new wells. That same year, the national power development plan for 1986-2006, prepared with the assistance of the UNDP, ESMAP, and the World Bank, identified geothermal generation as the least cost form of energy available in Kenya by a significant margin. The plan was designed to increase the share of geothermal supply from 8 percent in 1988 to about 21 percent by 2006. The government continues to develop geothermal resources and powerplants.

Recommendation: *Develop and promote a comprehensive solar water heating program.*

In 1983, a survey of the quantity and performance of solar installations in use in Kenya was carried out. The project was funded by the World Solar Power Foundation and the World Wildlife Fund. That same year, a solar water heating market study was carried out by the University of Western Ontario and Ontario Hydro. The aforementioned 1984 GTZ-SEP project also allocated resources for the establishment of local manufacturing facilities for solar collectors. ESMAP's 1987 solar water heating study evaluated the potential for substituting solar water heaters for electricity in all end use sectors. The study cost \$80,000 and was financed by DANIDA.

Recommendation: *Examine the prospects for increased commercialization of fuelwood and charcoal production through major peri-urban and rural plantations, a centralized charcoal corporation, and decentralized carbonization cooperatives.*

During the first half of the 1980s, the government requested technical assistance to design investments in peri-urban plantations, to better manage recovery of woodfuels from existing resources, and to examine prospects for improving the efficiency of carbonization. A preliminary design and costing of plantation development for a range of ecosystems near major demand centers was completed by the Stockholm Environmental Institute (formerly the Beijer Institute) in 1984. Other bilateral and multilateral organizations also pursued fuelwood projects. The Japanese Government, for example, was active in Kitui, the FAO (UN Food and Agriculture Organization) set up projects in semi-arid areas near Baringo, the ODA (UK Overseas Development Administration) was present in Isiolo, USAID (Agency for International Development) launched agro-forestry centers in various parts of the country, and CARE (Committee for American Relief Everywhere) pursued agroforestry activities in the Western Lake region around Kisumu. In addition, the International Council for Research in Agro-Forestry (ICRAF) set up its headquarters in Nairobi with an outstation in Machakos.

In 1987, ESMAP published the peri-urban woodfuel development activity. The activity was partly financed by the Netherlands. Approximately \$7.5 million in investments were recommended to meet the growing need for charcoal in major urban centers. The study recommended setting up about 100,000 hectares of fuelwood plantations or woodlots established inside existing government owned forest reserves situated closest to the townships and production from about 200,000 hectares of woodlots farms. Financing has, as yet, not been secured, but the World Bank is planning to undertake a comprehensive review of support for the forestry sector. No action has been taken on the creation of a parastatal centralized charcoal corporation.

Recommendation: *Improve charcoal demand and supply data.*

Despite numerous attempts to survey charcoal demand and supply flows, there has not been continuous monitoring of charcoal market developments. The most recent studies indicate that there has been a shift toward more charcoal production with wood grown on woodlots.

Recommendation: *Perform a power sector efficiency audit, undertake a distribution loss reduction project, and complete the Kipevu steam plant rehabilitation program.*

One of objectives of ESMAP's 1984 power system efficiency study was to define measures to implement cost effective modifications to system facilities, operations, and construction modifications that would improve technical efficiency and reduce losses. About \$11 million in investments were recommended to address these issues and rehabilitate the Kipevu steam plant. The rehabilitation of the Kipevu powerplant in 1986 was supplemented with the installation of a 30-35 megawatt gas turbine generator.

Recommendation: *Complete the East African Portland Cement Company, Ltd. oil substitution operation.*

A feasibility study of converting both from fuel oil to coal firing and from wet to dry processing was carried out for the East African Portland Cement Company. The study was completed in 1983 and funded through a grant from the Norwegian Government through NORAD.

Recommendation: *Examine conversion to coal in industries other than cement.*

In 1987, ESMAP completed the coal conversion action activity. The activity's objectives were to identify imported coal fuel substitution options for industry and identify cost effective opportunities for industrial energy conservation. The study was financed by the UNDP IPF, and cost about \$31,000.

Energy Assessment Status Report (June 1984)

Recommendation: *Strengthen the Ministry of Energy and Regional Development and allow its mandate to include all energy related programs.*

Although the creation of MOERD in the early 1980s was an important step in organizing sector activities, there was still a need to define overall priorities in sector development and coordinate activities with bilateral and multilateral agencies. The World Bank has made a continuous effort to assist MOERD in this matter. The 1984 Olkaria geothermal project, for instance, aimed to strengthen the geothermal capability of the ministry. MOERD also received training and institutional support under the 1985 World Bank petroleum exploration promotion project. In addition, the proposed World Bank Energy I project will have a study component for human resource and institutional development and investment planning.

MOROCCO

Issues and Options in the Energy Sector (March 1984)

Recommendation: *Continue to focus on gas exploration, appraisal, and development.*

The second half of the 1980s saw a continued policy orientation toward the development of Morocco's gas reserves. There were some minor setbacks such as the 1985 ONAREP (National Office for Petroleum Exploration and Development) announcement that after evaluating test wells drilled in the Essaouira gas field, it would move ahead with only limited development of the field. ONAREP had been forced to scale down estimates of proven reserves to roughly 3,000 million cubic meters, of which only 40 percent was recoverable. Nevertheless, in August 1987, the Moroccan Government announced that, within the context of the Moroccan-French Protocol of December 1983, well development in the Mescala area would continue to be supported by the construction of a gas treatment plant at the Essaouira field. The \$6.3 million project was designed to separate gas and condensates. One month later, in September 1987, ONAREP announced a gas discovery in an exploration well drilled at Oulad Mrah, near Kenitra. Initial estimates put reserves at "tens of millions of cubic meters". Improvements to Morocco's gas infrastructure are also on the drawing board. Discussions are underway between Algeria, Morocco and several European countries for the possible construction of an Algeria-Morocco-Spain natural gas pipeline. A company jointly owned by Morocco and Algeria, with Sonatrach representing Algeria and the Société Nationale de Produits Pétroliers (SNPP) representing Morocco, has been established to study the pipeline. A natural gas development study for Morocco will be carried out under ESMAP.

Recommendation: *Postpone shale development projects until an assessment has been made of the World Bank's 1982 oil shale engineering project.*

Large scale oil shale projects as envisioned during the early 1980s have not materialized. Instead, the authorities proceeded cautiously to examine its oil shale development options. ONAREP started tests in April 1985 at the Timhadit pilot plant, built to help evaluate the potential of oil shale deposits in the area. A \$2 million study on the project was conducted for the government. In 1987, the European Community allocated resources to develop new and renewable energy resources. The project included further studies on the exploitation of bituminous shales.

Recommendation: *Implement the legal and financial regulations needed to attract foreign hydrocarbon companies.*

The government changed its policy of limiting commercial exploration in the kingdom and inaugurated a campaign to attract foreign oil and gas companies. In 1986, the government drafted a hydrocarbon exploration law which featured investment incentives such as a 200 percent amortization clause and a moratorium on royalty payments until production reached 4 million tons per year. Morocco's parliament ratified the new law in December 1989. In July 1988, ONAREP signed an oil exploration agreement with three companies—Walter International Morocco, McMoran Morocco, and Samedan North Africa. They planned to drill in a 2,650-square-kilometer permit, Tarfaya offshore, in the south. In January 1990, the government announced its plans to privatize its holdings in six affiliates of the state-owned petroleum marketing company, SNPP. In February, the government changed its hydrocarbon investment law so that the proposed amortization of expenses on future discoveries would translate into lower exploration and production costs.

Recommendation: *Raise coal prices to encourage efficient substitution of coal for oil products and improve the financing of capital investments for coal projects.*

During the period 1982 to 1985, the government made an effort to introduce an energy pricing policy to encourage conservation and the development of indigenous resources. Domestic coal prices, for instance, were adjusted close to import parity levels. In addition, efforts have been made to put the finances of Charbonnages du Maroc (CdM), the national coal production company, on more secure footing. A plan to restructure the finances of the company is expected to be completed and implemented in 1990.

Recommendation: *Abandon the CdM plan to expand national coal production beyond one million tons per year, particularly the proposed development of Siege VI at the Jerada deposit.*

CdM awarded contracts to expand the Jerada coal mine to the China National Coal Development Corporation and two firms from the Federal Republic of Germany (FRG). The \$74 million project was intended to raise annual production at the mine to only one million tons from 450,000 tons. However, because of unexpected geological difficulties, coal production targets were scaled down. CdM is currently projecting to produce about 620 tons per year.

Recommendation: *Frequently review and adjust industrial and thermal powerplant fuel supply plans at the national and regional levels.*

The authorities have tried to incorporate a certain degree of flexibility in their approach to powerplant fuel supply planning. The biggest change was the conversion of 2 x 150MW units at the Mohammedia power station to permit the use of coal as well as fuel oil and gas. The planned new 2 x 300MW station at Jorf Lasfar will be equipped to use coal, fuel oil, or gas.

Recommendation: *Explore the production of improved solar water heaters as well as the rehabilitation or replacement of windmills for water pumping or small-scale electricity generation, particularly for use in remote rural areas not connected to the national electricity grid.*

In 1986, the Centre de Developpement d'Energie Renouvelable (CDER), a local organization promoting alternative energy sources, published a comprehensive study on the local applications of wind power. The CDER expected the study to guide local engineers and designers in their efforts to maintain, repair, and upgrade windmills and to increasingly use this technology as an energy source for development projects.

Energy Assessment Status Report (November 1987)

Recommendation: *Examine the option of expanding the coal-fired thermal generating capacity at Mohammedia.*

The government decided not to permit ships to unload coal at Mohammedia. Therefore, the national electricity utility, Office National de l'Electricite (ONE), decided to build a new coal power station at Jorf Lasfar. As of July 1990, ONE had nearly completed financing of the first 2 x 300MW units with the first unit expected to come into service by the end of 1994.

Recommendation: *Formulate a long-term plan for the national power generation and transmission network, schedule the introduction of needed 400 kilovolt lines, and optimize the use of different voltage lines.*

ONE commissioned a transmission system study which included evaluation of the option of introducing 400 kilovolt transmission lines at the time the Jorf Lasfar station comes into service. The study recommended against such lines before the year 2000. The existing power interconnection between Morocco and Algeria was reopened in June 1988 following the reopening of the Algeria-Morocco border. Plans are being made to reinforce the interconnection. An agreement has also been signed with Spain to evaluate interconnecting the Spanish and Moroccan networks. An ESMAP activity to reduce losses in ONE transmission and distribution networks and the distribution of 10 local utilities was started in mid 1990. The activity is estimated to cost \$280,000, and financing is being provided by the UNDP.

Recommendation: *Develop a household energy strategy by identifying the characteristics of urban and rural residential demand for energy in order to improve the supply and use of household fuels.*

A national household energy survey was designed with financing from U.S. Agency for International Development and technical support from ESMAP. The survey, covering 3,500 urban and rural households, was conducted over two seasons in 1989/90 by the Société Nationale des Produits Pétroliers. Separate surveys also covered woodcutters and fuel merchants. Based on a preliminary report issued in June 1990, follow-up activities are being planned to rationalize woodfuel exploitation and evaluate LPG supply.

SYRIA

Issues and Options in the Energy Sector (May 1986)

Recommendation: *Negotiate an agreement with foreign companies on their role in gas development.*

The future direction of foreign oil company activities in Syria's gas sector became clearer when, in September 1987, the US State Department withdrew its restrictions on American oil companies working in Syria.

In May 1987, the Turkish Government proposed talks about the possible joint exploitation of gas reserves discovered by the Marathon Oil Company in the Homs area and the construction of an export pipeline. After the removal of the restrictions, Marathon started negotiations for an extension of its leasing rights. The company's concessions covered 14,800 square kilometers between Homs and Palmyra. The agreement would enable Marathon to continue exploration and provide for the development of natural gas fields. Marathon's previous concession covered oil production only. By December 1988, these negotiations were completed.

In that same month, the Syrian Petroleum Company evaluated offers from international companies for the development of the Homs, Palmyra, Najib, Bishri, and Zukhuni gas fields. Five months later, the government announced that it had held talks with the Soviet Union about the development of gas fields in the Homs and the Palmyra regions. Simultaneously, Marathon and the Syrian Government reached an agreement concerning the conversion of the Mhardeh and Baniyas power stations to gas which detailed the cost recovery and profit share terms for crude oil and gas discovered in the Palmyra concession.

Recommendation: *Allocate any surplus gas from the recently developed Jebisse field to power generation.*

During the second half of the 1980s, the Syrian Government increasingly emphasized the use of gas for power generation purposes. In January 1989, for example, international companies were invited to bid for a contract to explore and develop gas fields in central Syria and to design and build a gas transmission system for the proposed 600 megawatt Jandar power station.

Recommendation: *Boost drilling and increase the recovery rate in the larger oil fields.*

Drilling in Syria increased in the years following the lifting of sanctions. In November 1986, the Syrian Government had invited international companies to bid for an estimated \$60 to \$70 million contract to install production facilities at the Thayem oil field, near Deir al-Zor. The scheme aimed to double output at the field to about 120,000 barrels per day.

A number of companies responded to the government's invitation. Total, the French oil company, reached agreement with the government in May 1987 on the Bishri oil exploration concession. That same month, a contract to explore for oil north of Deir-al-Zor was signed with Tricentrol from the UK. Tricentrol would be operator, with a 75 percent interest. In February 1988, the American company Pecten and its partners extended for one year the exploration period previously agreed to in the area. Pecten and Royal Dutch/Shell and Deminex of the Federal Republic of Germany were also exploring in the nearby Al-Sham concession. Three months later, the People's Assembly ratified two new oil exploration agreements with Occidental Petroleum Corporation and Enron Corporation. Occidental's block was in the south, around Damascus; Enron's concession was in the northern Deir al-Zor area. In September 1988, Syria Shell Petroleum Development announced the preparation of a drilling site in the Northeast. Syria Shell was carrying out an intensive drilling program in the Deir al-Zor concession. France's Elf Aquitaine acquired oil exploration rights in a 4,000 square kilometer concession in the Deir al-Zor region in January 1989. Concurrently, British Petroleum Development signed an agreement to explore for oil in a 3,300 square kilometer concession in the Deir al-Zor region (Block 2). In March 1989, the American oil company Pentagon Petroleum was awarded an exploration permit for a 4,500 square kilometer concession, north of the Euphrates (block 5). In that same month, blocks 1 and 3 were awarded to Unocal. An agreement to explore for hydrocarbons east of Homs, was signed with Yugoslavia's INA-Naftaplin in May 1989.

Later, in December 1989, the UNDP provided \$2.3 million for an oil development project. The scheme made funds available for experts, consultants, training, equipment, and other miscellaneous services.

Recommendation: *Evaluate the benefits of installing cracking facilities at the Banias Refinery.*

In April 1989, the Banias Refinery management chose to focus on the rehabilitation of the heavy distillate hydrogenation unit. International companies were invited to bid for a contract to convert this unit to allow operation as a small hydrocracker.

Recommendation: *Utilize lighter crude as a feedstock in the Banias Refinery, not heavy Souedie crude.*

A shift away from the use of Souedie crude became apparent when, in May 1987, a new sales agreement between Iran and Syria stipulated that the Banias Refinery would mix light crude supplied by Iran with heavier local crudes. Moreover, in March 1988, the government announced that the Omar field was coming onstream at 100,000 barrels per day within 12 months obviating the need to import crude oil. Before these Deir al-Zor discoveries, about nine million tons a year of imported light crude were needed to mix with the heavy domestic Souedie oil for refining at Homs and Banias. The bulk of the Deir al-Zor output, which is light and has a low sulphur content, would be refined locally.

Recommendation: *Prepare a least cost development plan for gas utilization in present powerplants and in new powerplants using combined cycle.*

Gas utilization in powerplants and the installation of combined cycle units received increasing attention during the latter half of the 1980s. By the end of 1988, the Public Establishment for Electricity (PEE) was considering inviting bids for a combined cycle power station as a replacement for the proposed Latakia power station. In January 1989, it invited bids for a 600 megawatt combined cycle power station at Jandar. In May 1989, Marathon announced that it would invest up to 420 million in the conversion to gas of the oil-fired Mhardeh and Banias power stations.

Recommendation: *Upgrade present power loss reduction efforts to a full scale program and commission a comprehensive maintenance and training program.*

ESMAP contributed to efforts to boost power loss reduction efforts by carrying out the power system efficiency study completed in 1988. The project cost \$140,000 and was financed by UNDP. Investments valued at \$107 million were recommended. These funds are presently being sought by the government.

Recommendation: *Promote the manufacture of more solar water heating (SWH) systems.*

Part of the effort to promote SWH systems was the 1987 UNDP plan for the establishment of a Renewable Energy Center (Solar, Wind, and Biomass). This technical assistance project cost \$645,000.

Recommendation: *Perform a comprehensive energy rationalization program and focus on fertilizers, cement, manufacturing, and transport.*

A number of international organizations assisted the Syrian Government in getting an energy rationalization program underway. In 1986, the UNEP provided \$7,000 to help finance a consultancy for a cement industry energy audit. ESMAP completed an energy efficiency in the cement sector activity in 1989. The activity was funded by the UNDP IPF and cost \$258,500. An estimated \$98.6 million in investments were recommended. ESMAP also finalized the fertilizer industry energy efficiency activity in the summer of 1990. The project cost \$160,000. Investments totalling \$81 million were recommended. Funding for the investments suggested in both final activity reports is presently being sought by the government.

BOLIVIA

Issues and Options in the Energy Sector (April 1983)

Recommendation: *Set up an energy information system and deploy appropriate analytical tools for energy planning purposes.*

In an effort to address the paucity of energy planning tools, ESMAP has initiated technical assistance to the Bolivian Ministry of Mines and Hydrocarbons. This activity involves the recruitment of five energy experts to form an energy policy analysis and planning team to coordinate and monitor the National Energy Plan, the selection of appropriate methodology and the creation of an energy database, and the preparation of an energy strategy document. The database has been set up, energy balances have been prepared, and a periodical energy bulletin is being published. The cost of the project is \$330,000, financed through the Government of Italy and UNDP IPF. ESMAP is simultaneously developing a household and rural energy strategy. Experts are establishing time series patterns for fuel use and associated supply-demand characteristics by region. The project will set up a system whereby this particular database can be updated on a yearly basis.

Recommendation: *Double the price of natural gas to cover its production and transport cost.*

Long-term international gas sales agreements with Bolivia's neighboring countries, have limited the government's ability to adjust natural gas sale prices. In October 1987, for instance, the government announced that Argentina would pay Bolivia \$3.05/million Btu (British thermal unit) for 210,000 Mcf/d (thousand cubic feet per day) of natural gas for the balance of a 20 year contract that was scheduled to end in 1992 under a new supply agreement. This agreement involved a 17.6

percent cut in export prices. ESMAP's technical assistance to the Ministry of Mines and Hydrocarbons will evaluate past energy pricing practices and assist in implementing the required changes.

Recommendation: *Allow exploration activities of Yacimientos Petroliferos Fiscales Bolivianos (YPFB) to focus on low risk areas while offering high risk areas to private investors.*

As of 1986, the brunt of YPF's exploratory actions shifted to traditional areas. In November of that year, YPF announced that it planned to invest \$230 million in 1987 in the exploration and development of hydrocarbons. YPF would accelerate installation of 17 oil production wells to increase production by 3,000 barrels per day. Funding was provided by the World Bank, the International Development Association (IDA), the Andean Treaty Financial Corporation, and local institutions. Exploration efforts took place mainly in the areas of Santa Cruz, Chuquisaca, and Tarija, in the Cochabamba Valley zones, Oruro, and the La Paz Plateau. In January 1987, YPF publicized its plans to increase oil production to 20,000 barrels per day from 17,000 with a \$70 million investment. The state oil company aimed to maintain a balance between production and consumption. Again, the development plans concerned Santa Cruz, and the Tarija departments. In the Santa Cruz structures, YPF planned to spend \$6.7 million to work on six production wells. In the Yapacani area the plans specified the development of five wells at an estimated cost of \$14.3 million. In the Cascabel field, four wells were slated for development which would cost \$9.4 million. About \$10.4 million would be invested in eight wells in La Pena, and \$5.3 million was budgeted for the development of the one well in San Roque. In February 1988, the Inter-American Development Bank (IDB) provided a \$45 million loan for oil exploration in the Bolivian plateau departments of Potosi, Oruro, and La Paz.

Since 1989, a number of foreign companies have declared their interest in starting up exploration activities. Several firms already hold study contracts that would help them determine their interest for formal exploration contracts. Shell U.S. and the Andean Bolivian Corporation (BAPCO) plan to invest \$500 million in oil exploration in new fields north of the La Paz Department. Several American companies such as Amoco, Chevron, Conoco, Enron, Exxon, Hunt, Mobil, Phillips, Santa Fe, Texaco, and Unocal and European firms like British Petroleum, Elf Aquitaine, Lasmo, and Total are now studying their options in Bolivia. To date, only four exploration contracts have been signed, with two old ones renewed.

Recommendation: *Complete the Vuelta Grande retrograde gas condensate field.*

The 1986 World Bank and IDA Vuelta Grande project allocated \$6,317,290 for the completion of the Vuelta Grande retrograde gas condensate field in the South, the installation of a gas recycling plant, and the laying and gathering of injection lines. This project is basically completed and under production.

Recommendation: *Expand the Los Omasuyos and Los Andes reforestation projects in the Altiplano.*

Altiplano inhabitants continue to suffer from a chronic shortage of fuelwood. Government policies, therefore, remain geared to reforestation efforts. Moreover, during the period 1987-1990, the Food and Agriculture Organization (FAO) and the Government of Norway provided \$241,000 for reforestation and forest rehabilitation in the department of Tarija. ESMAP's ongoing household and rural energy strategy activity is working in synergy with such multilateral and bilateral efforts. ESMAP will carry out an assessment of the proposed reforestation program and, based on the outcome of this review, recommend a program that provides appropriate incentives to the farmers and organizational support for the reforestation effort in viable areas and for the enforcement of the Forestry Law.

National Energy Plan (December 1987)

Recommendation: *Investigate alternative arrangements to the gas export agreement with Brazil.*

The attempt to pursue alternative gas export arrangements have taken on a multilateral slant. In March 1990, the Latin American Energy Organization (OLADE) proposed the building of a long distance gas pipeline through the southern cone of South America. The pipeline would link gas fields and major cities of Argentina, Bolivia, Chile, and Uruguay and build on the existing Bolivia-Argentina network. In August 1988, Bolivia and Brazil signed an agreement whereby Bolivia will sell gas in the form of electricity. This project is under serious consideration by many financial institutions including the World Bank.

Recommendation: *Investigate the investment options for power subtransmission and distribution to meet future demand in the Santa Cruz, Cochabamba, and La Paz systems.*

This particular recommendation is being addressed in ESMAP's private power technical assistance study. Issues associated with the renewal of a distribution concession contract between the municipality of La Paz and Compagnia Boliviana de Energia Electrica, such as the need to increase operating efficiency and need for appropriate power investments, will be examined, and a course of action recommended. The activity cost \$37,000 and was financed by the UK Government.

Recommendation: *Perform a cost benefit analysis of substituting biomass stoves with stoves fueled by hydrocarbons including kerosene.*

The need for improved stoves to reduce the demand for fuelwood and dung has been identified by specific regional development corporations, especially in Chuquisaca and Yampara. Kerosene is gradually being withdrawn from the household market to make room for rising requirements for jet fuel and in order to make its application in production of cocaine more difficult (in the Province of Cochabamba, the center of coca production, kerosene is no longer available on the open market). ESMAP's household and rural energy strategy will analyze the possibility of introducing inexpensive LPG cookers using 6 kilogram cylinders to make LPG economically accessible to rural households. This activity is funded by the Government of the Netherlands and costs about \$410,000.

Recommendation: *Work out a solution to give back to Direccion Nacional de Electricidad (DINE) the responsibility for setting electricity rates at all levels, in accordance with the provisions of the National Electricity Code.*

During the negotiations between the government and IDA which led to the Reconstruction Import Credit of 1985, the government agreed to allow Empresa Nacional de Electricidad (ENDE) to increase the power rates and make arrangements for the capitalization of its debt. Official tariffs would be set by DINE.

Recommendation: *Assess ENDE project analysis capabilities.*

Project analysis capacities were boosted by the 1987 World Bank Power Rehabilitation Project which provided, among other things, the resources for engineering and consultancy services for project execution, financial management, and development of a management information system with appropriate computer hard and software. The Bank provided \$1.2 million for this technical assistance effort.

JAMAICA

Issues and Options in the Energy Sector (April 1985)

Recommendation: *Institute a management information system to assist the government in developing energy policy and investment priorities for the various demand sectors.*

In order to bolster the capacity of the Ministry of Mining and Energy (MME) to manage vital energy statistics, ESMAP is carrying out a management information system activity. It consists of installing a computerized database which will underpin the development of pertinent energy policies. The MIS will also be used by other ministries in their planning activities. The activity is ongoing with financing from CIDA of \$100,000 as part of an overall energy efficiency project.

Recommendation: *Continue detailed and systematic geologic studies of Jamaica's onshore and offshore areas.*

On the basis of geophysical surveys in the New Bank and Pedro Bank areas, which were carried out under the umbrella of the 1981 World Bank funded Petroleum Exploration Project, the Petroleum Corporation of Jamaica (PCJ) made a presentation on a drilling project to the oil industry in Houston, Texas, in early 1984. No significant commitment of funds for participation in the drilling or exploration of the prospects materialized. In view of this discouraging response, as well as the negative results of the marine geochemical "sniffer" survey, PCJ decided not to try to reactivate onshore and offshore exploration.

Recommendation: *Remove all subsidies on petroleum products, rationalize taxes, and deregulate petroleum prices.*

The move toward deregulation of petroleum prices and a removal of product subsidies required a better grasp of the pricing and subsidy environment. In 1986, ESMAP contributed to this effort through the completion of the petroleum procurement, refining, and distribution study. The work included a detailed review of the regulatory system for petroleum pricing. CIDA contributed \$30,000 to the completion of this project.

Recommendation: *Implement a disciplined preventive maintenance program in the power sector and make adequate foreign exchange available for spare parts.*

During negotiations for the Power IV Project in June 1987, the World Bank and the Jamaica Public Service Company (JPS) agreed to continue to implement a recently adopted systematic preventive maintenance program. Moreover, agreement was reached on the adequate implementation of a spare parts stock program.

Recommendation: *Restructure electricity tariffs to promote rational consumption patterns.*

Tariff structures were an important agenda point of the Power IV Project negotiations between the World Bank and JPS. The Jamaican authorities increased tariffs on average by 30 percent, introduced time of day charges, and restructured the tariff to reflect the cost of capacity to meet power demand.

Recommendation: *Design and execute a program to reduce unregistered and illegal consumption.*

During negotiations in June 1987, the World Bank and the JPS agreed that the latter would submit by May 1988 a comprehensive loss reduction plan. Loss reduction targets would be monitored during the supervision of the proposed loan. To achieve further reduction of power losses, JPS would make efforts to identify and disconnect illegal users.

Recommendation: *Commission a detailed survey of the sugar industry's potential to supply surplus power to the JPS grid.*

A survey of the sugar industry's power potential has been made part of the ESMAP energy efficiency program which will be financed by the Canadian International Development Agency. The World Bank and JPS, during negotiations in June 1987, agreed that the latter would establish by June 1988 a policy for the purchase by JPS of electricity from other possible suppliers, such as sugar factories. A report has recently been issued and will form the basis of discussions at a seminar with potential private sector power producers planned for September 1990.

Recommendation: *Rearrange the Energy Division of the MME into two branches and form appropriate inter-ministerial committees to deal with conservation, transport efficiency, and power expansion.*

The government has transferred responsibility for all energy sector matters to the Ministry of Mining and Energy and has established an interministerial Energy Sector Development Committee as well as reactivating the National Advisory Committee on Energy Conservation.

LATEST FOLLOW-UP OPPORTUNITIES

Presented below are follow-up opportunities identified in ESMAP activities that have recently been completed or are nearing completion. In each case, the government is requesting assistance in implementing the recommended projects.

All references to cost are presented in US dollars.

Africa Regional

Biomass Assessment and Mapping for Sub-Saharan Africa

The recently completed mapping of biomass/ground cover types using data from the NOAA (U.S. National Oceanographic and Atmospheric Administration) weather satellite has provided a continental overview of the woody biomass situation in sub-Saharan Africa. Using information obtained from the project and input from two regional workshops, the need for more detailed woody biomass assessment became apparent. Two proposals have been prepared to assess the woody biomass in designated high use woodland types in West Africa and in Southeast Africa. The proposals are costed at \$700,000 and \$600,000, respectively.

Interafrican Electrical Engineering College: Proposals for Short- and Long-Term Development

The Interafrican Electrical Engineering College (IEEC) is supported by the national electric power companies of twenty African nations, with the objective of collectively meeting their engineering staffing requirements. The college has a good reputation, both in Africa and abroad. Following issuance of its diagnostic report on IEEC in March 1990, ESMAP sponsored a donors' conference to assist the college in raising additional funding. The conference, held in May 1990, was successful in obtaining supplemental grants to ensure the college's short-term survival. An additional donors' conference to discuss longer term funding, donor conditionality, and African commitment is scheduled for late 1990. The cost of the conference was borne by the Government of Swit-

zerland through the Directorate for Development Cooperation and Humanitarian Aid.

Botswana

Urban Household Energy Strategy Study

This report is in the process of being cleared by the Government of Botswana. There are a number of follow-up proposals in the fields of woodland management and fuelwood marketing. An improved stoves program and technical and training assistance to the Energy Unit are also proposed. As soon as the report has been cleared, ESMAP will seek financing for these projects.

Burkina Faso

Urban Household Energy Strategy Study

This report is being sent to the Government of Burkina Faso for clearance. It sets out several follow-up proposals that constitute the strategy's principal recommendations and range in cost from \$40,000 to \$5 million. The proposals under the urban fuel conservation program are an urban fuelwood savings program and institutions and training needs assessment. Under the interfuel substitution program, proposals include (a) an LPG infrastructure strengthening project, (b) an LPG stove development and marketing project, and (c) a kerosene promotion options project. The natural woodlands management program has two projects: (a) improving interagency coordination workshop and (b) a village-based management of old fallows and degraded woodlands project.

Honduras

Petroleum Supply Management

ESMAP visited Honduras from May/June 1990 to discuss the report with the government and to test and implement the computerized information system to improve procurement of oil reserves data. The report evaluated current petroleum supply arrangements and recommended the opening of the petroleum supply and local distribution to more competition to enhance efficiency and bring required investments in new storage facilities and products pipeline. The government has requested assistance in the liberalization of the petroleum market. The World Bank is expected to follow up on many of the recommendations.

India

Irrigation-Based Minihydro Study

The preinvestment activity is nearing completion. A minihydro demonstration project has been designed through which \$130 million will be invested over a three-year period to develop 145 MW of decentralized mini hydropower generation capacity from about 54 schemes located on existing irrigation dams and canal drops in five states of the country. The states include Andhra Pradesh, Karnataka, Kerala, Punjab, and Tamil Nadu. The Government of India has begun preliminary discussions with the World Bank to secure an IDA credit for the proposed project. A preappraisal mission is planned by the World Bank in October 1990. Cofinancing will be required from other external sources.

Mali

Household Energy Strategy Study

The objective of this activity was to formulate an integrated strategy for the household energy sector. The final output of this study is built around two main axes: (a) to improve energy accessibility in the sector through the promotion of new or existing energy efficient equipment and (b) to manage woodfuel supply areas for five main cities (Bamako, Gao, Koutiala, Mopti, Segou) through the implementation of woodfuel supply master plans, the management of state forests, dead wood recovery, forestry management of village lands, and the modernization of the charcoal sector. Strategy implementation would cover the 1991-1995 period, with long-term objectives and expected outputs set up for 2001. The total cost of the strategy is \$14.5 million. A total of \$1 million

has already been made available by the World Bank under the Second Power Project.

Syria

Energy Efficiency in the Fertilizer Industry

ESMAP has recently completed a preinvestment activity aimed at defining an action program to improve efficiency of energy utilization in the fertilizer complex of Homs in Syria. In the course of the activity, the scope of the work was extended to cover issues broader than energy efficiency improvement. A comprehensive rehabilitation program has been designed and assessed. This program, the total cost of which is evaluated at \$51 million (including \$14 million related to managerial and technical assistance), should lead to a substantial increase in production and improvement in operating conditions, safety, and environmental protection. The overall internal rates of return have been evaluated at about 70 percent financial and 100 percent economic.

Tanzania

Remote Sensing and Mapping of Woodlands

The imagery maps and overlays at a scale of 1:50,000 that have been produced as a result of this project provide a basis for a woody biomass inventory of the peri-urban areas concerned and for preliminary woodland management. As the study shows, there are 17 vegetation strata identified and mapped, including two density classes within woodlands and bushlands. A recent seminar held in Dar-es-Salaam to explain the methodology and results of the project elicited attention from those interested in land use planning and management. A proposal for the woody biomass inventory covering some 7 million hectares has been drawn up and costed at \$1.4 million including the production of forest/vegetation cover maps. Proposals have also been drawn up for management of some 450,000 hectares of woodlands on a pilot basis at a cost of \$14 million.

Zambia

Urban Household Energy Strategy Study

The final report has just been issued, and a package of follow-up projects has been recommended. They are listed below with the estimated cost of about \$6 million. The government is seeking financing for these projects. While the proposals were prepared as a package, donors may be interested in funding one or more elements. The

individual projects include: establishment of an indigenous (Miombo) woodland monitoring and management unit (IWMMU) (\$1,660,000); improvement of collection of woodfuel fees and levies and reassessment of stumpage fees (\$580,000); planting and managing trees by private farmers and/or individuals (not costed); feasibility study of the utilization of wood resources for charcoal in the Tazara Corridor (\$60,000); strengthening

of charcoal producers' organizations (\$60,000); improvement of the earth-kiln charcoal production technology (\$140,000); improvement of charcoal supply and distribution (\$600,000); establishment of a stove unit (\$2,570,000); evaluating the popularity of the improved charcoal stove (\$10,000); and strengthening of the Department of Energy (\$240,000).

IV

Financial Data

FUNDING OPPORTUNITIES

To give an overall picture of the ESMAP program, the "Information and Status Report" includes completed activities for which the government has approved a final report, ongoing financed activities, and those which are still in need of financing. Activities which require financing are identified in the prospective activities listing.

In addition to the financial and in-kind contributions to the program by the World Bank, multilateral and bilateral aid financing of ESMAP activities has been handled either through the UNDP or by the World Bank. There have also been other cost sharing mechanisms for support and cofinancing arrangements on specific activities. Although donors in the past have generally been government entities or bilateral and multilateral institutions, the program does not exclude financing from other sources.

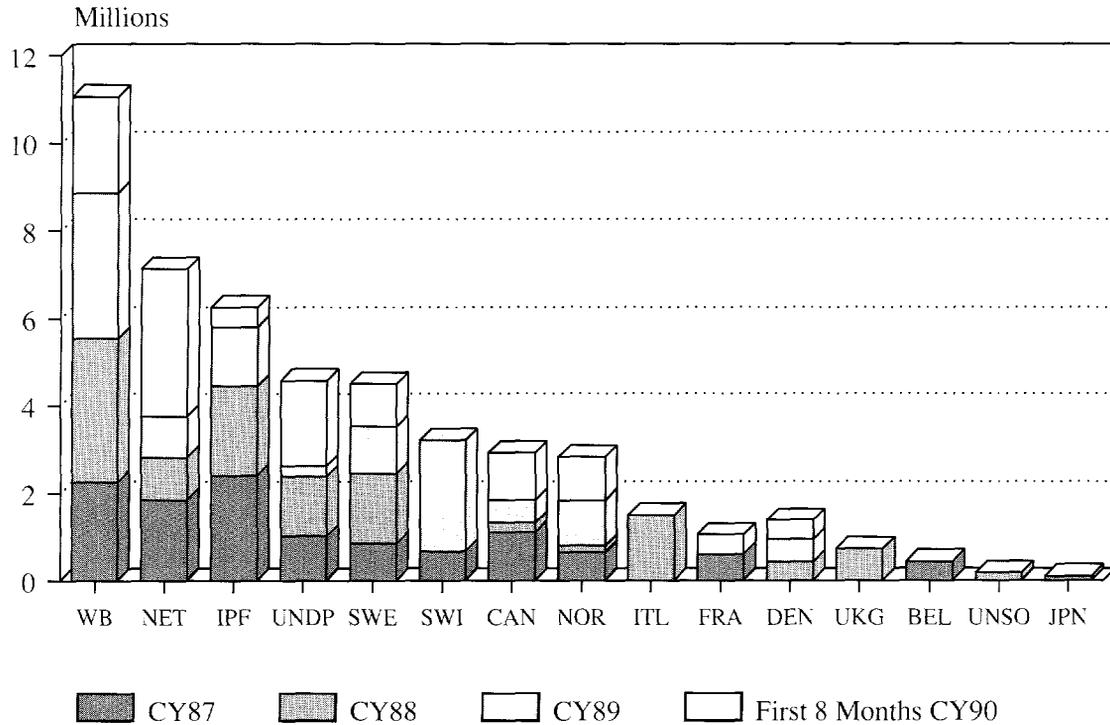
FUNDING RECEIVED BY DONOR

Donor	CY1987	Amount US\$	Donor	CY1988	Amount US\$
The World Bank		2,250,000*	The World Bank		3,305,211*
UNDP Interregional Programme		1,000,000	UNDP Interregional Programme		1,370,000
The Netherlands		2,399,631	The Netherlands		2,052,359
UNDP Country IPFs		1,858,552	Sweden		1,610,812
Canada		1,095,151	Italy		1,500,000
Sweden		833,008	UNDP Country IPFs		953,474
Switzerland		653,334	United Kingdom		711,000
Norway		629,079	Denmark		413,951
France		587,459	Canada		223,897
Belgium		424,365	UNSO		174,959
Japan		100,000	Norway		150,000
Total		\$11,830,579	Total		\$12,465,663

CY1989	
Donor	Amount US\$
The World Bank	3,305,211*
UNDP Interregional Programme	250,000
Switzerland	2,559,071
The Netherlands	1,358,058
Sweden	1,070,000
Norway	1,065,886
UNDP Country IPFs	938,200
Canada	532,428
Denmark	512,250
France	443,787
Total	12,034,891

First Eight Months CY1990	
Donor	Amount US\$
The World Bank	2,203,472*
UNDP Interregional Programme	1,950,000
UNDP Country IPFs	3,389,701
Canada	1,075,743
Norway	984,848
Sweden	977,331
The Netherlands	455,054
Denmark	100,859
Total	11,137,008

* Includes contributions in kind.



ESMAP SPONSORS AND OTHER FUNDING AGENCIES/UNITS/SOURCES

ACCT	<i>Agence de coopération culturelle et technique</i>
ADB	<i>Asian Development Bank</i>
AGCD	<i>Belgium Development Assistance Organization</i>
AIDAB	<i>Australian International Development Assistance Bureau</i>
The World Bank	<i>International Bank for Reconstruction and Development, IDA, IFC</i>
BMZ	<i>Bundesministerium fuer Wirtschaftliche Zusammenarbeit (Federal Republic of Germany)</i>
CARE	<i>Committee for American Relief Everywhere</i>
CCCE	<i>Caisse centrale de coopération économique (Central Office for Economic Cooperation) (France)</i>
CIDA	<i>Canadian International Development Agency</i>
Core	<i>Mixed funding by the Bank, UNDP and other donors</i>
DANIDA	<i>Danish International Development Agency</i>
DCD	<i>Italian Department of Cooperation and Development</i>
DDCH	<i>Directorate of Development Cooperation and Humanitarian Aid (Switzerland)</i>
DFA	<i>Department of Foreign Affairs (Ireland)</i>
DTI	<i>U.K. Department of Trade and Industry</i>
ECC	<i>European Communities Commission</i>
EIB	<i>European Investment Bank</i>
FAC	<i>Fonds d'aide et de coopération</i>
FAO	<i>Food and Agriculture Organization (UN)</i>
FINNIDA	<i>Finnish International Development Agency</i>
GTZ	<i>Gesellschaft für Technische Zusammenarbeit (Federal Republic of Germany)</i>
IDA	<i>International Development Agency (Bank)</i>
IFC	<i>International Finance Corporation (Bank)</i>
JICA	<i>Japanese International Cooperation Agency</i>
MDC	<i>Ministry of Development Cooperation (Norway)</i>
MFA	<i>Ministry of Foreign Affairs (New Zealand)</i>
NIB	<i>Nordic Investment Bank</i>
NL	<i>The Netherlands Government</i>
NORAD	<i>Norway Aid Agency</i>
OAS	<i>Organization of American States</i>
ODA	<i>Overseas Development Administration (UK)</i>
OLADE	<i>Latin American Energy Organization</i>
PF	<i>Program funds from untied contributions from UNDP and the Governments of Norway, Switzerland, and the United Kingdom.</i>
SADCC	<i>Southern Africa Development Coordinating Committee</i>
SIDA	<i>Swedish International Development Authority</i>
UNCDF	<i>United Nations Capital Development Fund</i>
UNDP	<i>United Nations Development Programme</i>
UNDP IPF	<i>UNDP Indicative Planning Figures</i>
UNDTCD	<i>United Nations Department of Technical Cooperation for Development</i>
UNPEDP	<i>United Nations Pacific Energy Development Programme</i>

*UNSO
USDOE
USEPA
USFS
USAID
USTDP*

*United Nations Sudano-Sahelian Office
U.S. Department of Energy
U.S. Environmental Protection Agency
U.S. Forest Service
U.S. Agency for International Development
U.S. Trade and Development Program*

ONGOING ACTIVITIES (CATEGORY)

*Activities presented in boldface are the latest additions to the listing.
All amounts are presented in US dollars.*

<i>Country</i>	<i>Activity</i>	<i>Cost</i>	<i>Funding</i>	
			<i>Sponsor</i>	<i>Amount</i>
POLICY, STRATEGY, AND PLANNING				
<u><i>General</i></u>				
Burundi	Energy Assessment Update	190,000	The Netherlands	190,000
Cameroon	Energy Strategy Study	250,000	The Netherlands	250,000
Central African Republic	Energy Assessment	296,000	ECC, PF	296,000
Colombia	Interfuel Substitution and End Use Efficiency Study	320,000	Italy	300,000
			Colombia	20,000
Côte d'Ivoire	Energy Sector Technical Assistance	2,150,000	Canada	2,150,000
Dominican Republic	Energy Assessment	330,000	Italy	330,000
Guatemala	Energy Assessment	248,000	Italy	248,000
Mali	Energy Assessment	275,000	The Netherlands	275,000
Peru	Energy Strategy Study	360,000	The Netherlands	360,000
Rwanda	Energy Assessment Update	200,000	Canada	200,000
Senegal	Energy Strategy and Donors' Meeting	165,000	The Netherlands	165,000
Solomon Islands	Energy Assessment Update	190,000	Japan	100,000
			Australia	30,000
			PF	70,000
Zimbabwe	Energy Strategy Evaluation	645,000	UNDP IPF	545,000
			Sweden	100,000
	Energy Strategy for Low-Income Communities Phase II	180,000	The Netherlands	180,000
<u><i>Hydrocarbons</i></u>				
Argentina	Regulatory and Contract Framework in the Natural Gas Sector	150,000	UNDP	150,000

Ongoing (Category)

<i>Country</i>	<i>Activity</i>	<i>Cost</i>	<i>Funding</i>	
			<i>Sponsor</i>	<i>Amount</i>
Bolivia	Natural Gas Distribution Strategy Study Phase I	180,000	The Netherlands	180,000
Global	Development of Potential for Small Uses of Natural Gas	190,000	The Netherlands	190,000
	Environmental Costs and Benefits of Natural Gas Use	320,000	Norway, The Netherlands	320,000
Morocco	Natural Gas Development Plan	450,000	Belgium	450,000
Poland	Natural Gas Development Plan	570,000	France	570,000
	Environmental Assessment	200,000	Norway	200,000
	Natural Gas Pricing and Tariff Study	250,000	UK	250,000
	Legal and Contractual Framework Study and Training Program	350,000	UNDP	350,000

Electricity

Africa Regional	SADCC Regional Electric Power Interconnection Prefeasibility Study	630,000	Sweden	630,000
Angola	Power Subsector Investment Review	600,000	Sweden	200,000
			UNDP IPF	400,000
Bolivia	La Paz Private Power Technical Assistance	37,000	UK	37,000
Colombia	Power Planning Technical Assistance	80,000	Italy, Canada	80,000
Mozambique	Household Electricity Utilization Study	165,000	Sweden	165,000

Renewables

India	Windfarm Development Preinvestment Study	220,000	Denmark	220,000
	Irrigation-Based Minihydro Study	220,000	PF	220,000
Indonesia	Biomass Gasifier Preinvestment Study	138,000	The Netherlands	138,000
	Improved Biomass Utilization Study Phase I	133,000	The Netherlands	133,000
	Technology Transfer and Demonstration of Charcoal Ferrocement Gasifiers	160,000	The Netherlands	130,000
Philippines	Assistance for Updating the Nonconventional Energy Program	275,000	The Netherlands	275,000
Yemen	Assessment of Photovoltaics for Rural Household Electric Supply	310,000	The Netherlands	310,000

<i>Country</i>	<i>Activity</i>	<i>Cost</i>	<i>Funding</i>	
			<i>Sponsor</i>	<i>Amount</i>
<u><i>Traditional Fuels</i></u>				
Mexico	Charcoal Production/Marketing within Forest Management Phase I (Veracruz)	130,000	Norway	130,000
	Charcoal Production/Marketing within Forest Management Phase II (Veracruz)	100,000	Norway	50,000
			United States	50,000
<u><i>Household</i></u>				
Bolivia	Household Energy Strategy Study	505,000	The Netherlands	454,000
Botswana	Urban Household Energy Strategy Study	365,000	Sweden	365,000
Burkina Faso	Urban Household Energy Strategy Study	755,000	Norway	655,000
			The Netherlands	100,000
Cameroon	Household Energy Strategy Study	560,000	The Netherlands	560,000
Guinea	Household Energy Strategy Study	272,000	PF	272,000
Guinea-Bissau	Urban Household Energy Strategy Study	384,000	Sweden	384,000
Haiti	Household/Small Industry Energy Strategy Study	154,000	PF	154,000
Mali	Household Energy Strategy Study	384,000	The Netherlands	384,000
Pakistan	Household Energy Strategy Study	3,044,000	UNDP IPF	2,794,000
Philippines	Household Energy Strategy Study	377,000	The Netherlands	377,000
Yemen	Household Fuel Marketing Study	356,000	The Netherlands	356,000
<u><i>Industry</i></u>				
Brazil	Carajas Energy Supply Options Study	300,000	Fed. Rep. of Germany	300,000
<u><i>Rural</i></u>				
Bolivia	Energy Planning for Rural Integrated Development	40,000	UNDP	40,000
India	Rural and Traditional Energy Study	400,000	Sweden	400,000

Ongoing (Category)

<i>Country</i>	<i>Activity</i>	<i>Cost</i>	<i>Funding</i>	
			<i>Sponsor</i>	<i>Amount</i>

ENERGY EFFICIENCY AND CONSERVATION

General

Jamaica	Energy Efficiency Program	1,000,000	Canada	1,000,000
Pakistan	Energy Efficiency Study	350,000	The Netherlands	200,000

Electricity

Congo	Improvement of the Operational Performance of the Power Sector	282,000	France	282,000
Ecuador	Electric Power Loss Reduction Study	600,000	Ecuador, Italy, Belgium	600,000
Malawi	Evaluation of Power System Losses	300,000	PF	300,000
Morocco	Loss Reduction in Transmission and Distribution	280,000	UNDP IPF	280,000
Nepal	Comparative Study of International Power Sales and Water Resource Development Agreements	50,000	PF	50,000
Tanzania	Power Loss Reduction and Distribution Planning	780,000	Sweden	780,000
Tunisia	Power System Efficiency Study	225,000	France	225,000

Renewables

Uganda	Minihydro Rehabilitation Feasibility Study	130,000	PF	130,000
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Traditional Fuels

Ghana	Improved Charcoal Production Project	148,000	Belgium	148,000
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<i>Country</i>	<i>Activity</i>	<i>Cost</i>	<i>Funding</i>	
			<i>Sponsor</i>	<i>Amount</i>
<u><i>Household</i></u>				
Ghana	Improved Charcoal Stoves Project	250,000	The Netherlands	250,000
Jamaica	Improved Charcoal and Kerosene Stove Pilot Project	415,000	The Netherlands	415,000
Rwanda	Charcoal Kilns Phase II	890,000	The Netherlands	450,000
			UNDP IPF	440,000
	Charcoal Stoves Phase II	150,000	The Netherlands	150,000
Tunisia	Energy Efficiency in Households and Services	200,000	The Netherlands	200,000
<u><i>Industry</i></u>				
Ghana	Industrial Energy Rationalization Study Phase I	275,000	Canada	275,000
Senegal	Industrial Energy Conservation	4,659,000	Canada	4,180,000
			UNDP IPF	479,000
Uganda	Energy Efficiency in Agro-Industries	390,000	Sweden	390,000
<u><i>Commercial</i></u>				
Côte d'Ivoire	Energy Efficiency in Buildings	830,000	Canada	830,000
Senegal	Energy Efficiency in Buildings and Transport	200,000	The Netherlands	200,000
INSTITUTIONAL STRUCTURE AND PERFORMANCE				
<u><i>General</i></u>				
Africa Regional	Study of SADCC Energy Unit	150,000	The Netherlands	150,000
	Design of ESAMI Energy Training Curricula	150,000	The Netherlands	150,000
	SADCC Household Energy Survey Applications Training Phase I	150,000	Sweden	150,000
	SADCC Household Energy Survey Applications Training Phase II	440,000	The Netherlands	440,000

Ongoing (Category)

<i>Country</i>	<i>Activity</i>	<i>Cost</i>	<i>Funding</i>	
			<i>Sponsor</i>	<i>Amount</i>
Asean Region	Financing Energy Services to Small-Scale Energy Users (Finesse)	350,000	United States	200,000
			PF	85,000
			The Netherlands	50,000
Bolivia	Technical Assistance in Energy Planning	328,000	Italy, UNDP IPF	328,000
	Private Power Generation and Transmission	76,000	The Netherlands	76,000
China	Rural Energy Training and Technical Assistance Phase I	391,000	PF	309,000
Poland	Restructuring Programs for the Electricity, Lignite, and Heating Subsectors	850,000	UK	850,000
<u><i>Hydrocarbons</i></u>				
Honduras	Petroleum Supply Management Assistance	225,000	Italy, UNDP IPF	225,000
Poland	Restructuring Study of the Poland Oil and Gas Company (POGC)	550,000	UK	550,000
	Restructuring Program for the Hard Coal Subsector	700,000	UK	700,000
<u><i>Electricity</i></u>				
China	Technical Assistance for Planning and Management in Small Power Companies Phase I	354,000	Sweden, PF	354,000
Colombia	Power Sector Information System	200,000	The Netherlands	200,000
Guinea-Bissau	Power Sector Management Assistance	260,000	France	260,000
India	Integration of Regional Power System Operations	200,000	Sweden	200,000
Lesotho	Institutional and Regulatory Framework for the Power Sector	65,000	PF	65,000
Sao Tome	Hydropower Feasibility Study	310,000	France	230,000
			PF	30,000
			Portugal	50,000

<i>Country</i>	<i>Activity</i>	<i>Cost</i>	<i>Funding</i>	
			<i>Sponsor</i>	<i>Amount</i>
SEMINARS				
<u><i>General</i></u>				
Gabon	Energy Efficiency Seminar	150,000	ACCT	150,000
Global	Francophone Seminar on the Design of Energy Efficiency Programs	150,000	ACCT	150,000
<u><i>Electricity</i></u>				
Caribbean Region	Power Seminar	223,000	Switzerland OLADE	73,000 150,000
<u><i>Household</i></u>				
LAC Regional	Household Energy Planning Seminar	200,000	The Netherlands OLADE, OAS	120,000 80,000
Pacific Region	Household and Rural Energy Seminar	170,000	UNDP PF	85,000 85,000

SECTORAL RESEARCH AND GUIDELINE DEVELOPMENT

Policy, Strategy, and Planning

PC Models for Energy Planning	120,000	Sweden	120,000
Unified Approach to Petroleum Contracts	180,000	The Netherlands	180,000
Policy Research on Interfuel Substitution in Urban Households with Special Reference to LPG and Kerosene Phase I	225,000	World Bank The Netherlands	75,000 150,000

Ongoing (Category)

<i>Country</i>	<i>Activity</i>	<i>Cost</i>	<i>Funding</i>	
			<i>Sponsor</i>	<i>Amount</i>
	Guidelines for Optimizing Power Network Distribution Standards	100,000	The Netherlands	100,000
<u><i>Energy Efficiency and Conservation</i></u>				
	Improved Cookstove Dissemination Impact Study	194,000	UNDP	194,000
	Energy Efficiency Strategy for the Transport Sector	65,000	The Netherlands	65,000
	Global Energy and Environmental Initiative: Alternative Energy Paths	300,000	PF	300,000
<u><i>Institutional Structure and Performance</i></u>				
	Guidelines for Utility Management and Billing	50,000	The Netherlands	50,000
	Energy Related Training in Italy	200,000	Italy	200,000

PROSPECTIVE ACTIVITIES (CATEGORY)

*Activities presented in boldface are the latest additions to the listing.
All amounts are presented in US dollars.*

<u>Country</u>	<u>Activity</u>	<u>Cost</u>
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POLICY, STRATEGY, AND PLANNING

Hydrocarbons

Africa Regional	SADCC Coal Utilization in the Household, Service, and Small Industry Sectors	178,000
Bolivia	Natural Gas Development Plan	450,000
Malaysia	Natural Gas Sector Study	150,000

Electricity

Swaziland	Power Development and Electricity Tariffs	300,000
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Renewables

Africa Regional	SADCC Assessment of Applications and Markets for Solar Photovoltaic Systems	250,000
Ecuador	Minihydro Prefeasibility Study	200,000
Honduras	Utilization of Wood Residues	160,000
Tanzania	Minihydro Feasibility Study	200,000

Traditional Fuels

Africa Regional	Biomass Assessment for West Africa	700,000
	Biomass Assessment for Southeast Africa	590,000

Prospective (Category)

<i>Country</i>	<i>Activity</i>	<i>Cost</i>
	Support for the Regional Wood Energy Program	199,000
	SADCC Woodland Management Strategy Study	195,000
Comoros	Design of Biomass Energy Strategy	300,000
Ethiopia	Fuelwood Forestry Feasibility Study	350,000
Global	Evaluation of Past Woodfuel Projects	415,000
Zaire	Design of Biomass Energy Strategy	253,000
Zambia	Enhancing Charcoal Production, Distribution, and Energy Management	286,000

Household

Chad	Household and Biomass Energy Strategy Study	500,000
Indonesia	Rural Household Energy Strategy Study	350,000
LAC Regional	Energy Consumption in Low-Income Urban Households	1,100,000
Lao People's Democratic Republic	Urban Residential Fuel Substitution Study	130,000
Malawi	Urban Household Energy Strategy Study	495,000
Sierra Leone	Household Energy Strategy Study	436,000
Swaziland	Household Energy Strategy Study	220,000
Yemen	Commercialization of LPG Appliances	85,000

Rural

Nepal	Rural Energy Technology Study	200,000
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ENERGY EFFICIENCY AND CONSERVATION

General

Bolivia	Energy Efficiency Strategy Study	263,000
China	Energy Efficiency and Environmental Strategy Study	350,000
Nepal	Energy Efficiency Study	250,000
Poland	Energy Efficiency and Environmental Protection Study	1,000,000

<i>Country</i>	<i>Activity</i>	<i>Cost</i>
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Electricity

Burundi	Power Distribution Cost Reduction Study	200,000
India	Power Efficiency Technical Assistance	500,000
Indonesia	Diesel Efficiency Preinvestment Study	240,000
Rwanda	Power Loss Reduction Project	365,000
Venezuela	Power Sector Restructuring and Loss Reduction	470,000

Household

Congo	Dissemination of Improved Stoves	435,000
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Industry

Africa Regional	SADCC Energy Efficiency in Rural Industries	1,000,000
Algeria	Industrial Energy Efficiency Study Phase I	200,000
Cameroon	Energy Efficiency in Public Buildings and Industries	1,500,000
Ghana	Industrial Energy Rationalization Study Phase II	500,000
Tanzania	Industrial Energy Efficiency Implementation	600,000
Zimbabwe	Industrial Energy Efficiency Study	300,000

Commercial

Maghreb Region	Preparation of an Energy Efficiency Building Code	300,000
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INSTITUTIONAL STRUCTURE AND PERFORMANCE

General

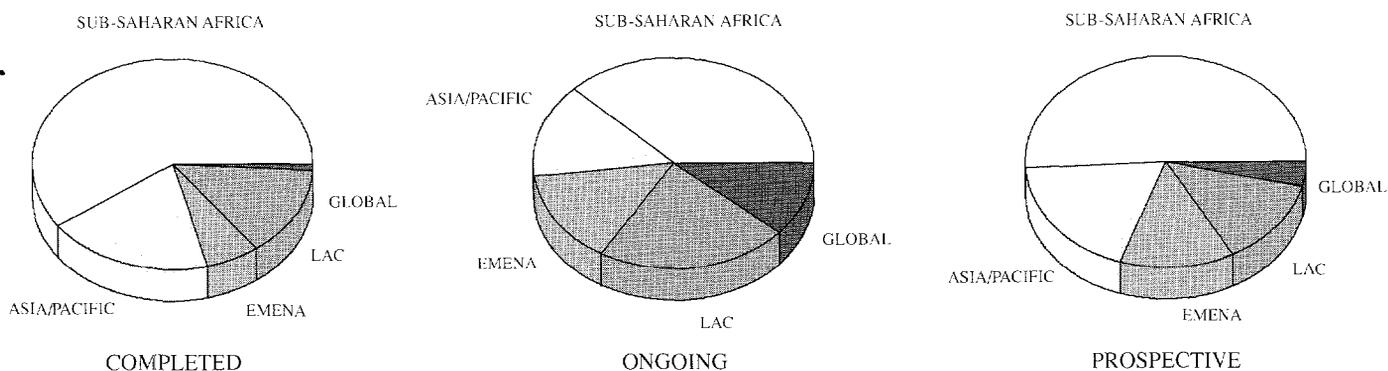
Botswana	Strengthening the Energy Unit	199,000
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Statistical Data

The tables in Section V give the status of the ESMAP work program. Two tables summarize the status of the ESMAP program by region and category, respectively. There is a table for completed activities, indicating the completion date and giving report numbers when applicable, as well as tables for ongoing and prospective activities. Whereas Section IV presented funding of individual activities by function, the status of activities is presented by region. The four regions used are the same operational divisions used by the World Bank. Because ESMAP does sectoral work that is not specific to any particular country, there is also a global category. These tables correspond to the summary details contained in Section VI.

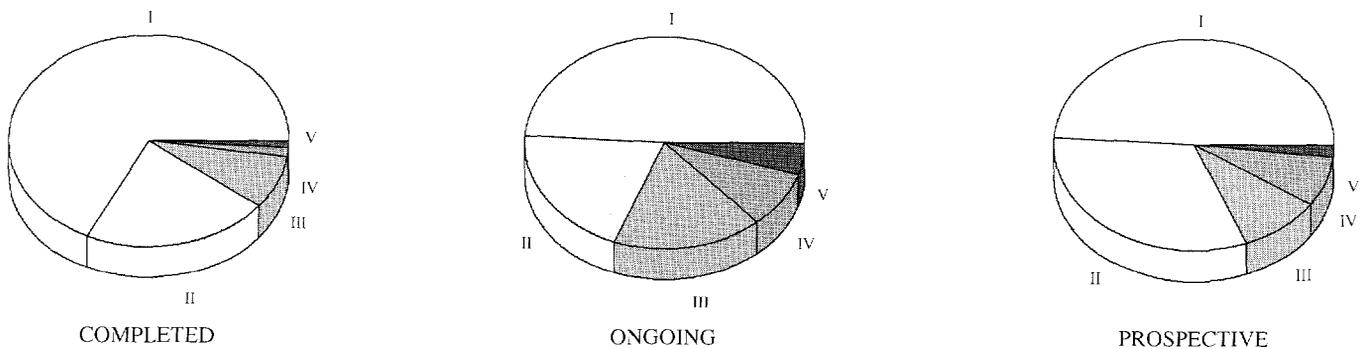
SUMMARY OF ACTIVITIES (REGION)

	Completed	Ongoing	Prospective	Total
Global	2	12	2	16
Sub-Saharan Africa	125	39	27	191
Asia and the Pacific	40	15	10	65
Europe, Middle East and North Africa (EMENA)	13	15	7	35
Latin America and the Caribbean (LAC)	29	23	7	59
Total	209	104	53	366



SUMMARY OF ACTIVITIES (CATEGORY)

	<u>Completed</u>	<u>Ongoing</u>	<u>Prospective</u>	<u>Total</u>
I. Policy, Strategy, and Planning				
<i>General</i>	101	14	0	115
<i>Hydrocarbons</i>	5	9	3	17
<i>Electricity</i>	5	5	1	11
<i>Renewables</i>	12	7	4	23
<i>Traditional Fuels</i>	10	2	9	21
<i>Household</i>	7	11	8	26
<i>Industry</i>	0	1	0	1
<i>Rural</i>	2	2	1	5
II. Energy Efficiency and Conservation				
<i>General</i>	0	2	4	6
<i>Electricity</i>	19	7	5	31
<i>Renewables</i>	1	1	0	2
<i>Traditional Fuels</i>	3	1	0	4
<i>Household</i>	8	5	1	14
<i>Industry</i>	13	3	6	22
<i>Commercial</i>	1	2	1	4
III. Institutional Structure and Performance				
<i>General</i>	7	9	3	19
<i>Hydrocarbons</i>	5	3	0	8
<i>Electricity</i>	5	6	0	11
<i>Rural</i>	0	0	2	2
IV. Seminars				
<i>General</i>	0	2	1	3
<i>Electricity</i>	1	1	3	5
<i>Household</i>	2	2	0	4
V. Sectoral Research and Guideline Development				
<i>Policy, Strategy, and Planning</i>	1	4	0	5
<i>Energy Efficiency and Conservation</i>	1	3	0	4
<i>Institutional Structure and Performance</i>	0	2	1	3
Total	209	104	53	366



COMPLETED ACTIVITIES (REGION)

Activities presented in boldface are the latest additions to the listing.

<u>Country</u>	<u>Activity</u>	<u>Date</u>	<u>Number</u>
SUB-SAHARAN AFRICA			
Africa Regional	Anglophone Africa Household Energy Workshop	07/88	085/88
	Regional Power Seminar on Reducing Electric Power System Losses in Africa	08/88	087/88
	Institutional Evaluation of EGL	02/89	098/89
	Biomass Mapping Regional Workshops	05/89	--
	Francophone Household Energy Workshop	08/89	103/89
	Interafrican Electrical Engineering College: Proposals for Short- and Long-Term Development	03/90	112/90
	Biomass Assessment and Mapping	03/90	--
Angola	Energy Assessment	05/89	4708-ANG
Benin	Energy Assessment	06/85	5222-BEN
Botswana	Energy Assessment	09/84	4998-BT
	Pump Electrification Prefeasibility Study	01/86	047/86
	Review of Electricity Service Connection Policy	07/87	071/87
	Tuli Block Farms Electrification Study	07/87	072/87
	Household Energy Issues Study	02/88	--
Burkina Faso	Energy Assessment	01/86	5730-BUR
	Technical Assistance Program	03/86	052/86
Burundi	Energy Assessment	06/82	3778-BU
	Petroleum Supply Management	01/84	012/84
	Status Report	02/84	011/84
	Presentation of Energy Projects for the Fourth Five-Year Plan (1983-1987)	05/85	036/85
	Improved Charcoal Cookstove Strategy	09/85	042/85
	Peat Utilization Project	11/85	046/85
Cape Verde	Energy Assessment	08/84	5073-CV
	Household Energy Strategy Study	02/90	110/90
Comoros	Energy Assessment	01/88	7104-COM
Congo	Energy Assessment	01/88	6420-COB
	Power Development Plan	03/90	106/90
Côte d'Ivoire	Energy Assessment	04/85	5250-IVC
	Improved Biomass Utilization	04/87	069/87
	Power System Efficiency Study	12/87	--
Ethiopia	Energy Assessment	07/84	4741-ET
	Power System Efficiency Study	10/85	045/85
	Agricultural Residue Briquetting Pilot Project	12/86	062/86
	Bagasse Study	12/86	063/86
	Cooking Efficiency Project	12/87	--
Gabon	Energy Assessment	07/88	6915-GA

Completed (Region)

<i>Country</i>	<i>Activity</i>	<i>Date</i>	<i>Number</i>
The Gambia	Energy Assessment	11/83	4743-GM
	Solar Water Heating Retrofit Project	02/85	030/85
	Solar Photovoltaic Applications	03/85	032/85
Ghana	Petroleum Supply Management Assistance	04/85	035/85
	Energy Assessment	11/86	6234-GH
	Energy Rationalization in the Industrial Sector	06/88	084/88
Guinea	Sawmill Residues Utilization Study	11/88	074/87
Guinea-Bissau	Energy Assessment	11/86	6137-GUI
Guinea-Bissau	Energy Assessment	08/84	5083-GUB
	Recommended Technical Assistance Projects Management Options for the Electric Power and Water Supply Subsectors	04/85	033/85
Kenya	Energy Assessment	01/90	100/89
	Energy Assessment	05/82	3800-KE
	Power System Efficiency Study	03/84	014/84
	Status Report	05/84	016/84
	Coal Conversion Action Plan	02/87	--
	Solar Water Heating Study	02/87	066/87
	Peri-Urban Woodfuel Development	10/87	076/87
Lesotho	Power Master Plan	11/87	--
	Energy Assessment	01/84	4676-LSO
Liberia	Energy Assessment	12/84	5279-LBR
	Recommended Technical Assistance Projects	06/85	038/85
	Power System Efficiency Study	12/87	081/87
Madagascar	Energy Assessment	01/87	5700-MAG
	Power System Efficiency Study	12/87	075/87
Malawi	Energy Assessment	08/82	3903-MAL
	Technical Assistance to Improve the Efficiency of Fuelwood Use in the Tobacco Industry	11/83	009/83
	Status Report	01/84	013/84
Islamic Republic of Mauritania	Energy Assessment	04/85	5224-MAU
Mauritius	Household Energy Strategy Study	07/90	123/90
	Energy Assessment	12/81	3510-MAS
	Status Report	10/83	008/83
	Power System Efficiency Audit	05/87	070/87
	Bagasse Power Potential	10/87	077/87
Mozambique	Energy Assessment	01/87	6128-MOZ
Niger	Energy Assessment	05/84	4642-NIR
	Status Report	02/86	051/86
	Improved Stoves Project	12/87	080/87
	Household Energy Conservation and Substitution	01/88	082/88
Nigeria	Energy Assessment	08/83	4440-UNI
Rwanda	Energy Assessment	06/82	3779-RW
	Status Report	05/84	017/84
	Improved Charcoal Cookstove Strategy	08/86	059/86
Sao Tome and Principe	Improved Charcoal Production Techniques	02/87	065/87
Senegal	Energy Assessment	10/85	5803-STP
	Energy Assessment	07/83	4182-SE

<u>Country</u>	<u>Activity</u>	<u>Date</u>	<u>Number</u>
	Status Report	10/84	025/84
	Industrial Energy Conservation Study	05/85	037/85
	Preparatory Assistance for Donor Meeting	04/86	056/86
	Urban Household Energy Strategy	02/89	096/89
Seychelles	Energy Assessment	01/84	4693-SEY
	Electric Power System Efficiency Study	08/84	021/84
Sierra Leone	Energy Assessment	10/87	6597-SL
Somalia	Energy Assessment	12/85	5796-SO
Sudan	Management Assistance to the Ministry of Energy and Mining	05/83	003/83
	Energy Assessment	07/83	4511-SU
	Power System Efficiency Study	06/84	018/84
	Status Report	11/84	026/84
	Wood Energy/Forestry Feasibility	07/87	073/87
Swaziland	Energy Assessment	02/87	6262-SW
Tanzania	Energy Assessment	11/84	4969-TA
	Peri-Urban Woodfuels Feasibility Study	08/88	086/88
	Tobacco Curing Efficiency Study	05/89	102/89
	Remote Sensing and Mapping of Woodlands	06/90	--
	Industrial Energy Efficiency Technical Assistance	08/90	122/90
Togo	Energy Assessment	06/85	5221-TO
	Wood Recovery in the Nangbeto Lake	04/86	055/86
	Power Efficiency Improvement	12/87	078/87
Uganda	Energy Assessment	07/83	4453-UG
	Status Report	08/84	020/84
	Institutional Review of the Energy Sector	01/85	029/85
	Energy Efficiency in Tobacco Curing Industry	02/86	049/86
	Fuelwood/Forestry Feasibility Study	03/86	053/86
	Power System Efficiency Study	12/88	092/88
	Energy Efficiency Improvement in the Brick and Tile Industry	02/89	097/89
	Tobacco Curing Pilot Project	03/89	UNDP Terminal Report
Zaire	Energy Assessment	05/86	5837-ZR
Zambia	Energy Assessment	01/83	4110-ZA
	Status Report	08/85	039/85
	Energy Sector Institutional Review	11/86	060/86
	Power Subsector Efficiency Study	02/89	093/88
	Energy Strategy Study	02/89	094/88
	Urban Household Energy Strategy Study	08/90	121/90
Zimbabwe	Energy Assessment	06/82	3765-ZIM
	Power System Efficiency Study	06/83	005/83
	Status Report	08/84	019/84
	Power Sector Management Assistance Project	04/85	034/85
	Petroleum Management Assistance	12/89	109/89
	Power Sector Management Institution Building	09/89	--
	Charcoal Utilization Prefeasibility Study	06/90	119/90

Completed (Region)

<i>Country</i>	<i>Activity</i>	<i>Date</i>	<i>Number</i>
ASIA AND THE PACIFIC			
Bangladesh	Energy Assessment	10/82	3873-BD
	Priority Investment Program	05/83	002/83
	Status Report	04/84	015/84
	Power System Efficiency Study	02/85	031/85
	Small Scale Uses of Gas Prefeasibility Study	12/88	--
China	County-Level Rural Energy Assessments	05/89	101/89
	Fuelwood Forestry Preinvestment Study	12/89	105/89
Fiji	Energy Assessment	06/83	4462-FIJ
India	Opportunities for Commercialization of Nonconventional Energy Systems	11/88	091/88
	Bagasse Cogeneration Preinvestment Study	07/90	120/90
Indonesia	Energy Assessment	11/81	3543-IND
	Status Report	09/84	022/84
	Power Generation Efficiency Study	02/86	050/86
	Energy Efficiency in the Brick, Tile and Lime Industries	04/87	067/87
	Diesel Generating Plant Efficiency Study	12/88	095/88
	Urban Household Energy Strategy Study	02/90	107/90
Malaysia	Sabah Power System Efficiency Study	03/87	068/87
Myanmar	Energy Assessment	06/85	5416-BA
Nepal	Energy Assessment	08/83	4474-NEP
	Status Report	01/85	028/84
Papua New Guinea	Energy Assessment	06/82	3882-PNG
	Status Report	07/83	006/83
	Energy Strategy Paper	--	--
	Institutional Review in the Energy Sector	10/84	023/84
	Power Tariff Study	10/84	024/84
Solomon Islands	Energy Assessment	06/83	4404-SOL
South Pacific	Petroleum Transport in the South Pacific	05/86	--
Sri Lanka	Energy Assessment	05/82	3792-CE
	Power System Loss Reduction Study	07/83	007/83
	Status Report	01/84	010/84
	Industrial Energy Conservation Study	03/86	054/86
Thailand	Energy Assessment	09/85	5793-TH
	Rural Energy Issues and Options	09/85	044/85
	Accelerated Dissemination of Improved Stoves and Charcoal Kilns	09/87	079/87
	Northeast Region Village Forestry and Woodfuels Preinvestment Study	02/88	083/88
	Impact of Lower Oil Prices	08/88	--
	Coal Development and Utilization Study	10/89	--
Tonga	Energy Assessment	06/85	5498-TON
Vanuatu	Energy Assessment	06/85	5577-VA
Western Samoa	Energy Assessment	06/85	5497-WSO

<i>Country</i>	<i>Activity</i>	<i>Date</i>	<i>Number</i>
EUROPE, MIDDLE EAST AND NORTH AFRICA (EMENA)			
Morocco	Energy Assessment	03/84	4157-MOR
	Status Report	01/86	048/86
Pakistan	Household Energy Assessment	05/88	--
	Assessment of Photovoltaic Programs, Applications, and Markets	10/89	103/89
Portugal	Energy Assessment	04/84	4824-PO
Syria	Energy Assessment	05/86	5822-SYR
	Electric Power Efficiency Study	09/88	089/88
	Energy Efficiency Improvement in the Cement Sector	04/89	099/89
	Energy Efficiency Improvement in the Fertilizer Sector	06/90	115/90
Tunisia	Fuel Substitution	03/90	--
Turkey	Energy Assessment	03/83	3877-TU
Yemen	Energy Assessment	12/84	4892-YAR
	Energy Investment Priorities	02/87	6376-YAR

LATIN AMERICA AND THE CARIBBEAN (LAC)

Bolivia	Energy Assessment	04/83	4213-BO
	National Energy Plan	12/87	--
Chile	Energy Sector Review	08/88	7129-CH
Colombia	Energy Strategy Paper	12/86	--
Costa Rica	Energy Assessment	01/84	4655-CR
	Recommended Technical Assistance Projects	11/84	027/84
	Forest Residues Utilization Study	02/90	108/90
Ecuador	Energy Assessment	12/85	5865-EC
	Energy Strategy Phase I	07/88	--
Haiti	Energy Assessment	06/82	3672-HA
	Status Report	08/85	041/85
Honduras	Energy Assessment	08/87	6476-HO
Jamaica	Energy Assessment	04/85	5466-JM
	Petroleum Procurement, Refining, and Distribution Study	11/86	061/86
	Energy Efficiency Building Code Phase I	03/88	--
	Energy Efficiency Standards and Labels Phase I	03/88	--
	Management Information System Phase I	03/88	--
	Charcoal Production Project	09/88	090/88
	FIDCO Sawmill Residues Utilization Study	09/88	088/88
Panama	Power System Efficiency Study	06/83	004/83
Paraguay	Energy Assessment	10/84	5145-PA
	Recommended Technical Assistance Projects	09/85	--
	Status Report	09/85	043/85
Peru	Energy Assessment	01/84	4677-PE
	Status Report	08/85	040/85
	Proposal for a Stove Dissemination Program in the Sierra	02/87	064/87
Saint Lucia	Energy Assessment	09/84	5111-SLU

Completed (Region)

<i>Country</i>	<i>Activity</i>	<i>Date</i>	<i>Number</i>
St. Vincent and the Grenadines	Energy Assessment	09/84	5103-STV
Trinidad and Tobago	Energy Assessment	12/85	5930-TR
GLOBAL			
	Energy End Use Efficiency: Research and Strategy	11/89	--
	Women and Energy—A Resource Guide		
	The International Network: Policies and Experience	04/90	--

ONGOING ACTIVITIES (REGION)

Activities presented in boldface are the latest additions to the listing.

<i>Country</i>	<i>Activity</i>	<i>Status*</i>	<i>Next Stage</i>
SUB-SAHARAN AFRICA			
Africa Regional	Study of SADCC Energy Unit	3	December 1990
	Design of ESAMI Energy Training Curricula	3	October 1990
	SADCC Household Energy Survey Applications		
	Training Phase I	1	September 1990
	SADCC Household Energy Survey Applications		
	Training Phase II	1	December 1990
	SADCC Regional Electric Power Interconnection		
	Prefeasibility Study	1	December 1990
Angola	Power Subsector Investment Review	3	October 1990
Botswana	Urban Household Energy Strategy Study	4	September 1990
Burkina Faso	Urban Household Energy Strategy Study	4	October 1990
Burundi	Energy Assessment Update	3	November 1990
Cameroon	Energy Strategy Study	3	December 1990
	Household Energy Strategy Study	2	July 1991
Central African Republic	Energy Assessment	2	November 1990
Congo	Improvement of the Operational Performance of the Power Sector	1	October 1990
Côte d'Ivoire	Energy Sector Technical Assistance	2	November 1990
	Energy Efficiency in Buildings	1	October 1990
Gabon	Energy Efficiency Seminar	4	October 1990
Ghana	Industrial Energy Rationalization Study Phase I	4	December 1990
	Improved Charcoal Production Project	4	October 1990
	Improved Charcoal Stoves Project	2	October 1990
Guinea	Household Energy Strategy Study	2	April 1991
Guinea-Bissau	Power Sector Management Assistance	4	September 1990
	Urban Household Energy Strategy Study	1	September 1990
Lesotho	Institutional and Regulatory Framework for the Power Sector	1	October 1990
Malawi	Evaluation of Power System Losses	1	September 1990
Mali	Energy Assessment	4	September 1990
	Household Energy Strategy Study	3	December 1990
Mozambique	Household Electricity Utilization Study	4	September 1990
Rwanda	Energy Assessment Update	4	September 1990
	Charcoal Kilns Phase II	2	October 1992
	Charcoal Stoves Phase II	2	May 1991
Sao Tome	Hydropower Feasibility Study	2	October 1990

Ongoing (Region)

<i>Country</i>	<i>Activity</i>	<i>Status *</i>	<i>Next Stage</i>
Senegal	Industrial Energy Conservation	4	December 1990
	Energy Strategy and Donors' Meeting	2	December 1990
	Energy Efficiency in Buildings and Transport	1	December 1990
Tanzania	Power Loss Reduction and Distribution Planning	1	December 1990
Uganda	Minihydro Rehabilitation Feasibility Study	3	October 1990
	Energy Efficiency in Agro-Industries	1	October 1990
Zimbabwe	Energy Strategy Evaluation	4	October 1990
	Energy Strategy for Low-Income Communities Phase II	2	December 1990

ASIA AND THE PACIFIC

Asean Region	Financing Energy Services to Small-Scale Energy Users (Finesse)	2	October 1990
China	Rural Energy Training and Technical Assistance Phase I	2	March 1991
	Technical Assistance for Planning and Management in Small Power Companies Phase I	2	December 1990
India	Irrigation-Based Minihydro Study	3	October 1990
	Windfarm Development Preinvestment Study	2	September 1990
	Integration of Regional Power System Operations	1	November 1990
Indonesia	Rural and Traditional Energy Study	1	October 1990
	Biomass Gasifier Preinvestment Study	4	March 1990
	Improved Biomass Utilization Study Phase I	2	October 1990
	Technology Transfer and Demonstration of Charcoal Ferrocement Gasifiers	2	February 1991
Nepal	Comparative Study of International Power Sales and Water Resource Development Agreements	3	December 1990
Pacific Region	Household and Rural Energy Seminar	2	November 1990
Philippines	Assistance for Updating the Nonconventional Energy Program	2	December 1990
Solomon Islands	Household Energy Strategy Study	2	December 1990
	Energy Assessment Update	2	September 1990

EUROPE, MIDDLE EAST AND NORTH AFRICA (EMENA)

Morocco	Loss Reduction in Transmission and Distribution	2	October 1990
	Natural Gas Development Plan	2	November 1990
Pakistan	Household Energy Strategy Study	2	October 1990
	Energy Efficiency Study	2	October 1990
Poland	Natural Gas Development Plan	2	October 1990
	Restructuring Program for the Hard Coal Subsector	2	December 1990
	Restructuring Programs for the Electricity, Lignite, and Heating Subsectors	2	December 1990

<i>Country</i>	<i>Activity</i>	<i>Status *</i>	<i>Next Stage</i>
	Natural Gas Pricing and Tariff Study	2	December 1990
	Environmental Assessment	1	October 1990
	Restructuring Study of the Poland Oil and Gas Company (POGC)	1	October 1990
	Legal and Contractual Framework Study and Training Program	1	December 1990
Tunisia	Energy Efficiency in Households and Services	3	December 1990
	Power System Efficiency Study	3	December 1990
Yemen	Household Fuel Marketing Study	4	October 1990
	Assessment of Photovoltaics for Rural Household Electric Supply	1	September 1990
LATIN AMERICA AND THE CARIBBEAN (LAC)			
Argentina	Regulatory and Contract Framework in the Natural Gas Sector	1	October 1990
Bolivia	La Paz Private Power Technical Assistance	4	November 1990
	Energy Planning for Rural Integrated Development Project (Agroyungas)	4	October 1990
	Technical Assistance in Energy Planning	2	December 1990
	Household Energy Strategy Study	2	February 1991
	Private Power Generation and Transmission	1	December 1990
	Natural Gas Distribution Strategy Study Phase I	1	October 1990
Brazil	Carajas Energy Supply Options Study	2	December 1990
Caribbean Region	Power Seminar	4	September 1990
Colombia	Power Sector Information System	3	September 1990
	Power Planning Technical Assistance	2	September 1990
	Interfuel Substitution and End Use Efficiency Study	2	September 1990
Dominican Republic	Energy Assessment	3	December 1990
Ecuador	Electric Power Loss Reduction Study	2	November 1990
Guatemala	Energy Assessment	2	November 1990
Haiti	Household/Small Industry Energy Strategy Study	2	December 1990
Honduras	Petroleum Supply Management Assistance	4	December 1990
Jamaica	Energy Efficiency Program	3	December 1990
	Improved Charcoal and Kerosene Stoves Pilot Project	2	October 1990
LAC Regional	Household Energy Planning Seminar	4	September 1990
Mexico	Charcoal Production/Marketing within Forest Management Phase I (Veracruz)	4	October 1990
	Charcoal Production/Marketing within Forest Management Phase II (Veracruz)	1	October 1990
Peru	Energy Strategy Study	2	November 1990

<i>Country</i>	<i>Activity</i>	<i>Status *</i>	<i>Next Stage</i>
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GLOBAL

	Guidelines for Utility Management and Billing	4	September 1990
	Improved Cookstove Dissemination Impact Study	2	September 1990
	Energy Related Training in Italy	2	November 1990
	PC Models for Energy Planning	1	November 1990
	Energy Efficiency Strategy in the Transport Sector	1	November 1990
	Francophone Seminar on the Design of Energy Efficiency Programs	1	November 1990
	Development of Potential for Small Uses of Natural Gas	1	October 1990
	Unified Approach to Petroleum Contracts	1	December 1990
	Environmental Costs and Benefits of Natural Gas Use	1	December 1990
	Policy Research on Interfuel Substitution in Urban Households with Special Reference to Kerosene and LPG	1	September 1990
	Guidelines for Optimizing Power Distribution Network Standards	1	December 1990
	Global Energy and Environmental Initiative: Alternative Energy Paths	1	December 1990

* Stages of Activities: (1) Preparatory work, (2) Missions, (3) Report being drafted, (4) Report sent to government

PROSPECTIVE ACTIVITIES (REGION)

Activities presented in boldface are the latest additions to the listing.

<u>Country</u>	<u>Activity</u>
SUB-SAHARAN AFRICA	
Africa Regional	Biomass Assessment for West Africa Biomass Assessment for Southeast Africa SADCC Coal Utilization in the Household, Service, and Small Industry Sectors Support for the Regional Wood Energy Program SADCC Woodland Management Strategy Study SADCC Assessment of Applications and Markets for Solar Photovoltaic Systems SADCC Energy Efficiency in Rural Industries
Angola	Rural Energy Technical Assistance Training
Botswana	Strengthening the Energy Unit
Burundi	Power Distribution Cost Reduction Study
Cameroon	Energy Efficiency Program in Public Buildings and Industries
Chad	Household and Biomass Energy Strategy Study
Comoros	Design of Biomass Energy Strategy
Congo	Technical Assistance for Energy Planning Dissemination of Improved Stoves
Ethiopia	Fuelwood Forestry Feasibility Study
Ghana	Industrial Energy Rationalization Study Phase II
Malawi	Urban Household Energy Strategy Study
Rwanda	Power Loss Reduction Project
Sierra Leone	Household Energy Strategy Study
Swaziland	Power Development and Electricity Tariffs Household Energy Strategy Study
Tanzania	Industrial Energy Efficiency Implementation Minihydro Feasibility Study
Zaire	Design of Biomass Energy Strategy
Zambia	Enhancing Charcoal Production, Distribution, and Energy Management
Zimbabwe	Industrial Energy Efficiency Study

Country Activity

ASIA AND THE PACIFIC

China	Rural Energy Training and Technical Assistance Phase II Energy Efficiency and Environment Strategy Study
India	Power Efficiency Technical Assistance
Indonesia	Diesel Efficiency Preinvestment Study Rural Household Energy Strategy Study
Lao People's Democratic Republic	Urban Residential Fuel Substitution Study
Malaysia	Natural Gas Sector Study
Nepal	Energy Efficiency Study Rural Energy Technology Study
Pacific Region	Seminar on Electric Power System Losses

EUROPE, MIDDLE EAST AND NORTH AFRICA (EMENA)

Algeria	Industrial Energy Efficiency Study Phase I
Maghreb Region	Preparation of an Energy Efficiency Building Code Regional Energy Problems Seminar Improvement of the Power Interconnection Operation
Poland	Energy Efficiency and Environmental Protection Study
Tunisia	Environmental Evaluation of Long-term Energy Sector Development
Yemen	Commercialization of LPG Appliances

LATIN AMERICA AND THE CARIBBEAN (LAC)

Bolivia	Natural Gas Development Plan Energy Efficiency Strategy Study
Caribbean Region	Diesel Efficiency Improvement Seminar
Ecuador	Minihydro Prefeasibility Study
Honduras	Utilization of Wood Residues
LAC Regional	Energy Consumption in Low-Income Urban Households
Venezuela	Power Sector Restructuring and Loss Reduction

GLOBAL

Evaluation of Past Woodfuel Projects
Handbook on Design and Evaluation of Minihydro Schemes on Irrigation Canals and Dams

Summary Activity Descriptions By Region

COMPLETED ACTIVITIES

Descriptions of completed activities correspond with the statistical table, "Completed Activities (Region)". They give an explanation of the purpose and results of the study or pilot project along with follow-up on recommendations.

All references to cost are presented in U.S. dollars.

Sub-Saharan Africa

Africa Regional

Anglophone Africa Household Energy Workshop (085/88)

The first in a series of workshops was held in February 1988 in Harare, Zimbabwe, at a cost of \$148,000, cofinanced by the Governments of Sweden and the Netherlands. The goal of the workshops was to promote an exchange of information on current household energy issues, methodologies, and options. Specific objectives were to (a) present ESMAP's approach to key issues such as data requirements and methodologies, analysis of policy options, assessment of investment priorities, and institutional requirements, (b) obtain feedback from developing country practitioners based on their concrete experience in dealing with the issues discussed, (c) emphasize the importance of

strategic planning to create a framework for selecting policy and investment options, and (d) discuss the present state of the art in preparing household energy strategies. The Harare workshop proceedings were published in July 1988.

Regional Power Seminar on Reducing Electric Power System Losses in Africa (087/88)

In collaboration with the Economic Development Institute of the World Bank, ESMAP held this seminar in Abidjan, Côte d'Ivoire, in November 1987. Fifty-seven participants attended from electric power utilities in Eastern and Western Africa. The objectives of the seminar were to (a) improve the awareness of the economic and financial costs of power system losses, (b) identify methods for bringing losses down to economic levels, (c) provide a forum for an exchange of ideas, and (d) en-

Completed

courage innovative solutions to system efficiency improvement. The seminar was directed at members of the Union des producteurs, transporteurs et distributeurs d'énergie électrique en Afrique (UPDEA) and selected non-UPDEA members. It was presented simultaneously in two separate working language sections, an anglophone section and a francophone section, each with approximately twenty-eight participants. A series of lectures were presented over the four days covering national energy strategy and the importance of loss reduction in power systems, technical losses, power system rehabilitation, and nontechnical losses. A report consisting of country papers prepared by the participants was circulated.

Institutional Evaluation of EGL (098/89)

The study proposed the appropriate role for l'Organisation de la CEPGL pour l'énergie des pays des grands lacs (EGL), the energy affiliate of the Communauté économique des pays des grands lacs (CEPGL), founded by Burundi, Rwanda, and Zaire. The analysis reviewed the effectiveness of EGL's past work, identified its comparative advantages as an energy planning organization, and proposed a future work program and organization for the entity. The annual report served as the basis for a subsequent review of the function and organization of EGL.

Biomass Mapping Regional Workshops

Workshops were held in Abidjan and Nairobi to explain the aims, uses, and methodology of the biomass mapping project for Africa south of the Sahara and to have the draft maps and biomass estimates reviewed by experts from representative countries covered by the project. The workshops were considered successful in achieving their objectives with a high level of professional interaction taking place. Information and recommendations received from the delegates are to be included in the final maps and report for the mapping project.

Francophone Household Energy Workshop (103/89)

The second in the series of household energy workshops was held for the countries of francophone Africa in January 1989 in Dakar, Senegal. The \$230,000 cost was financed by the Governments of the Netherlands and Sweden. The main objective of the workshop was the creation of a forum for the cross-country exchange of experiences and views on improved stoves programs, the management of natural resources by local villagers, and

interfuel substitution and pricing. This agenda was supplemented by the introduction of a discussion on women in energy policy planning and program implementation. The discussions and debates were built around case studies delivered by experts from Burkina Faso, Burundi, Haiti, Rwanda, and Senegal and were supplemented with working group sessions which brought participants from tropical and semiarid countries together to compare and contrast experiences and to seek solutions to specific country situations. The Dakar workshop proceedings were published in August 1989.

Interafrican Electrical Engineering College: Proposals for the Short- and Long-Term Development (112/90)

The Interafrican Electrical Engineering College (IEEC) at Bingerville, Côte d'Ivoire, was established in 1979 by the Union of Producers, Conveyors and Distributors of Electrical Energy in Africa (UPDEA) to provide a high quality education to degree level coupled with practical engineering training. The college has graduated 127 engineers who are now working in 14 African countries. These graduates have a reputation for being equivalent or better prepared than their peers who graduate from European or American universities. They also have been shown to return to their home country and exercise their profession with the sponsoring utility. Since the IEEC does not receive direct support from African governments, it is faced with higher tuition costs per student than national institutions. Furthermore, some bilateral donors offering assistance with engineering education prefer to sponsor students to the donor's country instead of to the IEEC. As a result, the college has continuously had financial shortfalls, which have been recently exacerbated by economic difficulties in many African countries. In 1986, ESMAP issued a confidential report on the IEEC curriculum, pedagogical quality, management, and finances. This report contained the following three key recommendations which have now been largely implemented: (a) delegation of authority from UPDEA to IEEC management and development of clearly defined areas of responsibility, (b) separation of financial reporting and accounting functions between UPDEA and IEEC and the production of externally audited financial statements, and (c) budgeting and accounting of external bilateral assistance as part of the cost per student. In addition, a number of less significant recommendations have also been put into practice. However, financial difficulties persisted and, in early 1989, ESMAP agreed to again review the college's orientation and funding. A revised report, produced in March 1990, outlined 12 action plans to enable the col-

lege to increase enrollment and obtain financial self-sufficiency within ten years. The activity was financed by the Government of the Netherlands.

Biomass Assessment and Mapping

The objective of this activity was to provide estimates of the area, location, growing stock, and annual growth of the various vegetation/biomass classes on a regional basis for Africa south of the Sahara. The data required was obtained from satellite imagery, the interpretation of which was checked by field verification in selected sites and through review by the Bank, FAO, and other relevant agencies and national experts. The final output is a summary biomass map of aboveground woody biomass supplies, regional maps, biomass profiles, and tables of regional biomass stock and yield. This information is being used as the first stage of a multistage biomass assessment for sub-Saharan Africa and will be a useful planning tool for woodfuel supply and demand strategy formulation when combined with spatial consumption information. Regional biomass assessments are now being planned for selected woody biomass/vegetation types using more intensive methods.

Angola

Energy Assessment (4708-ANG)

The objectives of this exercise were to (a) evaluate options for improving energy planning at the national level, (b) improve the efficiency of energy use through pricing, incentives, and other demand management tools, (c) in the petroleum subsector, evaluate production operations, natural gas recovery, and refining supply, (d) in the electricity subsector, assess reorganization, manpower, training, financial performance, and plant condition, and (e) in household energy, assess the forestry resource, firewood and charcoal supply, pricing, and interfuel substitution. The final report on the activity was issued in English and Portuguese in October 1989.

Benin

Energy Assessment (5222-BEN)

Since the 1970s, the Government of Benin has assumed a greater role in steering the country's economy. After a period of pronounced economic decline, the authorities resolved to improve performance especially in the areas of agricultural development and the rehabilitation of the industrial sector which would require a compatible set of policy measures. The challenge for

the ESMAP mission was to design a least cost energy strategy which involved the most economic utilization of domestic energy resources and thus reduce the dependence on imported petroleum products. It became evident that the government needed to consider a whole number of measures to ensure an adequate long-term supply of fuelwood at competitive prices. This demanded implementation of a management plan for the rational exploitation of existing forest resources and evaluations of the potential contribution by agricultural residues and the related cost of converting them into usable energy forms. Surveys also had to be carried out to verify Benin's oil and gas potential. An energy conservation program covering all consumer groups had to be designed so that the damaging effects of electricity supply disruptions could be minimized. Simultaneously, the energy management capacity of the country needed strengthening. Lastly, the ESMAP study proposed a \$200 million investment program for the period 1984 to 1988.

Botswana

Energy Assessment (4998-BT)

The Government of Botswana during the past decade have grappled with numerous important energy issues. In the first place, they needed to sustain an ongoing transition from the country's almost complete dependence on imported petroleum to increased reliance on local resources, particularly coal. They devised and implemented a strategy for exploring and exploiting indigenous energy resources for export as well as domestic consumption purposes, in the process of which they had to overcome institutional fragmentation in energy planning and sector management. Finally, significant progress was made in outlining energy policy objectives which addressed some aspects of these problems. ESMAP reviewed Botswana's energy programs and made recommendations on the (a) prospects for and economic viability of proposed projects to exploit huge coal deposits for export, (b) expansion and consolidation of the power system, (c) scope for substituting diesel generated power for water pumping, and (d) strategy for promoting exploration for oil and gas in the Kgalagadi desert area. Evaluations of government initiatives concerning the supply and use of woodfuels, and efforts to apply renewable energy technologies were added.

Pump Electrification Prefeasibility Study (047/86)

The purpose of this study was to determine the technical and economic feasibility of converting water pumps from diesel to electric power. The final study,

Completed

presented in January 1986, identified a group of 23 villages where pump electrification appears to be attractive. The total investment required is about \$1 million.

Review of Electricity Service Connection Policy (071/87)

The activity evaluated the electricity connection policy of the Botswana Power Corporation (BPC) and made recommendations of financial and technical options which will make connections more affordable without promoting uneconomic connections or impairing the financial viability of BPC.

Tuli Block Farms Electrification Study (072/87)

Under this activity, a prefeasibility study was prepared on the connection of the Tuli Block Farms to the Morupule power station in order to replace imported diesel oil with electricity produced by cheaper domestic resources (coal). The total investment was estimated at about \$6.9 million.

Household Energy Issues Study

This activity, which was wholly financed by the World Bank, resulted in an issues paper which identified the major energy problems facing the household sector in Botswana. The paper also put forward to the government a suggested program of survey, analysis, and program formulation. Discussions were held with the government in October 1987, and agreement was reached with ESMAP on a further activity which is estimated to cost \$365,000 and for which financing from the Government of Sweden was secured. The project started in September 1988.

Burkina Faso

Energy Assessment (5730-BUR)

The key energy issues that the Government of Burkina Faso faced were problems related to fuelwood use and desertification in the central Mossi Plateau, petroleum products imports from the Côte d'Ivoire and Togo, the country's power sector, and energy planning. The 1986 study put forward a number of recommendations to promote improved biomass demand and supply management, the introduction of hydro systems for irrigation and electricity generation, massive donor support for institution strengthening activities, and research and development and preinvestment appraisal of substitutes.

Technical Assistance Program (052/86)

This activity identified a technical assistance program for the energy sector in Burkina. Since then, Norway and the Netherlands have provided funding for the top priority project identified in the report, an urban household energy strategy study. Petroleum import management and power plant rehabilitation studies also were identified as priorities.

Burundi

Energy Assessment (3778-BU)

The 1982 assessment of Burundi's energy economy identified a whole set of problems, the most important of which was the increasing scarcity of fuelwood and other traditional fuels used for cooking and other basic energy needs. Issues such as the high cost of oil imports, relatively low reliability of petroleum product supply, and assuring the long- and medium-term reliability of electric power were also addressed. ESMAP, amongst other things, recommended the introduction of improved charcoal cookstove and kiln designs and in the area of peat production suggested additional studies of the potential industrial market for this domestic resource. Furthermore, a petroleum product stockpiling plan and various institution building proposals were introduced and deemed of high priority.

Petroleum Supply Management (012/84)

The purpose of this activity, carried out in September 1983, was to review existing and alternative arrangements for importing and distributing petroleum products. The study set out a number of recommendations for diversifying supply routes and strengthening the government's capacity to formulate and implement a cost-effective petroleum supply strategy. It also includes a proposal for technical assistance over one year to help the government develop this capability. The technical assistance package identified in the study was included as part of an IDA power project in Burundi.

Status Report (011/84)

The status report, completed in 1984, recommended a number of government policies designed to improve the supply and availability of the country's energy resources. The lack of trained personnel was a critical weakness especially in the forestry sector. Moreover, the coordination of ongoing reforestation efforts deserved closer attention and the forest administra-

tion needed to be strengthened. With regard to peat promotion, the ESMAP team observed that the government had not introduced any price incentive to substitute peat for coal. No progress was reported on a petroleum stockpiling plan, but advances were made in the preparation of a power master plan. Surveys of Burundi's hydro and other renewable energy resources potential had also been carried out.

Presentation of Energy Projects for the Fourth Five-Year Plan, 1983-1987 (036/85)

Under this activity, priority investment and technical assistance project profiles were prepared and presented to potential donors at the UNDP sponsored round table meeting in Bujumbura in February 1984. The final report on this activity, issued in May 1985, included an update on Burundi's energy sector and, in particular, on the status of the projects presented at the round table. Since February 1984, progress has been made in the areas of woodfuel plantations, petroleum supply arrangements, conversion of industrial boilers to peat, the Ruzizi II-Burundi electricity connection, rationalization of Bujumbura's electricity network, and promotion of improved charcoal stoves in Bujumbura.

Improved Charcoal Cookstove Strategy (042/85)

ESMAP support was used to design an improved stove for the IDA urban development project (Cr. 1049-BU). The improved stove has a slightly higher production cost than the traditional model but consumes about 30 percent less charcoal. The ESMAP study proposed a program for marketing this stove which involves training and extension.

Peat Utilization Project (046/85)

This activity proposed a three-phase plan to expand the peat market from its present level of 9,000 tons/year to a more economically justified level of 28,000 tons/year.

Cape Verde

Energy Assessment (5073-CV)

In 1984, the ESMAP study found that Cape Verde relied totally on imported petroleum fuels to meet the requirements of one-third of the household sector and the total needs of the transport and industrial sectors. The remaining two-thirds of the households consumed biomass fuels which contributed to the gradual destruc-

tion of the country's naturally sparse plant cover. ESMAP recommended a number of policy measures to increase and optimize energy supply and utilization and to continue developing firewood resources. Funding was provided under the supplementary Small Country Assessment Program financed by the Swedish government through the UNDP.

Household Energy Strategy Study (110/90)

This activity assisted the Government of Cape Verde in the development and assessment of realistic household energy strategies which are based on currently available woodfuel resources, demand management and interfuel options, and pricing policy issues. The implementation of the activity started in March 1988, with the main field mission completed in August 1988. The study undertaken included, among others, a household energy survey, a stove efficiency assessment, a market survey of consumer attitudes vis-à-vis various stove models and their fuels, and the development of a socioeconomically feasible long-term project to implement a household energy strategy. The total cost of \$292,000 was met by DANIDA. The final project report was issued in February 1990.

Comoros

Energy Assessment (7104-COM)

This exercise focused on household energy, power supply efficiency, and petroleum pricing. Identified follow-up activities would address a petroleum accounting and information system, improved stoves, power loss reduction, and improving the efficiency of ylang-ylang distilleries. The final report was published in January 1988.

Congo

Energy Assessment (6420-COB)

The report analyzes the basic energy supply and demand trends over the past years and assesses the main policy issues and options related to energy pricing, sub-sector investments, and institutional development at both the sectoral and enterprise levels. The report outlines a strategy aimed at strengthening energy sector management and technical assistance needs for priority investigations and institution building including planning and training in areas pertaining to hydrocarbon production and distribution, electricity rehabilitation, and charcoal development and its promotion.

Power Development Plan (106/90)

The study evaluated the electricity supply options and recommended a least cost investment program to cope with the demand. The recommended strategy is based, in the medium term, on regional cooperation and electricity imports from the Inga hydropower plant in Zaire. A comprehensive risk analysis was carried out to ensure proposed investment decisions are risk averse and robust in an uncertain environment.

Côte d'Ivoire

Energy Assessment (5250-IVC)

The work which ESMAP carried out in 1984 and 1985 in Côte d'Ivoire was mainly targeted at problem areas such as pricing policies of the public enterprises and institutional arrangements in the subsectors. The endeavor was intended to alleviate the burden on energy development posed by existing tight financial conditions and the limited coordination of subsector planning and policy. The final study recommended measures to stimulate further exploration of hydrocarbon resources, the revision of plans to expand power generation, and the introduction of programs to expand the supply and efficient utilization of traditional fuels such as fuelwood, charcoal, and biomass residues.

Improved Biomass Utilization (069/87)

This activity considered four biomass sources with significant potential for increased utilization: sawmill wastes, palm oil residues, rice husks, and coffee residues and evaluated the economic and technical feasibility for tapping unutilized wastes from these sources.

Power System Efficiency Study

A technical assistance mission visited Côte d'Ivoire in February 1986 and undertook the efficiency audit. The findings of the audit were presented to the public electric utility, EECI, and the government in November 1986, and the project was further discussed with them in June 1987. The recommended rehabilitation of the Vridi steam generation plant is underway. The technical assistance recommended in the report in operations and commercial administration has been formulated and discussed with an interested bilateral agency. This activity was largely financed by the Government of France.

Ethiopia

Energy Assessment (4741-ET)

Serious household fuel supply and demand imbalances have dominated the Ethiopian energy picture. Massive deforestation and soil erosion have threatened an otherwise fertile agricultural base. In 1984, ESMAP designed a strategy to increase the availability of household fuels through reforestation, the production of new biomass fuels, and the introduction of cooking fuel demand management techniques. In addition, the strategy included measures to determine the means to optimize the exploitation of hydropower and natural gas and promote the efficient use of electricity and imported petroleum. The study identified energy sector investments worth an estimated \$1.7 million for the period 1984 to 1993.

Power System Efficiency Study (045/85)

This study identified a package of five action programs to bring power transmission and distribution losses down to economic levels and to improve the efficiency, capacity, and availability of generating plants. The total cost of the project was estimated at \$15.9 million. The first phase involved institutional strengthening and planning of physical improvements at a cost of about \$3.5 million. The second phase included physical improvements to generation plant at a cost of about \$12.4 million.

Agricultural Residue Briquetting Pilot Project (062/86)

This activity (a) reviewed the technical and economic prospects of collecting wasted crop residues on Ethiopian state farms and (b) developed bidding documents for a series of pilot projects covering the collection and densification of these residues into fuel briquettes.

Bagasse Study (063/86)

This activity assessed opportunities for increasing energy efficiency in existing and planned sugar mills to produce surplus bagasse. It also assessed the technical, economic, financial, and institutional feasibility of alternative uses for the bagasse.

Cooking Efficiency Project

This project helped to establish a self-sustaining improved stoves program for urban households, building

upon the existing artisanal capacity for stove production. A household energy survey was conducted in Addis Ababa and improved stoves were tested. Field work for phase I was concluded in July 1987. Draft study reports were prepared on (a) a longitudinal study of fuel consumption, (b) a survey of the acceptability of metal, wood, and charcoal stoves for households, and (c) plans for a cooking efficiency program in Ethiopia. Draft study reports also have been prepared on a plan for producing and marketing improved woodstoves and on the use of charcoal and kerosene stoves for household use in Addis Ababa. Financial support was provided by the Government of the Netherlands (\$75,000), UNDP IPF (\$140,000), the World Bank (\$100,000), and the ILO (\$21,000). The latter also contributed staff resources to assist implementation of phase I.

Gabon

Energy Assessment (6915-GA)

This assessment reviewed the country's options following the oil price decline. As a result, emphasis was given to the conventional energy subsectors (petroleum and electricity). Discussions with the government were held in December 1987, at which time several potential follow-up activities were reviewed. These included a gas utilization study and a diagnostic evaluation of refining and petroleum product pricing. The final report was published in July 1988.

The Gambia

Energy Assessment (4743-GM)

The Gambia's petroleum import requirements have greatly contributed to the country's trade deficit especially since groundnut prices remained depressed over a long period of time. In 1983, the country relied completely on imported petroleum to meet its commercial energy needs, and electricity was generated entirely by diesel systems. A complicating factor was the loss of a substantial amount of power caused by the damage done to the power station at Half Die. ESMAP reviewed the existing petroleum import arrangements and outlined a technical assistance program to improve the country's energy situation.

Solar Water Heating Retrofit Project (030/85)

The study presented a preinvestment analysis of solar water heating retrofit at the five largest tourist hotels and included terms of reference to extend the experience

to the remaining tourist hotels. The total investment for the retrofit program was estimated at \$500,000, including spares, contingency, and technical assistance.

Solar Photovoltaic Applications (032/85)

This study presented a prefeasibility analysis of photovoltaic applications in the rural health and telecommunications sectors and identified highly profitable investments consisting of \$500,000 for hardware procurement and installation and \$112,000 for technical assistance.

Petroleum Supply Management Assistance (035/85)

This activity defined and proposed (a) measures to reduce petroleum acquisition costs, (b) methods to improve the government's capacity to monitor the petroleum sector, (c) terms of reference for an energy economist to set up the energy unit, (d) a flexible pricing structure in the petroleum sector, and (e) a strategy to determine levels of compulsory stocks.

Ghana

Energy Assessment (6234-GH)

Ghana's economic predicament has been aggravated by insufficient energy supplies during the first half of the 1980s. The government faced (a) scarcity of foreign exchange needed for maintenance and system rehabilitation, (b) a large petroleum import bill, (c) deforestation, especially in the Northeast, and (d) institutional weaknesses at the sectoral level and in the operating entities. ESMAP's response involved a four-pronged approach. The study recommended (a) the rehabilitation of the infrastructure and productive installations in the electricity and petroleum subsectors, (b) the improvement of energy demand management through economic-cost pricing and nonpricing measures to increase energy efficiency, (c) the strengthening of the operating entities, and (d) improving energy planning and coordination. Development expenditure requirements in 1986-1990 were projected to total \$620 million.

Energy Rationalization in the Industrial Sector (084/88)

Energy efficiency in industrial firms in Ghana has been low but could be increased by at least 15 percent through improved housekeeping measures. However, policy, institutional, economic, and financial constraints limit the effectiveness of any government program to

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rationalize energy use in industry. A report was prepared, financed by CIDA, to assist the government in initiating an effective industrial energy rationalization program. The report was issued in June 1988.

Sawmill Residues Utilization Study (074/87)

A substantial amount of residues from the wood processing industry in Ghana is at present wasted. These residues could be used to (a) generate steam for mills for further value added wood processing and (b) produce charcoal and sawdust briquettes for urban commercial and domestic consumption. The ESMAP study evaluates these options and prepares viable projects for utilizing sawmill residues. The study report was discussed with the government in January 1988 and was issued in final form in November 1988. The Government of Ghana has investigated the possibility of obtaining financing for the recommended investments from the Government of Sweden.

Guinea

Energy Assessment (6137-GUI)

Measures to overcome urgent problems in the power and petroleum procurement sector were the centerpiece of a strategy prepared by ESMAP for the Government of Guinea in 1986. The policies attempted to counter chronic operating breakdowns in the electricity supply system, strengthen the Société nationale d'électricité (SNE), and eliminate low electricity prices which caused a squeeze on SNE revenues. The petroleum subsector was characterized by (a) institutional weaknesses, (b) supply and distribution problems, (c) low pricing levels, (d) high port costs, and (e) low levels of security stocks. ESMAP's response consisted of seven priority short-term investments costing about \$11 million. The study also put forth suggestions to strengthen sector institutions in the energy sector as a whole. The formation of an interministerial coordination group for energy and the reorganization of the Ministry of Natural Resources, Energy and Environment were part of these recommendations.

Guinea-Bissau

Energy Assessment (5083-GUB)

The focal point of an action plan to boost the energy sector of Guinea-Bissau was a set of 1984 recommendations that aimed to complete and consolidate the organization of the energy sector's institutions and

concentrate investments on the rehabilitation and debottlenecking of the existing installations. The study suggested a number of investments to expand capacity and to ensure operations at a satisfactory level.

Recommended Technical Assistance Projects (033/85)

The purpose of this activity was to review with the government a number of technical assistance priorities that had been identified in the energy assessment report. Based on the discussions, terms of reference were prepared for projects designed to strengthen the power sector.

Management Options for the Electric Power and Water Supply Subsectors (100/89)

Supply of electricity and water in Guinea-Bissau has been characterized in the past by poor efficiency and chronic service interruptions. The response of the donor community has been to make a generous supply of grants and preferential financing available, in addition to providing ample technical assistance. In spite of this, service remains unreliable with most areas having water or electricity for only a few hours each day. The total amount of multilateral and bilateral funding for power and water in Guinea-Bissau during the past ten years is equivalent to three times the present value of the electricity and water systems. The amount spent on technical assistance has far exceeded the total payroll for all employees working in these subsectors. This ESMAP activity was funded by Sweden and was the first phase of a two-part project to improve service and efficiency. The report describes different management structures for the electric power and water supply subsector, and analyses the implications of each. The second phase, which is presently underway with French funding, assists the government in implementing the selected structure.

Kenya

Energy Assessment (3800-KE)

The ESMAP team which visited Kenya in 1981 found that the government faced two major energy problems. In the first place, the cost of imported energy had become an increasingly heavy burden on the balance of payment. In 1980 this item accounted for 36 percent of exports, while in 1978 it was still 16 percent. Secondly, deforestation had worsened because woodfuels were consumed at about four times the annual rate of incremental production. The study outlined a comprehensive strategy

to counter these developments. This involved, amongst other things, the reduction of the net cost of petroleum products by encouraging a more economic mix of petroleum product imports and exports. Moreover, special emphasis was placed on promoting end use efficiency and the improvement of reforestation programs.

Power System Efficiency Study (014/84)

The objective of this audit was to define short- and medium-term measures to implement cost effective modifications to system facilities, operations, and construction standards that would improve the technical efficiency of the power system and reduce nontechnical losses. The study identified an \$11 million investment and technical assistance package for reducing system losses and rehabilitating the Kipevu steam plant. Investments could be expected to yield annual benefits of \$10.5 million.

Status Report (016/84)

The 1984 study found that economic conditions had deteriorated in Kenya since the 1981 energy assessment mission. It recommended relatively wide-ranging fuel saving measures and quick assistance to the private sector and successful parastatals. Simultaneously, a plan to optimize energy investment including a least cost power development strategy was proposed. This involved determining the appropriate institutional structure for the power sector as well as the strengthening of the ability of the new Ministry of Energy and Regional Development to formulate policies and energy development priorities.

Coal Conversion Action Plan

This activity evaluated the potential for industrial firms to convert to imported coal and identified cost-effective opportunities for industrial energy conservation. Phase I of the study indicated that substitution of coal in the industrial sector would not be economically justified at the prevailing prices for petroleum products, except in a few specific cases. Phase II assessed the potential for cost-effective energy conservation in industry and identified specific conservation projects.

Solar Water Heating Study (066/87)

Based on work done by the government and donor agencies, this study evaluated the potential for substituting solar water heaters for electricity in the residential/commercial, industrial, and institutional sectors. It

also proposed a policy and incentive framework for local production and dissemination of solar water heaters.

Peri-Urban Woodfuel Development (076/87)

This activity identified a program of investments and associated policy measures necessary to meet the growing need for charcoal in Kenya's major urban centers.

Power Master Plan

This activity outlined a national power generation and transmission plan for Kenya covering the period 1986-2006. The plan identified both the specific projects that should be undertaken in the short term to meet anticipated growth in electrical power demand and the general direction that investment should take over the next 20 years.

Lesotho

Energy Assessment (4676-LSO)

ESMAP visited Lesotho in the spring of 1983 to carry out an in-depth examination of this landlocked country's energy requirements. Because Lesotho is endowed with few indigenous resources, the activity focused on the development of hydropower and fuelwood resources. Attention was also given to electric power distribution, rural electrification, petroleum supplies, and institution building in the hydrocarbon section.

Liberia

Energy Assessment (5279-LBR)

The severe problems of the Liberian economy could be partly attributed to the lessened demand for Liberia's export products, especially iron ore, and problems of the economy and major state owned enterprises. ESMAP's strategy for the energy sector was characterized by three main themes: (a) restoring financial viability to the Liberian Electricity Corporation (LEC) and the Liberian Petroleum Refining Company (LPRC), (b) maximizing the service handling capacity in the petroleum and power sectors, and (c) optimizing the exploitation and replenishment of presently abundant woodfuel resources. The study, furthermore, put forward an energy sector investment program of \$60 million between 1984 and 1993.

Recommended Technical Assistance Projects (038/85)

This activity prepared terms of reference for the following projects: (a) improvement of utilization efficiency of charcoal, (b) preinvestment analyses of ore drying using fuelwood, (c) power system efficiency improvement, and (d) review of power exchange possibilities between a mining enclave and a power utility.

Power System Efficiency Study (081/87)

This activity identified a \$37.4 million program to improve commercial operations, electricity distribution, and generation plant efficiency and reliability. The draft report was prepared in August 1986, and the government and the Liberia Electricity Corporation have implemented many of the recommendations with assistance from bilateral agencies. The draft report also contained a recommendation for a complete restructuring of the electric power subsector. This was accepted by the government in July 1987, along with a request to study privatization of the subsector.

Madagascar

Energy Assessment (5700-MAG)

The main energy related issues which the Government of Madagascar faced by 1987 were the threat to the country's forest cover caused by over-utilization of woodfuels and a total dependence on imported oil. The ESMAP study contained a policy package, key components of which were policies designed to promote the more efficient exploitation and utilization of existing woody biomass and hydropower resources. Other elements focused on the measures needed to improve the existing energy infrastructure in the form of power plant, transmission, and distribution facilities, and the Toamasina petroleum refinery. One attractive option for increasing woodfuel supply until the early 1990s was thought to be the upgrading of traditional charcoaling efficiency and the use of forest residues and noncommercial grade timber such as the Haut Mangoro pine smallwood, sawmill wastes, and logging residues. The demand aspect of the study's household energy proposals concentrated on commercial trials of improved wood and charcoal burning metal stoves as well as more efficient kerosene stoves and electric rice cookers. A proposal to rehabilitate the petroleum refinery aimed at reducing the need for corresponding imports. Finally, the study suggested comprehensive reviews of the government's pricing policies and institutional requirements.

Power System Efficiency Study (075/87)

This activity produced comprehensive reports on the situation of JIRAMA, the national electric utility in Madagascar. It also recommended several improvement projects including diesel plants (\$12.0 million), hydroelectric plants (\$6.2 million), electricity distribution (\$3.1 million), commercial operations (\$11.7 million), and support services (\$4.0 million). The government accepted all recommendations, and the final ESMAP report was published in December 1987. IDA agreed to finance the improvement projects through the power sector investment program. The cost of this study was borne by the Government of France.

Malawi

Energy Assessment (3903-MAL)

The energy policy of the Government of Malawi during the early 1980s was largely influenced by the existence of two major problems. It had become increasingly clear that the consumption of fuelwood, which accounted for 90 percent of the country's primary energy supply, exceeded the sustainable yield of this resource. A continuation of this trend could seriously deplete the country's extensive forest cover. The other major issue concerned petroleum imports; rising world market prices and the charges involved in the disruption of supplies in transit from the coast of Mozambique added significantly to total import costs. The study stressed that the reforestation programs already in place needed to be fine tuned and changed. More importantly, the effort needed to be stepped up and vigorously accompanied by fuelwood efficiency programs in artisanal industries such as the tobacco curing sector. Simultaneously, the study proposed streamlining the petroleum product transport arrangements and encourage more appropriate provisions for holding petroleum stocks. And, specific recommendations were made for the strengthening of the institutional framework for energy policy and management. A listing of the technical assistance required to develop an effective national energy planning capability was included.

Technical Assistance Package to Improve the Efficiency of Fuelwood Use in the Tobacco Industry (009/83)

The objective of this activity was to evaluate the various technical options for improving the efficiency of wood use in the tobacco curing industry. The study defined a \$10 million program to introduce the most

economic set of improvements to be carried out in two phases.

Status Report (013/84)

During the period between the presentation of Malawi's energy assessment and the preparation of the status report, progress was observed in a number of areas. The Ministry of Forestry, for example, had initiated studies and projects related to energy efficiency in wood fired tobacco curing, and a comprehensive inventory of various technical efficiency packages for tobacco curing was completed. Reforestation and fuelwood conservation projects had been started. A study was underway of the country's hydro potential that would include a ranking of project sites. A 20 megawatt power plant was planned for 1984, to be completed by 1986-1987. The government also streamlined the country's petroleum supply system, and alternative supply routes from the neighboring states were developed. Efforts were made to maintain an adequate emergency reserve stock, and a national uniform gasoline price was introduced.

Islamic Republic of Mauritania

Energy Assessment (5224-MAU)

This task established priorities to alleviate the severe development constraints to Mauritania's energy strategy. ESMAP formulated an integrated strategy composed of energy conservation and substitution policies with an emphasis on appropriate energy pricing as well as other measures. Recommendations concerning household and rural fuel supply centered on forestry and woodfuels development through forest management and protection, tree planting, and dissemination of improved stoves. The assessment also covered hydrocarbon exploration, selective wind and solar development, and the strengthening of the institutional and manpower capabilities at the operating agencies and the Energy Directorate in charge of energy planning.

Household Energy Strategy Study (123/90)

This activity analyzes the key policy changes needed to raise the efficiency of woodfuel use in the household sector and to evaluate the potential for substituting butane, kerosene, or imported charcoal for indigenous woodfuels. The study was financed by the Government of Norway through UNSO at a cost of \$175,000.

Mauritius

Energy Assessment (3510-MAS)

The rising cost of petroleum imports was identified as the main problem troubling Mauritius' energy sector. In 1980, it absorbed seven percent of GDP and sixteen percent of the country's scarce export earnings. The comparable figures for 1973 were three and six percent respectively. While price hikes on the international petroleum market played an important role in this development, the fact remained that a large part was caused by the growth of petroleum consumption during the mid 1970s. ESMAP suggested a number of measures aimed at substituting petroleum for cheaper energy resources and increasing the efficiency with which all forms of energy are consumed. Concretely, this meant that the program aimed for a tenfold increase in the contribution of bagasse as an energy source through efficiency improvements and for the construction of a coal fired power plant during the late 1980s. Demand management measures centered on an effort to implement an energy conservation program designed to complement the energy product pricing policy already in place.

Status Report (008/83)

This 1983 review of Mauritius' energy sector since the end of 1981 examined government policies to improve sectoral and institutional performance. It noted that a number of steps had already been taken to define more precisely the potential contribution of bagasse to electricity generation. The institutional framework of the energy sector was strengthened by the creation of an Energy Policy and Projects Division in the Ministry of Energy. This new unit had started to play a much more active role in sector policy formulation and investment programming. However, staffing constraints have limited progress made on the demand management front and hindered the implementation phase of the energy supply diversification program.

Power System Efficiency Audit (070/87)

This audit prepared a project-oriented package of steps to reduce losses and to improve the efficiency of the power system.

Bagasse Power Potential (077/87)

The activity aimed to determine the least cost system for processing, storing, and transporting surplus

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bagasse for power generation and industrial and household use. The analysis concluded that large bales (650 kilograms) are the least cost handling option and recommended installation of a commercial-scale facility to demonstrate the optimal handling system to the sugar industry.

Mozambique

Energy Assessment (6128-MOZ)

ESMAP's assessment of the energy sector in Mozambique identified many policy issues related to investments, pricing, manpower, and institutional development. The mission concluded that the main objective in the short and medium term for the energy sector should be the improvement of operational efficiency and the strengthening of sectoral institutions. This would involve manpower training, development of improved management, financial and operational procedures, rehabilitation of facilities, and improvements in the efficiency of energy utilization, supply, and fuel substitution. Substantial inputs from abroad were required, and technical assistance constituted a vital component of this strategy.

Niger

Energy Assessment (4642-NIR)

Niger's energy picture is dominated by massive overexploitation of the natural forest cover which causes desertification; net renewable supply of fuelwood meets only approximately 35 percent of total fuelwood demand. Moreover, the country is critically dependent on oil imports. The recommended strategy to counter this deteriorating situation involved (a) reforestation and improving forest management, (b) disseminating improved cooking stoves in urban and peri-urban areas, (c) promoting kerosene for cooking, (d) replacing fuelwood with domestic lignite, (e) ensuring continued oil exploration, (f) evaluating the lignite resource available and determining priorities for its use, (g) conserving energy in transport and air conditioning, (h) developing an integrated power system planning, (i) implementing a realistic energy pricing policy, and (j) strengthening overall energy planning through manpower training programs and technical assistance.

Status Report (051/86)

In 1986, ESMAP completed an energy sector review in Niger. The study attempted to review develop-

ments in the energy sector since 1982, evaluate progress on implementation of the energy assessment recommendations, and propose an action program to mobilize technical assistance support from donors, including ESMAP. Key components of this program were (a) policies designed to slow down the decline in agricultural productivity caused by energy-related consumption of biomass, (b) an effort to introduce imported kerosene or domestic coal (or lignite) as viable household fuels, (c) measures that aim to ensure that petroleum products are imported and distributed at minimum cost and priced in such a way as to promote efficient use, a more rational choice between alternative fuels, and cost recovery on the roads, (d) a drive to strengthen the government's capacity to promote petroleum exploration and efficient use of energy in buildings, and (e) policies that aim to reduce fuelwood consumption in urban areas and promote reforestation.

Improved Stoves Project (080/87)

The objective of this activity was to establish a self-sustaining production and marketing system for the dissemination of portable and prefabricated improved woodstoves. The campaign to sensitize men (who purchase the cookstoves) to household energy decisions achieved very good results, while sales by the private sector gradually replaced sales by the project itself. About 45,000 stoves were sold on a cost recovery basis, 200 percent of projected sales for the entire two-year project. A completion report was finalized in December 1987. Follow-up activities executed during 1987 and 1988 include an assessment of the sensitization methodologies used, the impact on wood consumption, a pilot project to disseminate Mai Sauki improved woodstoves in rural areas, and market testing of improved kerosene stoves.

Household Energy Conservation and Substitution (082/88)

The objective of this project was to establish the socioeconomic viability of fuelwood substitutes for urban households, emphasizing kerosene or LPG substitution in the short term. The activity also assisted the government in developing an operational plan for more rational management of the woodfuel production and marketing system through more effective pricing, fiscal, and legal measures. Finally, it assisted in the national dissemination of improved woodstoves (Mai Sauki). The project was financed by the Norwegian Government through UNSO and executed under ESMAP. The project has resulted in an investment and policy package for

household energy strategy which has been incorporated in an IDA energy project approved in February 1988.

Nigeria

Energy Assessment (4440-UNI)

This 1983 examination of Nigeria's energy sector produced a strategy for developing the country's gas, electric power, LPG, woodfuels, hydro, and coal resources and identified and analyzed the investments and policies required to optimize the exploitation of Nigeria's oil resources. Appropriate energy investments between 1983 and 1995 were estimated at \$12 to \$15 billion. Moreover, the studies outlined measures to strengthen the organizational structure and resolve some of the technical and institutional difficulties that hamper the performance of the existing energy supply systems.

Rwanda

Energy Assessment (3779-RW)

Rwanda's geography, demography, and its economic penury are at the root of many of its energy related problems. The 1982 study identified five major areas where immediate action was thought to be appropriate. In the woodfuels sector, for example, the assessment suggested a number of policies that could supplement programs already in place. Peat was singled out as a potential partial substitute for firewood in small industries and some rural institutions. Moreover, the oil stockpiling arrangements were reviewed and a number of suggestions were made to fine tune and change existing procedures. The major issues in the power sector were also addressed. Some institutional arrangements were reviewed and responsibilities regrouped, and the development of an overall sector planning capacity and electricity tariffs received the highest priority.

Status Report (017/84)

The review of Rwanda's energy sector looked at all the recommendations previously made by ESMAP in 1982. The 1984 study noted that considerable progress had been made in several fields and that a number of follow-up projects had been initiated. The Rwandan Bureau national d'etudes de projets (BUNEP) and the Ecole Polytechnique Fédérale de Lausanne (EPFL), for example, formulated an energy action program that included (a) an improved woodstoves component, (b) reforestation efforts, (c) substitution of charcoal by biomass, (d) dissemination of biogas digestors, (e) plans

for the extraction of Lake Kivu gas, (f) the supply of energy to rural centers, (g) the launching of a solar water heating manufacturing industry, and (h) various other activities in the power sector.

Improved Charcoal Cookstove Strategy (059/86)

This study proposed an integrated program of action for the design, production, promotion, marketing, and dissemination of improved charcoal stoves in Kigali.

Improved Charcoal Production Techniques (065/87)

This study prepared a \$300,000 action program delineating training and technical support activities for charcoal producers, government policies to promote the use of improved kilns, measures to strengthen the links between the producers of fuelwood and charcoal, and an analysis of the impact of using improved charcoal stoves and kilns on charcoal supply, price, and the incomes of charcoal makers.

Sao Tome and Principe

Energy Assessment (5803-STP)

Sao Tome and Principe's economy in 1985 was characterized by very high per capita consumption of energy (422 Kgoe) which was mainly caused by low energy prices. The central recommendation of ESMAP's assessment was for the government of Sao Tome and Principe to intervene to reduce the growth of energy consumption to levels that the economy needs and can sustain. This reduction has to come about primarily through the mechanism of pricing. In particular, the study urged the government to provide better institutional support to forestry, improve the regulatory environment for woodfuels, implement realistic petroleum products pricing, and immediately increase electricity tariffs.

Senegal

Energy Assessment (4182-SE)

Senegal's complete dependence on imported oil and the rapid deforestation which is caused by the over-exploitation of its natural forests are the country's core energy problems. A number of measures were recommended in 1983 that could be deployed to tackle the petroleum import dependence problem. A major conservation program, for example, would have substantial and early payoffs in terms of reduced oil consumption particularly in the industrial sector. What is more, simul-

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taneous substitution efforts should make it possible to reduce projected oil imports by 40 percent in 1990. The measures to combat deforestation would have to concentrate on promoting efficient cooking stoves. More generally, the government was advised to strengthen its decisionmaking processes. A preliminary listing of investment priorities and areas requiring technical assistance was also included.

Status Report (025/84)

In July 1984, an ESMAP mission visited Senegal to review progress on the recommendations made in the Senegal energy assessment and examine the latest energy related developments. The ESMAP study first covered the specific energy sector developments that occurred between 1980 and 1984. This involved an examination of energy supply and demand (subdivided by energy type), energy pricing policies, institutional changes, and energy conservation measures. A later section provided a detailed review of the follow-up action taken in response to the ESMAP recommendations. Recommendations were classified according to the following categories: demand management, peat, reforestation, renewable energy sources, coal, power supply, and energy planning and institutions.

Industrial Energy Conservation Study (037/85)

This activity defined a three-year project to establish and implement an industrial conservation program, supported by a \$2.6 million technical assistance package.

Preparatory Assistance for Donor Meeting (056/86)

With the assistance of ESMAP consultants, the Government of Senegal prepared background documents for the Senegalese energy sector donor meeting held in July 1985. The documents covered electricity, petroleum, woodfuels, renewable energy, energy conservation and development strategies, policies, and investment programs for the energy sector, 1985-1992.

Urban Household Energy Strategy (096/89)

This activity consisted of (a) developing a disaggregated database for analytical purposes, (b) identifying, testing, and establishing a hierarchy of project and policy options (substitution, demand management, pricing, increasing supply), and (c) preparing a detailed, costed, and coordinated plan of action. A draft report was discussed with the government in November 1988, and the final report was issued in February 1989. Financing for im-

plementation of the proposed strategy is being sought from the donor community.

Seychelles

Energy Assessment (4693-SEY)

Income derived from tourism has been the main source of revenue for the Government of the Seychelles. A mid decade decline in that industry has led to a drop in the level of economic activity and therefore to a decrease in the demand for petroleum. But despite lower oil consumption, the oil bill has remained more or less the same; the rise in the price of oil has compensated for the loss in volume. Reducing oil import costs became a pressing priority. ESMAP reviewed a twenty-year integrated energy project put together by the Government of the Seychelles to develop renewable energy technologies to substitute for oil consumption. The study proposed recommendations that aimed to promote (a) institutional reorganization, (b) the restructuring of the integrated energy project and ongoing technical assistance programs, (c) the provision of technical assistance for petroleum exploration, (d) the evaluation of least cost supply options, and (e) the rationalization of the petroleum pricing structure.

Electric Power System Efficiency Study (021/84)

The activity aimed to define the scope, costs, and benefits of a technical assistance project to improve the efficiency of the electric power system. The study identified a \$500,000 project which included a cost related tariff structure, a training program for diesel generating units, an efficient maintenance system plan, installation of capacitors, and microcomputer facilities for monitoring system losses.

Sierra Leone

Energy Assessment (6597-SL)

Sierra Leone is favorably endowed with energy resources, but over the past few years the country has experienced severe energy supply shortages which have disrupted economic activity. The ESMAP analysis of Sierra Leone's energy sector resulted in a number of recommendations designed to improve the supply of electricity and petroleum products and strengthen demand management by linking energy prices to the cost of supply. Moreover, the study enumerated a set of measures to initiate institutional reform to improve sector coordination and enhance the autonomy of the parastatal

energy agencies. The study also considered the options for meeting future power requirements, the disposition of the refinery, and the strategy for increasing fuelwood supplies.

Somalia

Energy Assessment (5796-SO)

Despite the fact that per capita consumption of commercial energy was low, Somalia found itself in 1985 in a position where it has to allocate more than 40 percent of its export earnings to petroleum imports. Somalia's principal indigenous energy resources, forests and woodlands, were threatened by long-term damage and degradation. ESMAP designed an energy strategy which focuses on (a) energy demand management through appropriate pricing and direct, non-pricing measures to enhance end use efficiency, (b) woodfuels development, (c) adoption of least cost solutions for electricity generation and distribution, (d) the acceleration of hydrocarbon exploration and a greater role for the private sector, and (e) institutional and manpower development in the operating and planning agencies.

Sudan

Management Assistance to the Ministry of Energy and Mining (003/83)

The purpose of this activity was to help establish a data reporting and monitoring system that would allow senior policymakers in the ministry to take prompt and informed decisions on key sector issues. This activity also identified the need for a clearer definition of the functions of different departments in the ministry.

Energy Assessment (4511-SU)

The 1983 study identified a number of energy related factors that contributed to Sudan's economic problems. The productive sectors, for instance, were plagued by crippling energy shortages. The study reviewed the country's energy resources, including the discovered oil and gas reserves. It contained demand projections over a 15-year period for each subsector and two macroeconomic growth scenarios were used to project the demand for petroleum products. The recommendations focused primarily on investment options and strategies, technical assistance requirements, institutional strengthening, and conservation.

Power System Efficiency Study (018/84)

This study identified a short-term rehabilitation program of \$3.3 million with an economic payback of one to two years. It also recommended additional longer-term measures costing over \$18 million. Some of the measures recommended have been included in the Bank's power rehabilitation project and others implemented under assistance from USAID.

Status Report (026/84)

Progress in the implementation of energy development programs in Sudan were hampered by the economic conditions prevailing in the country, notwithstanding efforts made by the government to successfully introduce a number of important energy policy measures, studies, and development programs. This was the overall conclusion of an ESMAP mission which visited the country in 1984. Further advances, according to ESMAP's study, largely depended on the ability of the authorities to mobilize adequate financial and other resources required to sustain the energy development program. The study outlined the actions taken by the government to implement the major ESMAP recommendations, reviewed ongoing and planned technical assistance to the energy sector by the international donor community, and identified some of the priorities for further technical assistance. Here, ESMAP stressed the need for a realistic approach in determining future technical assistance priorities and emphasized low cost projects with quick returns which could contribute to developing managerial and technical capabilities.

Wood Energy/Forestry Feasibility (073/87)

Based on the forestry sector review conducted by the World Bank and a group of donors in 1985, ESMAP prepared a detailed feasibility report for donors to use in appraising an integrated wood energy/forestry project. The follow-up project includes (a) institution building, (b) protection and management of natural woodlands, (c) wood energy conservation, (d) social forestry/extension, (e) research, and (f) education/training. The project as designed will cost about \$52 million, including physical and price contingencies. After appraisal by the World Bank and several preproject activities, it is now due to be implemented.

Swaziland

Energy Assessment (6262-SW)

Swaziland has been endowed with substantial coal and hydropower resources. The sugar and wood based industries also produce large volumes of biomass residues. Despite these indigenous resources, the country imported 40 percent of its total energy requirements in 1987. Swaziland's main supplier is the Republic of South Africa. In view of the government's desire to reduce cost and its vulnerability to supply disruptions, ESMAP drew up a plan to boost the country's energy security by increasing the development of its domestic resources. This involved an examination of the main issues and options for energy development and the associated economic costs and benefits, especially as they related to import substitution. The study also reviewed the pricing and institutional frameworks in which the energy sector functions. It concluded with a discussion of investment options and technical assistance priorities over the next decade.

Tanzania

Energy Assessment (4969-TA)

Throughout the early 1980s Tanzania's economy was characterized by a contraction in the monetary productive sector, reduced export earnings, and a shortage of foreign exchange needed for importing essential goods such as crude oil and petroleum products. The government responded by attempting to stimulate the development of alternative indigenous energy sources while economizing on imported fuel use. The discovery of significant offshore natural gas reserves could allow for reduced petroleum product imports and favorably affect foreign exchange availability. Within this context ESMAP reviewed the country's energy resources, including natural gas reserves, hydroelectricity, biomass, and coal deposits. The study also incorporated demand projections for a fifteen-year period for each subsector using two macro-economic scenarios. Simultaneously, the study examined issues such as (a) optimal utilization of the natural gas reserves, (b) least cost system expansion and supply reliability in the power subsector, (c) and increased fuelwood production. The recommendations focused on investment options and strategies, technical assistance requirements, institutional strengthening and energy conservation.

Peri-Urban Woodfuels Feasibility Study (086/88)

The main objective of the activity was to develop economically viable options to alleviate growing shortages of charcoal and fuelwood in and around the major urban centers of Dar-es-Salaam, Mwanza, Shinyanga and Arusha. Phase I of the project, identifying the options available and the principal issues, was completed in July 1987. Phase II resulted in a detailed feasibility report for donors to use in appraising a woodfuels/forestry project. The follow-up project includes (a) woodland management, (b) extension forestry to promote tree growing and management among villagers, (c) improved charcoal production, (d) peri-urban plantations, and (e) improvements in training and research. The project, as prepared, would cost approximately \$37 million including physical and price contingencies. It is included, for partial funding, in the IDA FY91 lending program, with considerable donor interest in the various components.

Tobacco Curing Efficiency Study (102/89)

A pilot project involving tobacco curing trials, a census of barns, and field workshops for about a thousand farmers was part of this preinvestment study to verify and field test a technical package of measures designed by ESMAP to help farmers to improve tobacco curing efficiency in Tanzania. The pilot project was successfully implemented in the Tabora region of the country from December 1987 through May 1988. The follow-up will be a \$3.5 million smallholder tobacco curing efficiency improvement project which is designed to assist the government over a six-year period to disseminate the technical package to progressive farmers in the Tabora, Urambo, Iringa and Chunya districts of the country. The activity cost \$152,000 and was funded by SIDA.

Remote Sensing and Mapping of Woodlands

This activity used remote sensing methods, primarily the SPOT satellite system, to obtain data to stratify vegetation classes, particularly woodlands, and develop 1:50,000 scale maps for the woodfuel supply areas surrounding major urban centers and tobacco curing areas of Tanzania. These will serve as a basis for a biomass inventory and woodland management of the areas. Image maps and overlays have been completed and a seminar conducted to explain the methodology and results in Tanzania.

Industrial Energy Efficiency Technical Assistance (122/90)

The first phase of the industrial energy efficiency activity has been completed. The activity was designed to assist the government in improving the energy efficiency of Tanzania's industrial sector through institution building, training, and energy audits. ESMAP staff and consultants paid two visits to the country during October/November 1989 and May/June 1990 to carry out ten walk-through energy audits and two semi-detailed audits of industrial firms. They also conducted two seminars for senior government officials and industrial specialists from the parastatals and private sectors. Engineers from the Tanzania Industrial Research and Development Organization (TIRDO) were sent to the industrial energy efficiency training course in April 1990 in Sweden.

Togo**Energy Assessment (5221-TO)**

Togo's energy related problems are typical for a country with a small modern and a large traditional sector. The manufacturing industries rely on imported petroleum products and electric power, while the energy needs of households and artisanal industries are met mostly by fuelwood. In 1985 the country's critical economic condition imposed severe limitations on investments and made efforts to increase sectoral management and energy use efficiency of the highest priority. ESMAP designed policies that aimed to (a) limit high cost projects to those that had already been started, (b) focus on projects that reduce dependence on and cost of imported oil, and (c) identify projects that could have a catalytic effect on private sector involvement. Regional integration was another course of action that was identified. Coordination of energy programs in the West African region and energy resource development joint ventures were projected to result in net economic benefits.

Wood Recovery in the Nangbeto Lake (055/86)

This ESMAP study was carried out as part of a World Bank hydroelectric project for Togo. The objectives of the study were to (a) define the optimal means of clearing wood in the catchment area of the Nangbeto power plant and (b) devise an appropriate scheme for using the wood cleared, such as for transportation to Lome, supply to the household sector, and input for charcoal production.

Power Efficiency Improvement (078/87)

A study of the electricity distribution and sales organization (CEET) in Togo indicated that several improvements could be made. The government accepted all recommendations, and the final ESMAP report in French and English was produced in November 1987. Among the report's recommendations are a \$1.5 million program to improve not only the diesel plant operations itself but also the communications services and management and commercial operations. IDA and CCCE have financed several of these recommendations. The cost of the study was donated by the Government of France with some additional support from the Government of Italy.

Uganda**Energy Assessment (4453-UG)**

In 1983 the projections for energy consumption in Uganda indicated a significant increase in energy demand during the rest of the 1980s. An attendant consideration in the calculations needed to determine the rate of economic recovery was the availability of energy resources. The ESMAP study consequently centered on the implications of this growth outlook for energy supply options, pricing policies, institutions and manpower, investment priorities, and resource requirements.

Status Report (020/84)

This study outlined the significant developments which occurred in Uganda's energy sector since November 1982. In particular it looked at the actions taken by the government to implement the recommendations designed to address (a) the high cost of petroleum imports, (b) the relatively low efficiency rates in petroleum product and woodfuel consumption, (c) distortions in petroleum product retail prices and shortcomings in the retail pricing formula, (d) power supply unreliability and high power system losses, (e) a shortfall in power generation capacity to meet forecast demand beyond the mid 1980s, (f) the low level of power tariffs and an inappropriate tariff structure, (g) the insufficient supply of fuelwood, especially in the Kampala/Entebbe region, (h) the inadequate level of stumpage fees, and (i) the lack of sectorwide coordination and planning.

Institutional Review of the Energy Sector (029/85)

The purpose of this review was to recommend a set of measures for strengthening the government's planning and policy formulation capability. The work focused

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primarily on the establishment and operation of the Energy Department within the Ministry of Power, Posts, and Telecommunications. The study defined a \$670,000 technical assistance program including organizational restructuring, staffing, provision of short-term specialists, training, and specialized equipment.

Energy Efficiency in Tobacco Curing Industry (049/86)

This activity recommended a two-phase program to improve the energy efficiency in the tobacco industry in Uganda. Efficiency improvements were identified to reduce fuelwood consumption by 60 percent at enhanced production levels and to increase barn output by up to 20 percent. The study recommended a pilot demonstration project costing about \$150,000 and a nationwide dissemination project costing about \$600,000.

Fuelwood/Forestry Feasibility Study (053/86)

This study identified a \$36 million forestry project which includes peri-urban fuelwood plantations, rehabilitation of the Forestry Department, social forestry programs, improvement of natural forest management, support to wood industries, and improved research.

Power System Efficiency Study (092/88)

This study reviewed the operations and plans of the Uganda Electricity Board and recommended improvements in management, productivity, customer billing, nontechnical loss control, and power system reliability. Most of the study's recommendations are being implemented in major part under an IDA credit. Of special importance is a reassessment of the feasibility of extending the generating capacity at Owen Falls, once thought to be unfeasible. Preliminary indications of the study now in progress as a result of the ESMAP recommendations are that it is technically and economically feasible to increase generation at Owen Falls with potential savings of millions of dollars to the Ugandan economy.

Energy Efficiency Improvement in the Brick and Tile Industry (097/89)

This ESMAP study documented a 9:1 variation in the energy efficiency of brick and tile manufacture in Uganda. The bulk of production occurs in small-scale artisanal units which use fuelwood inefficiently, contributing to national deforestation concerns and building material supply constraints. Possible energy solutions were identified in a recommended \$2.9 million technical

assistance and investment package and include (a) low-cost energy efficiency enhancements through improved kiln design, maintenance and operation and (b) substitution of available alternative fuels, especially agricultural residues, for firewood.

Tobacco Curing Pilot Project

This activity was a follow-up to the ESMAP tobacco industry energy efficiency study. The pilot project was designed to test a number of technical packages (improved furnaces, etc.) which aim to reduce woodfuel consumption for tobacco curing in Uganda. The pilot project, funded by the UNDP IPF for Uganda, has been successful. The transition to a national dissemination program has begun, using funds from an IDA credit for agricultural rehabilitation. A UNDP terminal report on the pilot project was reviewed with the government in May 1989.

Zaire

Energy Assessment (5837-ZR)

By 1986, Zaire needed to develop a clear long-term strategy to make maximum use of its major resources. Energy infrastructure weaknesses, ill defined pricing policies, and institutional deficiencies further acted to put a break on the country's efficient development and utilization of its energy resources. An ESMAP team which visited Zaire in November 1984 made a number of recommendations that complement the measures already taken by the government. They include priority actions with regard to (a) the rational production and consumption of wood fuels, (b) the implementation of institutional and financial changes in the petroleum subsector, and (c) the coordination and reinforcement of energy sector institutions.

Zambia

Energy Assessment (4110-ZA)

Falling copper prices on the world market, decreasing exports, and the rapid deterioration of the country's economic infrastructure and capital stock provided the background in 1982 in Zambia against which an energy strategy had to be formulated. Despite a generous supply of indigenous energy resources, the country had developed a considerable dependence on oil imports. ESMAP prepared a number of recommendations to promote (a) optimal configuration of the petroleum refinery, (b) import substitution, (c) reduced distribution

losses and improved maintenance of the power system, (d) coal production and transport efficiency, (e) augmented supply of woodfuels and ineffective afforestation programs, (f) appropriate energy product pricing, and (g) strengthened energy planning and policy implementation.

Status Report (039/85)

This study systematically reviewed the status of the recommendations made in the previous assessment of the Zambian energy economy and the ongoing technical assistance provided by the international donor community. In addition the study described the most recent energy related developments and outlined an illustrative priority energy sector investment program. This was accompanied by a comprehensive summary of recommended technical assistance projects. A review of the effectiveness of energy sector institutions and arguments in favor of institutional reform were included.

Energy Sector Institutional Review (060/86)

This activity assessed the current energy policy and planning system and recommended measures to strengthen its performance, including institutional reforms.

Power Subsector Efficiency Study (093/88)

This study was designed to identify ways to improve the overall efficiency of the power subsector in Zambia. The study examined the various problems facing the Zambia Electricity Supply Corporation Limited (ZESCO), Zambia's publicly owned electric utility, and defined an economically feasible action program for ZESCO to guide its investment decisions and improve its operations. Several recommendations were made to increase electricity consumption and to reduce financial constraints. In addition, salary and benefit levels for professional employees of ZESCO needed to be raised. A procedure needed to be established whereby foreign exchange is made available to ZESCO without the need for repeated applications and justifications to the central bank prior to each expenditure. A number of investments were recommended to maintain the quality of ZESCO's power system and to increase the efficiency of electricity distribution.

Energy Strategy Study (094/88)

A study was prepared, jointly with the Zambian authorities, of an energy policy and investment strategy

through the year 2000. The strategy identified priority investments for rehabilitating energy supply systems and conserving energy use and key policy changes such as appropriate adjustments in energy prices. The study served as a source document for preparing the energy chapter of the Revised Fourth National Development Plan.

Urban Household Energy Strategy Study (121/90)

This study was a component of the energy strategy study. An energy strategy through the year 2000 was prepared together with several follow-up projects. The main strategies which emerged from the study are ensuring a continuous and sustainable supply of biomass fuels, principally charcoal, and encouraging the production of cheaper and/or more efficient stoves. To this end, projects have been proposed for biomass management and monitoring improved charcoal production and distribution, the commercial manufacture of more efficient stoves, and the strengthening of the energy department.

Zimbabwe

Energy Assessment (3765-ZIM)

During the early 1980s, Zimbabwe's decision-makers confronted three dominant energy issues. In the first place, policies had to be formulated to reduce the growing burden of energy imports. In 1980 energy imports amounted to 23 percent of the total energy supplies (11.5 percent electricity, 11.5 percent petroleum products). That same year the cost of energy imports added up to 22.6 percent of total export earnings. In 1981 the figure was about 22 percent. Secondly, the least cost development of indigenous energy resources had to be addressed. Finally, energy efficiency improvements in all end use sectors needed high priority consideration. The study evaluated the mix between imported and locally produced liquid fuels and the future of the mothballed Umtali refinery. The development of domestic thermal and hydro resources for electricity generation purposes was also explored. At the same time, the most efficient means to increase fuelwood production and other biomass resources were examined. A comprehensive review of appropriate pricing policies and institutional organization in the fuelwood sector was added.

Power System Efficiency Study (005/83)

This activity evaluated the potential for reducing losses in the electric power distribution network and

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identified substantial savings that could be realized in the short and medium term.

Status Report (019/84)

This report chronicles the response of the then newly established Government of Zimbabwe to issues made in the energy assessment. The study shows that the government's reaction to the pricing and investment policy recommendations had been quick and wide ranging. These actions had, in turn, been strongly supported by external agencies which provided technical and financial assistance. With regard to the institutional questions, significant progress had been made in the definition of the objectives for reorganizing and consolidating energy institutions and organization. Further opportunities existed for improving energy use efficiency, particularly in the energy intensive metallurgic and mining industries.

Power Sector Management Assistance Project (034/85)

The objectives of this study were (a) to present a detailed work plan through a team of specialists assisting Zimbabwean agencies and officials in the establishment of ZESA and (b) to strengthen planning capabilities in the Department of Energy through training organized by a resident consultant for two years. This study was critical in the government's efforts to amalgamate ZESA.

Petroleum Management Assistance (109/90)

The purpose of this activity was to (a) develop a computerized oil scheduling/procurement system and (b)

train the National Oil Company of Zimbabwe (NOCZIM) and DOE staff on the use, maintenance, and expansion of a computerized MIS. UNDP country IPF committed funds toward training on operation of the MIS, and the system is being used by NOCZIM to control and monitor petroleum stocks.

Power Sector Management Institution Building

The objective of this activity was to provide the government and organizations responsible for power supply with technical assistance in order to reorganize and strengthen the local power companies. The activity had two main components: (a) the attachment to the Department of Energy of an experienced power sector planning advisor for two years and (b) the provision of the services of consultants on short-term assignments.

Charcoal Utilization/Marketing Study (119/90)

The objective of this study was to (a) investigate the scope for increasing charcoal production using residues from commercial lumber and wattle operations in eastern Zimbabwe and (b) evaluate potential markets for charcoal in different economic sectors, for example to substitute imported low sulphur coke as a fuel for industrial burners. The report defines follow-up activities to complete series of trials with local industry to determine the technical and economic feasibility of using charcoal as a substitute for imported coke for the production of ferrosilicon.

Asia and the Pacific

Bangladesh

Energy Assessment (3873-BD)

In 1981 Bangladesh confronted two energy crises that severely affected the performance of its economy. One could be described as the beginning of a fuelwood crisis. The other involved the expenses incurred by oil imports required to make up for the absence of indigenous energy resources; in 1980-1981 net oil imports

of around 1.6 million tons cost about \$460 million, which used about 60 percent of its total foreign exchange earnings. To counter these developments, the study recommended to (a) expand production, distribution and use of natural gas, particularly for power generation and industry in order to meet growing energy demand and substitute for more costly imported fuels, (b) improve the domestic oil refining facilities, (c) increase energy efficiency through better control of conversion and distribution losses and industrial energy conservation

efforts, (d) raise energy prices to economic levels, particularly for electricity, petroleum fuels, and gas, and (e) carry out reforestation and improved fuelwood development and charcoal production programs.

Priority Investment Program (002/83)

This activity identified high priority energy investments, particularly in the power and natural gas subsectors. The final report has a restricted distribution.

Status Report (015/84)

The ESMAP mission which visited Bangladesh to review the implementation by the government of previous energy sector recommendations came away with the impression that substantial progress had been made. For example, natural gas was beginning to replace imported oil. Between 1981 and 1983, petroleum demand had declined by 14 percent, while the demand for natural gas grew by 36 percent. The government had raised all major petroleum product prices at or above their economic cost and new adjustment mechanisms had been put in place. Natural gas prices and electricity tariffs remained below the long-run marginal cost of supply. The government has decided that an energy planning project should be launched to assist the Planning Commission and help formulate a long-term energy plan spanning the 1980s until the end of this decade. At the same time a number of new energy institutions had been founded to strengthen the energy sector's institutions.

Power System Efficiency Study (031/85)

This study reviewed the existing power system loss reduction program of the Bangladesh Power Development Board and proposed measures to bring losses down to economic levels. The study identified the sources of losses and prepared specific recommendations for implementing the loss reduction program. The final report identifies about \$56 million in potential investments.

Small-Scale Uses of Gas Prefeasibility Study

This activity identified the economic potential for expanding the use of abundant natural gas among small industrial and commercial users. It outlined a costed and phased program to establish this potential and prepared a methodology to replicate the work in other countries where natural gas is in abundant supply.

China

County-Level Rural Energy Assessments (101/89)

These studies were a joint effort by teams of Chinese and ESMAP experts to conduct detailed and integrated assessments of rural energy development options in two counties. Conclusions from similar study work in a third county, reviewed as part of the parallel fuelwood forestry study, were also drawn upon. Outputs included county-specific development plans, comparative analysis of the issues and options faced in the three counties, and identification of priority areas for future international assistance for China's rural energy development efforts, based on the micro-level experience and the ongoing dialogue with national authorities. ESMAP's final report, which represents the conclusions of the joint study team, was issued in May 1989.

Fuelwood Forestry Preinvestment Study (105/89)

This study was a joint effort of ESMAP and Chinese experts that examined the role of the fuelwood development and conservation in an integrated rural energy and land-use development context in Hengnan County, Hunan Province and prepared a operational research/demonstration tree planting and improved stove project commensurate with that role. The five-year project is designed to establish methodologies and technology for cost efficient fuelwood production and stove development and dissemination that may be used on a much larger scale for a fuelwood development and conservation program in southern China. Applied research, training, the introduction of an improved extension system, and institutional strengthening are included as well as provision for planning and preparation of subsequent follow-up programs. The total estimated cost with contingencies is \$7.7 million of which \$4.7 million is required from foreign donors.

Fiji

Energy Assessment (4462-FIJ)

The main issues that the Government of Fiji had to deal with in 1983 were related to securing an appropriate mix of indigenous energy resources, ensuring that energy supplies are available in rural and urban areas, and making sure that efforts to encourage efficient use of energy were continued. The ESMAP study examined the adequacy of power supplies until the early part of the 1990s and set out a number of recommendations about the production of fuel ethanol and procuring petroleum

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supplies. It also outlined technical assistance programs for institutions, a rural electrification study, and oil and gas exploration.

India

Opportunities for Commercialization of Nonconventional Energy Systems (091/88)

This study (a) assessed the prospects for greater dissemination of nonconventional energy technologies, both through commercial markets and government financed activities, (b) identified opportunities for preparing bankable projects in selected technology areas, including specific requirements for prefeasibility and feasibility studies, and (c) provided the World Bank with a framework for cooperating with India in the renewable energy field. The main mission was fielded in January 1987. This activity was financed jointly by the World Bank and the Government of the Netherlands (\$76,000). A draft study report was sent to the government in December 1987 and discussed with the government in April 1988.

Bagasse Cogeneration Preinvestment Study (120/90)

The purpose of this activity was to identify investments at specific sugar mills which would lead to energy self-sufficiency and utilization of excess bagasse to generate electricity for export to the grid. Institutional, policy, and contractual constraints to the implementation of cogeneration programs were examined. The output of this study, which cost \$275,000 and which was funded by DANIDA, identified \$87 million in investment opportunities. The main mission composed of experts in sugar/bagasse, power engineering, and financial and economic analysis was fielded in March/April 1989, and a report was issued in July 1990.

Indonesia

Energy Assessment (3543-IND)

Numerous energy related issues arose during the early 1980s which the Government of Indonesia has had to address. The dominant theme has been the response of the authorities to an acceleration in the domestic demand for oil while the oil available for export was declining. Such a trend would ensure an oil revenue squeeze which threatened to contract economic and social development spending. The study comprised a review of energy consumption trends, particularly since the 1970s. Based on these trends and various assumptions about GDP growth,

the sectoral distribution, and diversification of the energy base, preliminary indications of likely future energy demand were prepared for FY89/90 as well as for FY90/2000. The study also examined future supply policy issues. It reviewed petroleum products, gas, coal, and electricity pricing policies and assessed the options for interfuel substitution and the provision of energy in the rural areas. Proposals for institutional strengthening were also included. The study wound up with an investment priority schedule.

Status Report (022/84)

During the period between the Indonesia energy assessment in 1981 and the status report in 1984, Indonesia's energy sector experienced major changes caused by both domestic and international economic developments. The study reviewed the progress made by the government in implementing the recommendations of the assessment and reported on some of the major ongoing technical assistance activities by various multilateral and bilateral donors. In addition, it formulated the requirements for further technical assistance that had been identified by the government as deserving priority attention.

Power Generation Efficiency Study (050/86)

The study, completed in February 1986, presented a set of programs to improve efficiency in the Java power system and a program to reorganize maintenance of diesel plants.

Energy Efficiency in the Brick, Tile, and Lime Industries (067/87)

This activity defined a project to improve energy efficiency through technical support, training, and limited investment at the enterprise level.

Diesel Generating Plant Efficiency Study (095/88)

This activity was designed to improve the operational efficiency of isolated diesel generating systems. The report made recommendations for: (a) planning generation expansion, (b) new ways of maintenance, (c) a methodology for making decisions regarding repairs or replacement of generating units, and (d) training of operations and maintenance staff. In addition, a survey of the rehabilitation needs of five selected diesel stations was undertaken. An engineering advisor has been assigned to assist the Indonesian utility in managing the planning operation and maintenance of diesel generating systems.

Follow-up took place under a World Bank loan, and further follow-up is proposed through Netherlands bilateral assistance. The original study and the engineering advisor were made possible by funding from the Netherlands.

Urban Household Energy Strategy Study (107/90)

The principal objective of this study was to formulate an integrated set of programs and policies for the urban household sector that would support the government objectives of diversifying domestic energy use away from exportable petroleum products and encouraging energy conservation. The recommended strategy is built around three components: (a) pricing and policy analysis that quantifies the economic and financial benefits of various means to stimulating LPG substitution, (b) a pilot program to introduce low cost technical modifications to existing kerosene stoves designs coupled with a cooking practices sensitization campaign and appropriate pricing policy, and (c) a phased program designed to raise the average efficiencies of key electric appliances on the market and encourage the adoption of fluorescent lighting. These components of the proposed urban household energy strategy are designed to reduce government expenditures (principally through displacing and conserving subsidized kerosene) and improve the balance of payments while increasing effective energy services obtained by urban households. The study was financed by the Government of the Netherlands. The final report has been submitted to the Government of the Netherlands for consideration in funding components of the proposed strategy.

Malaysia

Sabah Power System Efficiency Study (068/87)

This activity reviewed the generation, transmission and distribution, and commercial operations of the Sabah Electricity Board and identified measures to reduce non-technical losses and improve revenue collection performance. A complete revamping of the customer service system was recommended, including computerization of the billing and customer records. In transmission and distribution operations, improvements were recommended to reduce distribution construction costs.

Myanmar

Energy Assessment (5416-BA)

This activity involved an analysis of the technical, financial, and institutional requirements for the development of the country's abundant energy resources. The study's parameters were determined by the introduction of a planned growth scenario which reflected the official growth targets and an economic growth scenario under which public finance and balance of payments constraints result in slower economic growth. Under either scenario, a major investment program and infusion of current technology was needed. The study recommended considerable technical assistance and studies to help effect this transfer of technology.

Nepal

Energy Assessment (4474-NEP)

Nepal's energy related problems are twofold. With regard to fuelwood availability, it was quite evident that traditional practices of cutting down trees without replanting them were the main cause of the severe deterioration of the country's large forest resource base. Oil import dependence was observed to be low; during the early 1980s imported petroleum accounted for only six percent of total energy use. Despite this, the imports proved to be very costly in that they absorbed 12 percent of foreign exchange earning from goods and services in 1983. In 1983, Nepal's government called on ESMAP to help address the serious imbalance between the supply and demand for fuelwood and to assist in lowering the oil import bill. ESMAP recommended action in three areas: (a) the development of energy supplies and resources (mainly fuelwood and hydropower), (b) improvements in energy demand management and efficiency, and (c) the development of energy institutions.

Status Report (028/84)

In 1984, an ESMAP mission reviewed developments which had occurred subsequent to the Nepal energy assessment of the previous year. The task also involved carrying out an assessment of the need for further technical assistance in the energy sector. Particular attention was paid to projects which could be financed under the ESMAP umbrella. The review showed that progress had indeed been made; the government's Water and Energy Commission (WECS) had made an impressive effort to implement the assessment's recommendations. This work involved car-

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rying out fuelwood and hydropower studies and designing long-term plans for the development of these resources. At the same time, the potential contribution of biogas as a substitute for fuelwood was investigated.

Papua New Guinea

Energy Assessment (3882-PNG)

During the early 1980s, the Government of Papua New Guinea found itself in a position where it had to formulate a response to rapidly rising world oil prices and increasing domestic demand for petroleum products. The share of export revenue spent on oil imports had risen from about three percent to an estimated 24 percent in 1981. Oil imports in 1981 totalled an estimated \$209 million (CIF) and amounted to over 8 percent of GNP, 30 percent of gross domestic investment, and 80 percent of net external assistance. The government developed a strategy in an attempt to substitute imported petroleum products by indigenous energy sources. The study recommended methods to stimulate and strengthen the energy planning process. The study also included suggestions to carry out further comprehensive evaluations of the different energy supply options such as the various options for electric power generation. Reserves of gas, oil, hydro, and coal also needed to be firmed up so that decisions on medium- to long-term demand strategies for optimal energy source combinations could be made.

Status Report (006/83)

After a twelve-month period, it was apparent the government's response to the issues identified by the Papua New Guinea energy assessment report had been remarkably quick and wide-ranging. Work had started on most of the studies. Further analysis was required to define a petroleum development and utilization strategy and prepare a least cost power plan. The renewable energy plan had been further scaled down and reoriented to technologies which were more likely to have earlier and certain payoffs. Further action was particularly necessary to strengthen the government's policy and technical capability. This was found to be especially true for the petroleum sector. The existing institutional structure and staffing would soon become inadequate to cope with increased private exploration and development activity. Thus, the study recommended that support for institutional strengthening be assigned the highest priority in the future technical assistance.

Energy Strategy Paper

A national energy strategy study was prepared for Papua New Guinea. A final report, however, is not available.

Institutional Review in the Energy Sector (023/84)

This study evaluated needs for institutional restructuring, staffing, training, and technical assistance in the energy sector and presented specific technical assistance and training proposals to be financed under a World Bank supported public sector management reform project.

Power Tariff Study (024/84)

PNG has a number of electricity autogeneration and cogeneration opportunities that cannot be exploited until the appropriate tariffs and regulations are revised. This activity was designed to assist the government and the electricity commission (ELCOM) in reviewing and modifying the tariff structure based on long-run marginal costs.

Solomon Islands

Energy Assessment (4404-SOL)

The main observation of the mission that visited the Solomon Islands in late 1982 was that the integrated energy systems present were inappropriate for the island nation. The country's diverse energy potential had, in addition, not yet been identified, assessed, and developed. The mission predicted that the islands in the immediate future would remain dependent on oil imports to meet commercial energy needs. The study therefore concentrated on priority issues in the petroleum and power sector and recommended changes in the petroleum procurement system. Technical assistance programs for the power sector, exploration activities, and institutional support were incorporated.

South Pacific

Petroleum Transport in the South Pacific

The objective of this study was to establish the least cost regional petroleum procurement strategy for countries in the South Pacific: Western Samoa, Vanuatu, Solomon Islands, Papua New Guinea, Tonga, the Cook Islands, and Fiji. Between the time of the mission June 1985 and discussion with governments of the draft report May 1986, the oil industries operating in the region

voluntarily adopted a pricing formula which resulted in savings similar to those that could have been obtained through competitive bidding, as proposed in the study. As a result, it was agreed that no final report would be issued.

Sri Lanka

Energy Assessment (3792-CE)

During the late 1970s, steep increases in the demand for petroleum products driven by rapid economic growth in Sri Lanka set the stage for an unprecedented oil shock. Total petroleum consumption grew at 9.5 percent per annum during the years from 1978 to 1980, after having declined at an average 3.3 percent per annum in the 1970-77 period. Between 1978 and 1981, the oil import bill more than tripled and the proportion of export earnings devoted to oil imports rose from 11 to 39 percent. Moreover, the energy crisis spilled over to other sectors. The supply of electricity could not keep pace with rising demand and severe power shortages occurred in both 1980 and the early months of 1981. Within this context, the study evaluated supply and demand side options to improve the near-term energy situation. One of these options was the recommendation to close down the pipeline in Colombo operated by the Colombo Gas and Water Company. Secondly, it was suggested that further detailed work should be carried out to assess the viability of recovering additional LPG from the refinery for distribution in bottled form. Substantial savings could also accrue from streamlining the arrangements for crude oil imports. Another important recommendation entailed the immediate implementation of a concerted national energy conservation program in the industrial and transportation sectors.

Power System Loss Reduction Study (007/83)

This activity evaluated the potential for reducing power distribution losses and identified potential savings both in distribution and in generating plant efficiency.

Status Report (010/84)

A number of immediate and far-reaching steps were taken by the Government of Sri Lanka based on the recommendations in the energy assessment. The institutional structure for energy policy analysis and sector management had been greatly strengthened through the establishment of a number of issue-specific task forces in the Ministry of Power and Energy under the direction of the Senior Energy Advisor to the Minister. Demand

management policy recommendations were also followed up. Both electricity and petroleum prices had been raised to reflect the cost of supply, and the relative price structure had been changed to remove a number of anomalies identified in the report. These actions did have some impact on alleviating the energy problem. But, their main importance was that it laid the basis for substantially larger improvements during the second half of the 1980s.

Industrial Energy Conservation Study (054/86)

This work involved carrying out prefeasibility studies of possible energy improvements in 16 industrial plants, one hotel, and one hospital in Sri Lanka, as part of an ongoing government program to promote energy conservation in industry. The study identified highly profitable retrofitting projects involving investments of \$9.1 million. Altogether, the projects have an economic payback of 1.8 years.

Thailand

Energy Assessment (5793-TH)

The role of the private sector in the development of Thailand's energy resources was given special attention in the energy strategy which ESMAP drew up in 1985 for the Thailand Government. Private sector participation would not only have to be ensured in the exploration and production of energy. Private companies would also have to become involved in energy transportation, refining, and marketing. In order to do this, ESMAP proposed to improve the regulatory process which governs such involvement in energy activities and to set up a pricing system that more accurately reflected the opportunity costs of energy resources. Also, the study suggested (a) expanding the uses of natural gas, (b) formulating a program to increase exploration and development of lignite for power, industry, and domestic uses, (c) raising electricity tariffs to augment internal cash generation at the utilities, (d) deregulating petroleum product prices to allow them to adjust more freely to changes in international prices and the value of the Baht, (e) making institutional reforms to clarify responsibilities and improve long-term planning in the public sector, and (f) formulating new policies to ensure adequate rural energy supplies of both traditional and commercial fuels at competitive and economic prices.

Rural Energy Issues and Options (044/85)

This study was prepared as an input to the main assessment report. As a result of this study, the Thailand

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Government requested ESMAP assistance in preparing innovative biomass supply and utilization programs.

Accelerated Dissemination of Improved Stoves and Charcoal Kilns (079/87).

This activity was designed to assist the government in devising the most effective means for large-scale dissemination of improved stoves and charcoal kilns.

Northeast Region Village Forestry and Woodfuels Preinvestment Study (083/88)

The final report was issued in February 1988. The study presented the detailed design of a project to provide infrastructural support and extension services for the promotion of increased tree planting in the Northeast Region, primarily by small-scale private farmers. The implementing agency for the proposed project, the Royal Forestry Department, approved the draft final report in October 1987 with minor revisions, and submitted it to the Department of Technical and Economic Cooperation for presentation for international donor agency support. The total project cost is \$4.8 million.

Impact of Lower Oil Prices

The objective of this study was to evaluate the impact of the volatile petroleum prices on Thailand's energy policy and investment options. The study was funded by the World Bank and carried out in close collaboration with Thai Government staff (primarily National Economic and Social Development Board (NESDB), and the line agencies, Electricity Generating Authority of Thailand (EGAT), Petroleum Authority of Thailand (PTT) and Bangchak Refinery). The report was sent to the government in July 1988.

Coal Development and Utilization Study

The Government of Thailand requested ESMAP assistance in the preparation of a program for the development of lignite (soft coal). A mission of ESMAP and Asia regional staff of the World Bank visited Thailand in April/May 1988 to determine the scope of the study and apportion tasks among government staff (principally the National Energy Policy Office, NEPO), local consultants, and ESMAP/World Bank staff. The main mission took place in January 1989. This task was cofinanced by the Government of Thailand, the World Bank, the UNDP/IPF for Thailand, and CIDA. The final report was issued in October 1989.

Tonga

Energy Assessment (5498-TON)

In 1985, Tonga's outstanding energy related issues include the country's complete dependence on petroleum imports and high freight costs, the economic displacement of imported petroleum fuels by senile coconut stemwood in power generation, and the need for biomass replanting efforts to avert a projected critical fuelwood shortage. The ESMAP team recommended that an effort be made to (a) evaluate the alternative petroleum product procurement arrangements, (b) develop an agroforestry extension scheme, (c) carry out economic power system expansion, and (d) introduce energy efficient crop processing practices.

Vanuatu

Energy Assessment (5577-VA)

Vanuatu by 1985 continued to be dependent on imported petroleum products for its commercial energy needs. The assessment of the energy sector mapped the measures needed to exploit Vanuatu's diverse indigenous energy resource base. They included (a) the development of a regional least cost strategy for procuring petroleum products, (b) institutional modification in the power sector to establish guidelines for development, generation, and distribution of power, (c) an analysis of the economic costs of public power supply, (d) acceleration of hydropower investigations, and (e) continued encouragement of economic use of indigenous energy resources in power generation and agro-industries.

Western Samoa

Energy Assessment (5497-WSO)

The island economy of Western Samoa by 1985 had suffered over recent years from declining export revenues caused by lower world market prices for copra and cocoa. This allowed for an amplification of the impact of fluctuating prices for essential imports such as petroleum products. ESMAP's study on Western Samoa suggested an integrated approach to deal with these energy related issues. The study recommended (a) an evaluation of alternative arrangements for procuring petroleum products, (b) an integrated analysis of power system planning and operations, and (c) provision for technical expertise to monitor proposed biomass gasification pilot projects.

Europe, Middle East and North Africa (EMENA)

Morocco

Energy Assessment (4157-MOR)

The kingdom of Morocco is endowed with diverse and abundant energy resources. Nevertheless, decision-makers have faced a complex set of choices. The country has important oil shale, hydropower, oil and gas, and uranium resources, but, as ESMAP discovered in 1984, it was dependent on imported oil for 85 percent of its commercial energy needs. Morocco's continuing economic difficulties forced a reevaluation of energy investment priorities, and this underscored the need to strengthen energy planning in the private and public sector. ESMAP's activity aimed at designing a strategy to improve demand management and energy efficiency through efficient pricing and tariff setting. It also sought to improve the management of large energy producing and consuming public enterprises and better sector coordination and planning.

Status Report (048/86)

The follow-up by the Government of Morocco to the recommendations made in the energy assessment was noteworthy despite continuing macroeconomic difficulties such as rising costs of energy imports, a slowdown of economic growth, a decline in revenues from phosphate exports, and the drought of 1980-84. The legal and financial regulations needed to attract foreign hydrocarbon companies had been made more effective in promoting economic development of petroleum reserves. Electricity tariffs had been increased and a process established for frequently reviewing the industrial and thermal power plant fuel supply plans at the national and regional levels. The ESMAP study emphasized the need for more priority activities that would lead to specific energy sector investments.

Pakistan

Household Energy Assessment

This activity assessed available data and reviewed work that had been done to date in order to provide a plan of action for addressing household energy issues in Pakistan. The cost of this activity was \$65,000, provided by the Government of the Netherlands. The assessment produced a proposal for a \$2.8 million household energy strategy study which is being funded by the UNDP IPF.

Assessment of Photovoltaics Programs, Applications, and Markets (103/89)

This preinvestment market study evaluated the economics of photovoltaic applications for remote health centers, telecommunication networks, water pumping for village water supply and irrigation, and remote household power including lighting and radio reception. Based on this analysis, the study developed photovoltaic market estimates and policy recommendations and identified appropriate photovoltaic programs.

Portugal

Energy Assessment (4824-PO)

Portugal's main energy problem by 1984 was essentially how to keep down the cost of imported energy while maintaining acceptable rates of economic growth. The country has a limited domestic energy resource base and is dependent on imported energy sources; imported oil accounted for around 80 percent of final energy demand and net oil imports absorbed about 30 percent of export earnings from goods and services in 1982. The ESMAP assessment formulated a strategy to (a) reduce the energy intensity of GDP through demand management, (b) substitute cheaper energy sources for oil, and (c) promote flexibility to meet future energy demand.

Syria

Energy Assessment (5822-SYR)

In 1986 the most urgent issue that needed to be addressed by the Government of Syria was related to the sharp increase in domestic demand for hydrocarbons and electric power. A rapid rise in energy demand of over 10 percent per annum during the period 1975-85, and a stable rate of oil production sharply reduced net earnings from oil exports and contributed to the shortage of foreign exchange and the slowdown in economic growth. The ESMAP mission which visited Syria in 1985 proposed to undertake a number of actions to improve the supply of energy resources. Measures needed to be taken to accelerate the development of gas, maintain oil production in the oil fields, redirect exploration efforts, and change the pattern of refined product output to produce more middle distillates. In the electric power sector, prices had to be raised, time-of-day pricing introduced, losses reduced, and least cost development plans with an emphasis on gas power generation prepared and implemented. In the domestic and industrial sectors, studies had to be carried out to assess the scope for increasing energy efficiency.

Electric Power Efficiency Study (089/88)

This preinvestment study identified \$107 million of energy efficiency projects for the electricity generation and distribution systems of Syria. These projects are in the areas of improved fuel efficiency for steam generation plants, improved maintenance management systems, reinforced distribution networks, and rehabilitated metering and invoicing systems. The study also provided for training and provision of computer hardware and software. It was financed through UNDP country IPF resources.

Energy Efficiency Improvement in the Cement Sector (099/89)

This study financed by the UNDP country IPF identified, evaluated, and recommended measures to improve energy efficiency as well as overall efficiency of three plants in the cement industry. Recommendations included operational improvements, small investment modifications, and long-term investments. Capital cost (foreign component) required to implement them would amount to \$35 million, and the internal rate of return would range on the average, from 20 to 37 percent (financial analysis) and from 14 to 22 percent (economic analysis).

Energy Efficiency in the Fertilizer Industry (115/90)

This activity was financed by the UNDP country IPF and aimed at defining an action program to improve efficiency of energy utilization in the fertilizer complex of Homs in Syria. In the course of the activity, the scope of the work had to be extended to cover issues broader than energy efficiency improvement. A comprehensive rehabilitation program has been designed and assessed. This program, the total cost of which is evaluated at \$1 million (including \$14 million related to managerial and technical assistance), should lead to a substantial increase of production and improvement in operating conditions, safety, and environmental protection. The overall internal rates of return have been evaluated at about 70 percent (financial) and 100 percent (economic).

Tunisia

Fuel Substitution

The study reviewed the possible uses of coal and natural gas, particularly in the power generation and cement industry where possibilities exist for substitution for oil and identified the interfuel substitution potential. Economic evaluation of substitution strategies and risk analysis were carried out based on two contrasting scenarios of international energy prices. The report recommended a flexible and risk averse strategy of substituting petroleum products with natural gas over the medium and introduction of combined cycle in the power generation system. This least cost strategy hold the environmental impact to a minimum.

Turkey

Energy Assessment (3877-TU)

The objective of this ESMAP's activity was to devise policy measures to reduce Turkey's dependence on imported petroleum. Supplementary measures aimed to improve the performance of Turkey's major state energy institutions.

Yemen

Energy Assessment (4892-YAR)

The energy assessment made recommendations to improve the efficient use of highway fuels, correct the imbalance between power generating capacity and transmission and distribution capacity in the public power system, and restructure power tariffs to attract industrial

consumers. The study also included proposals to survey the country's forestry resources and carry out an afforestation project aimed at institutional development, pole and timber production, and environmental stabilization. A final policy consideration was the need to encourage the continued shift away from fuelwood use to commercial energy.

Energy Investment Priorities (6376-YAR)

This study examined the impact of recent oil discoveries on the supply of oil, gas, LPG, demand growth, and energy investment priorities. A major focus was gas utilization options. The study was completed in February 1987.

Latin America and the Caribbean (LAC)

Bolivia

Energy Assessment (4213-BO)

During the mid 1980s, the Bolivian government faced the task of meeting incremental demand for commercial energy through the balanced development of gas and hydropower production, transport, and utilization facilities. All this had to be done in such a manner that the domestic and export energy market potential could be exploited without weakening the country's borrowing capacity. ESMAP proposed that the conventional methods to increase the energy supplies be complemented by a massive program to assist energy consumers to switch away from liquid fuels to gas, use liquid fuels in specific cases when their value could be maximized, and increase the overall efficiency of consumption. In order to create the necessary conditions for fuel substitution, ESMAP outlined a pricing policy based on opportunity costs. This, in turn, had to be supplemented with an active and carefully directed demand management program. Appropriate attention was also given to the development of a long-term program of reforestation and utilization of agricultural wastes in the denuded Altiplano region.

National Energy Plan

Under this exercise, support was provided to the Ministry of Energy and Hydrocarbons for developing a national energy plan. A draft of the plan was completed in June 1987 and subsequently discussed with the government. The final consultant's report was issued in Decem-

ber 1987 and forms the basis for technical assistance to the government in implementing this plan.

Chile

Energy Sector Review (7921-CH)

The energy sector review, which has been part of the World Bank's economic and sector work, was financed by the Bank and issued in August 1988 following thorough discussions with the government and the major operating entities on the draft of the report in April 1988. The report addresses the principal issues related to energy development requirements in the face of a long-term decline in domestic petroleum output, including energy pricing, least cost development of alternative energy sources especially natural gas, coal, and forestry reserves, and the complementarities and trade-offs between energy development requirements and environmental concerns.

Colombia

Energy Strategy Paper

This exercise, which was carried out by a group of Colombian consultants in conjunction with ESMAP and World Bank regional staff, was completed in December 1986, and many of the recommendations were implemented by the new Colombian Government. As a follow-up, ESMAP is providing assistance in (a) designing an information system in the power sector, (b) conducting an evaluation on interfuel substitution and end use ef-

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iciency, and (c) evaluating means to improve the planning capability of the power sector.

Costa Rica

Energy Assessment (4655-CR)

The dominant issue in the Costa Rican energy sector in 1984 was how to deal with the investment flow adjustment which was called for in the context of severe economic difficulties while still meeting future energy requirements. On the demand side, policies were recommended that promoted the rational use of energy. On the supply side, the study proposed investments concentrated on the development, transformation, and distribution of those energy resources which had demonstrated the greatest potential for meeting the diverse energy needs of the country at lowest cost. Moreover, energy prices would have to reflect the economic cost of exploiting the resources. The planning system was to be strengthened so that it would be able to formulate sectoral priorities and design the requisite long-term policies and investment programs.

Recommended Technical Assistance Projects (027/84)

This activity reviewed a number of technical assistance possibilities with the government. As a result of the discussions, terms of reference were completed for four technical assistance projects: (a) establishing a maintenance program for buses, (b) developing a program to assess the feasibility of charcoal production from forest residues, (c) preparing three studies to improve the planning tools and system function of the Institute Costarricense de Electricidad (ICE), and (d) developing a study of fiscal policy and petroleum prices.

Forest Residues Utilization Study (108/90)

This study evaluated the technical and economic potential for recovering, converting, and utilizing forest residues left by land clearing and logging operations in the North and Central Atlantic zones of Costa Rica. The options examined included direct substitution of biomass for oil in domestic industry and charcoaling of residues for export. The study found that export of charcoal derived from logging residues to the western European barbeque market is a financially and economically viable venture yet should only be attempted on a pilot scale because of environmental risks. The study identifies a number of opportunities for donor-assisted forest management projects, and these are expected to be incor-

porated into the national Tropical Forestry Action Plan presently being formulated.

Ecuador

Energy Assessment (5865-EC)

In 1985, issues related to petroleum exploration, the development of the existing oil fields, the role of the national petroleum company, energy pricing, and the power subsector's financial difficulties were addressed by the energy assessment. The recommended strategy for the petroleum subsector aimed at increasing petroleum production while backing it with a strong exploration program. The Ecuadorian Petroleum State Corporation's (CEPE) role was redefined, and plans were made to increase CEPE's involvement in exploration efforts and to change the petroleum legislation to enlarge CEPE's autonomy. The study, furthermore, observed the imbalances caused by a pricing policy which involved heavy subsidies for petroleum and electricity which led to constraints in carrying out the power investment program.

Energy Strategy Phase I

The short-term energy sector strategy study for Ecuador was completed in August 1988 and issued in Spanish in October. An English version was issued in December 1988. The study was carried out by a team of Ecuadorian and international consultants under the aegis of the National Energy Institute of Ecuador, who were advised by several ESMAP missions. The main findings and recommendations concerned energy prices (need to raise power tariffs and oil prices to improve the financial situation of enterprises and diminish claims on government budget for subsidies), power and petroleum investment programs (need to strictly prioritize investments and subject them to economic and financial criteria), and institutional and legal matters, (e.g. revise legislation which prevents the application of economic criteria in the setting of domestic petroleum prices).

Haiti

Energy Assessment (3672-HA)

Haiti's energy economy during the early 1980s was characterized by a number of pressing problems. The country had a weak natural energy base, and its forest resources were rapidly being depleted. The manufacturing and service sectors, in addition, were becoming increasingly energy intensive and dependent on imported

petroleum. The size of Haiti's energy systems constrained the choice of least cost solutions. Finally, the country's weak institutional structure and the scarcity of technical and economic capabilities severely crippled energy demand and supply management. The ESMAP study, therefore, drew up an energy strategy which involved the development of effective and carefully balanced programs in supply development, demand management, institution building, sector organization, and pricing. It also called for coordinated project implementation to enhance the effectiveness of bilateral and multilateral aid initiatives and avoid duplication.

Status Report (041/85)

In 1985 Haiti was visited by an ESMAP mission which set out to review the energy sector's development and actions taken to improve the sector's health. The mission concluded that, in the space of almost three years since the energy assessment, no major changes had occurred. The depletion of the country's forest resources, the attendant soil erosion, and the reduction of agricultural productivity continued unabated. Costly oil imports increasingly became a drain on scarce foreign exchange resources. The oil import bill amounted to 24 percent of merchandise exports in FY82. ESMAP, therefore, reiterated the need to (a) develop indigenous energy resources to an extent consistent with efficient allocation of the country's financial and human resources, and (b) introduce appropriate demand management and energy efficiency measures without impairing economic growth. Carrying out this strategy demanded, in turn, a strengthening of decisionmaking and program implementation in the energy sector institutions.

Honduras

Energy Assessment (6476-HO)

During the period 1981-1985, energy accounted for almost 50 percent of public investment expenditures in Honduras and debt service and petroleum imports were a major drain on the economy. ESMAP's study, therefore, recommended that the country's energy policy be geared to (a) purchasing petroleum products at least cost over a medium-term period and improving collection of oil revenues for sale of petroleum products, (b) supporting the integrated social forestry management projects, (c) promoting export sales of electricity produced by the El Cajon hydrogenerating plant, and (d) improving policy coordination and formulation by the public entities and the different government agencies. As a follow-up, the government with the assistance of ESMAP has set up an

information system to improve procurement and collection of oil revenues.

Jamaica

Energy Assessment (5466-JM)

Jamaica's economic predicament during the mid 1980s was worsened by the growing impact of oil imports on the country's balance of payments. Imported oil continued to be the main energy source in the energy balance (89 percent in 1983), and efforts to substitute oil by indigenous energy resources had been negligible. What is more, even if proven reserves of peat, hydropower, and bagasse were developed at their maximum capacity, only a minor contribution by these resources to future energy supplies could be expected. ESMAP concluded that with a projected oil demand growth rate of 4.5 percent per annum, it would prove imperative to exploit coal substitution opportunities and increase demand efficiencies. The study's recommendations therefore emphasized (a) the continued implementation of the rehabilitation and preventive maintenance programs for the Jamaica Public Service Company (JPSC), (b) the need for a more generous allocation of foreign exchange to the refinery, (c) the restructuring of the Ministry of Mining, Energy and Tourism (MMET), and (d) the need to transfer responsibility for developing electrical generation options from the Petroleum Corporation of Jamaica to the JPSC. Aside from these immediate priorities, the study covered the available technical, organizational, and institutional policy and investment options during the following decade.

Petroleum Procurement, Refining, and Distribution Study (061/86)

This study made a detailed review of the regulatory system for petroleum pricing and recommended various changes to improve the system's efficiency. It also recommended strengthening of the Ministry of Mining, Energy and Tourism.

Energy Efficiency Building Code Phase I

Under phase I of this project financed by Canada, a draft national energy efficiency building code was prepared by the National Energy Efficiency Building Code Committee with assistance from an international consultant. The code will be introduced on a mandatory basis for the design of public buildings and on a voluntary basis for the private sector. After a trial period and with any necessary modifications, the code will become man-

Completed

datory in order to achieve the full energy savings anticipated. During implementation (phase II), comments will be received from the public, weather data for a building code will be collected, and a building design manual will be prepared.

Energy Efficiency Standards and Labels Phase I

This activity supported work at the Jamaican Bureau of Standards to develop a program to improve the level of energy efficiency of selected domestic appliances. A national committee was formed under the project, consisting of government, manufacturing, trading, and consumer interests. An international expert and local consultant supported the committee in selecting appliances, designing labels and preparing a program of appliance testing, standards development, and public information. The committee demonstrated strong private sector support for the activity, and the project was reviewed at a seminar in March 1988. The activity was funded by the Canadian Government.

Management Information System Phase I

The Ministry of Mines, Energy and Tourism (MMET), acting upon the recommendations of the energy assessment report, undertook to develop a management information system which would assist in the development of a national energy policy. International expertise was deemed necessary to expand the system in order to provide greater inputs for policy development. A team consisting of an international expert and three local consultants designed and established the database.

Charcoal Production Project (090/88)

The charcoal production activity documented the growth in the consumption of charcoal in Jamaica and reveals that demand for fuelwood resources meets or exceeds the short-term limits of exploitation in accessible areas, such that permanent vegetation is being significantly reduced. While charcoal making is not the only contributor to such degradation, it is closely linked to land clearing. The report recommended (a) a \$1.4 million effort over four years to promote improved kilns nationally as a means of increasing carbonization efficiency and (b) development of a charcoal strategy. Elements encompassed in the strategy include organization of charcoal producers⁶ and woodfuels pricing. In mid 1989, a national forestry action plan was being drawn up by the government and was expected to incorporate the ESMAP recommendations into a fuelwood/energy component.

FIDCO Sawmill Residues Utilization Study (088/88)

This study examined the highest and best economic use of the residue output from the FIDCO sawmill. Some 11,000 tons per year of mill wastes are presently unutilized. The study found that direction of this biomass fuel to the nearby Petronol cogeneration plant would result in a net present benefit of \$1.2 million over ten years. No additional investment is required as the fuel handling and cogeneration equipment at Petronol is a sunk cost.

Panama

Power System Efficiency Study (004/83)

This study identified measures to reduce power distribution losses, some of which were incorporated in the World Bank's second power distribution loan.

Paraguay

Energy Assessment (5145-PA)

The chief aim of ESMAP's mission to Paraguay in 1983 was to provide assistance to the government in (a) formulating a long-term plan for expanding electricity utilization, (b) finding solutions for the problems arising from a growing imbalance in fuelwood supply and demand, (c) decreasing petroleum supply costs, and (d) improving overall energy policy coordination. The study's discussion of the electricity expansion plan posed a number of questions which needed answering before any long-term program could be drawn up. The timing and other important details of the construction of electricity intensive industries, for example, were considered important considerations. With regard to the impending fuelwood crisis, ESMAP recommended carrying out a number of high priority studies and an effective long-term reforestation program. A fuelwood conservation program and measures by ACEPAR (Acero del Paraguay) to minimize the impact of its charcoal production program were also called for.

Recommended Technical Assistance Projects

This activity reviewed with the government a number of technical assistance priorities that had been identified in the energy assessment report. A package of eight technical assistance projects were identified: two in power, three in forestry, two in petroleum, and one covering energy institutions. The cost of proposed technical assistance was \$450,000.

Status Report (043/85)

The findings of the status report were included in the study, "Recommended Technical Assistance Projects".

Peru

Energy Assessment (4677-PE)

During the early 1980s an economic recession slowed down productive activity in Peru. This resulted in a reevaluation of the country's energy investment program, pricing policies, and institutional arrangements in the energy assessment.

Status Report (040/85)

This study showed that as a result of ESMAP's mission to Peru in 1982, the government had taken some important and well directed initiatives in the energy sector. The authorities had promoted a petroleum exploration program, revised the Power Master Plan and decentralized Electroperu (Electricidad del Peru). Additional policies were launched in the household energy sector such as measures concerned with the fuelwood needs of the low-income Sierra population. Yet, a number of issues remained unresolved, i.e., oil reserves were declining and it became increasingly likely that Peru would become a net petroleum importer during the second half of the 1980s. Moreover, the power expansion program was suffering from a lack of financial resources and fuelwood supplies remained inadequate in the Sierra. The lack of financial resources and institutional weaknesses have been identified as being the root causes of these problems.

Proposal for a Stove Dissemination Program in the Sierra (064/87)

The principal objectives of this study were to compare traditional technologies with improved modern stoves and utensils, identify economically viable self-sustaining ways to produce and disseminate reliable and

energy efficient woodstoves, and formulate a costed and phased program of action to achieve this.

St. Lucia

Energy Assessment (5111-SLU)

The 1984 assessment of Saint Lucia's energy sector examined options to reduce the costs of the island's petroleum supply chain and to establish common service arrangements for the electric utility company. The study also addressed questions pertaining to energy policy, supplies, demand, and institutions. The supply issue was seen in terms of developing indigenous energy resources such as geothermal.

St. Vincent and the Grenadines

Energy Assessment (5103-STV)

The energy problems of St. Vincent and the Grenadines by 1984 centered largely upon the costly arrangement for petroleum product supply, transport and storage, and technical and nontechnical losses during electricity generation and distribution. ESMAP's study focused mainly on measures designed to formulate a least cost strategy for petroleum product imports and to reach a regional agreement on petroleum procurement. In addition, a number of recommendations are enumerated that aim to boost investment in the power sector and improve utility management.

Trinidad and Tobago

Energy Assessment (5930-TR)

The main issues addressed in this study related to Trinidad's (a) declining petroleum production and utilization of its large natural gas reserves, (b) improving the efficiency of its petroleum refining operations, (c) energy pricing with respect to the relevant economic cost of supply and energy conservation in transport, and (d) the need for better coordination of energy sector investment planning.

Global

Energy End Use Efficiency: Research and Strategy

As an outcome of a meeting in July 1989 with representatives of several Energy Research Donor agencies, ESMAP staff undertook the preparation of a policy paper entitled "Energy Efficiency Strategy for Developing Countries: The Role of ESMAP" for presentation at its annual meeting. The paper presented the results of a review of ESMAP, GTZ, and USAID energy efficiency projects and an assessment of the potential for energy efficiency improvements. About 15-25 percent of total industrial energy consumption, for instance, could be saved at little or no cost or with investments having a payback of less than two years. A six-point strategy for accelerating energy efficiency improvements in developing countries was recommended which would involve:

(a) correcting energy pricing signals, (b) making markets work more effectively, (c) strengthening institutions, (d) improving financial flows, (e) closer integration of energy efficiency into supply planning, and (f) fuel substitution. Copies of the strategy paper are available on request.

Women and Energy—A Resource Guide. The International Network: Policies and Experience

This document reviews the work being done by various international donor agencies and NGOs to incorporate gender issues into energy projects, policies, and energy related activities. It has been issued as part of ESMAP's ongoing women and energy strategy work.

ONGOING ACTIVITIES

Descriptions of ongoing activities include the purpose and the goals of the assessments, preinvestment and prefeasibility studies, and pilot projects. This section corresponds with the statistical table, "Ongoing Activities (Region)". It also identifies the recipient government's current involvement in the activities. In most cases, types of consultants used are identified or can be derived from the write-up. For those current activities still seeking consultants, the types needed are specifically noted. Where activities are entering their final stages, known investment opportunities are identified.

All references to cost are presented in U.S. dollars.

Sub-Saharan Africa

Africa Regional

Study of the SADCC Energy Unit

This study will examine the role and achievements of the SADCC Energy Unit in Luanda, as a follow-up to the work begun on the Angola energy assessment. The main mission took place in September/October 1988. A draft report was sent to the SADCC unit in January 1990 and discussions were held with SADCC TAU and the government in February 1990.

Design of ESAMI Energy Training Curricula

The main objective of this activity is to assist the Eastern and Southern Africa Management Institute (ESAMI) to assess the feasibility of introducing specialized training and management development activities for the energy sector into the ESAMI curricula. The goal is to provide in-service training opportunities for public

servants in the subregion, with emphasis on developing local capabilities for planning and managing energy strategies, policies, and programs to meet the diverse needs of small-scale enterprises, households, and rural development schemes. A four-day workshop was held in Livingston, Zambia, in February 1990 to provide a forum for senior energy officials and professionals in the subregion to participate in the training needs assessment phase of the activity. A detailed report is being prepared on the proposed energy training program to be established at ESAMI. Also, a draft report on the workshop proceedings has been prepared. The Government of the Netherlands is financing this \$150,000 activity.

SADCC Household Energy Survey Applications Training Phases I and II

By providing training to energy professionals in the SADCC region on the application of state-of-the-art survey techniques for household energy strategy work, the

objective of this activity is to assist the SADCC TAU to establish a network of experts in SADCC to cover wood-fuels and household energy programs. During phase I of this activity, ESMAP, with the assistance of Statistics Sweden (SCB), will collaborate with counterparts from the SADCC TAU and other energy professionals from SADCC countries in a workshop to (a) review the experience with household energy surveys, especially in the context of ESMAP activities in Botswana, Tanzania, Zambia, and Zimbabwe and (b) define a detailed plan of action for follow-up training activities that will be executed in phase II. The proposed workshop is tentatively scheduled for October/November 1990. The Swedish Government has provided \$150,000 in financing for the first phase of this activity. The Netherlands Government will provide \$440,000 for phase II of the activity.

SADCC Regional Electric Power Interconnection Prefeasibility Study

The objective of this prefeasibility study is to assess the scope for coordinated utilization and development of regional generation and transmission facilities. It is also to evaluate the potential benefits and costs of increased cooperation related to transfers of electrical power and energy. This evaluation will take into account the requirements of individual member states in terms of reliability, quality of service and planning criteria, security of supply and self-reliance considerations, as well as institutional, contractual, and pricing issues. The aim of the activity is thus to illustrate what regional options may be available for the mutual benefit of the various countries concerned and the SADCC region as a whole. The study will also include identification of the opportunities and potential benefits of power transfers to non-SADCC countries, particularly to South Africa. The activity is to be divided in three phases with the inception phase of data collection and preliminary identification of issues begun in August 1990. The total estimated cost of the activity is \$630,000.

Angola

Power Subsector Investment Review

This activity is a follow-up on the recommendations in the Angola energy assessment by ESMAP. The funding for the project is being provided in part by SIDA. The project document for UNDP IPF cofinancing has been drafted and signed by all parties. A main mission visited Angola in February 1990, and a draft report is expected in October 1990.

Botswana

Urban Household Energy Strategy Study

The fieldwork for this project commenced in early September 1988 and lasted just over one year. The draft final report is in preparation. A detailed assessment of urban household energy demand and supply was conducted. An energy marketing survey was undertaken as was a desk study of biomass supply. The trade in energy was monitored, especially the fuelwood trade. Outputs included baseline data on household energy consumption and patterns of use, the formulation of energy strategies, and the identification of priority areas for future assistance. The Swedish International Development Authority financed the \$365,000 project which strengthened the capabilities of the Energy Unit of the Government of Botswana and help it monitor and continually update energy supply and demand patterns and, if necessary, modify energy policy.

Burkina Faso

Urban Household Energy Strategy Study

Fieldwork for this activity was completed in December 1989, and the final report is being sent to the government. This report supports a continuation of the government's household energy policy, strengthening and expanding its components to emphasize the management of the urban household demand for biomass and opportunities for urban fuel substitution. These components will be combined with a framework to introduce village-based forestry management practices in the woodfuel supply zones of the fast growing urban centers. The activity is estimated to cost \$755,000. A trust fund equivalent to \$655,000 at current exchange rates was set up by the Government of Norway, and further financing of \$100,000 was provided by the Government of the Netherlands.

Burundi

Energy Assessment Update

Following the 1982 energy assessment, events such as the fall in international petroleum prices, developments in the power sector, and household energy initiatives made a reevaluation of Burundi's energy position and prospects necessary. The energy assessment update will outline a strategy for energy sector development and identify priority energy sector investments and policy

actions for the 1990s which could form the basis of donor and World Bank activity in Burundi. It will review energy demand, power investment, household energy supply and demand management, cost reductions in petroleum supply, economic utilization of peat, the requirements for institutional strengthening and energy demand management. Total costs are budgeted at approximately \$190,000, for which funding has been secured from the Netherlands. The main mission took place in October 1989, and a draft report is being prepared.

Cameroon

Energy Strategy Study

Following data collection and background studies carried out by the Energy Division of the Ministry of Mines, Water and Power with technical assistance from CIDA, ESMAP was requested to assist in an energy strategy study. The study focuses on (a) preparing a report to address the major issues in the Cameroones energy sector and (b) recommending and prioritizing measures to be included in the first Cameroon Energy Plan. The task should be completed by the end of 1990. A review of the main issues was carried out during an energy seminar in January 1990. The task should be completed by mid 1991.

Household Energy Strategy Study

The objective of this activity is to assist the Government of Cameroon in the design of a household energy strategy consisting of both policy initiatives and project interventions. Pursuant to discussions with the government, the project includes (a) a definition of urban fuelwood supply zones based on an assessment of the wood fuel resources that are economically accessible, (b) a woodfuel marketing and distribution study, (c) a survey of charcoal production, (d) a survey of the energy demand of urban households and of the informal sector, (e) the design of an improved stoves program, and (f) an economic, financial, and institutional analysis of different strategy options. The cost of the strategy is estimated at \$560,000, which is financed by the Government of the Netherlands. The activity has become operational as of September 1990.

Central African Republic

Energy Assessment

The energy sector is affected by high costs of petroleum and electricity supplies as a partial result of the country's landlocked position, compounded by weak institutions at the policymaking and operational levels. A coherent government strategy aimed at addressing these problems does not exist. The government has requested ESMAP to carry out an energy assessment which would (a) analyze the present position and prospects of the energy sector and (b) evaluate the principal policy options and requirements for making the energy sector more viable including initially an investment program which is realistic and suitable to attract external capital and technical assistance. Cost of the proposed activity is estimated at \$296,000, with funding by the ECC and ESMAP. A reconnaissance mission took place in May 1990, and the main mission will take place in November 1990.

Congo

Improvement of the Operational Performance of the Power Sector

The purpose of this activity is to (a) review the condition of generating plants, distribution networks, and support services, (b) propose a least cost investment and rehabilitation program to improve the operational performance of existing equipment and the global efficiency of the power sector, (c) recommend improving institutional structure and managerial procedures, and (d) identify institutional constraints to improving the overall operational performance of the sector. This activity is estimated to cost \$282,000 and will be financed by the 1990 contribution of the Government of France.

Côte d'Ivoire

Energy Sector Technical Assistance

This is one of the largest single energy strategy and efficiency activities that ESMAP has undertaken in any one country. The principal component of the activity is oriented to improving the efficiency of the national electric utility, Energie électrique de la Côte d'Ivoire (EECI). It will also encompass an energy efficiency component for administrative, commercial, and modern residential buildings. Three electric power engineers have been sent to Côte d'Ivoire for a period of two or more years each to participate in EECI's system improve-

ment project. This will encompass network rehabilitation, power flow management, hydroelectric reservoir optimization, training, and planning. Total cost is estimated at \$1,250,000.

Energy Efficiency in Buildings

As an extension of the technical assistance activity, an activity for improving energy efficiency in modern buildings will be designed; some of its components (training, preparation of regulations, appliance labelling, preparation of standards, energy audits, etc.) will be implemented with the aid of ESMAP. Total cost is estimated at \$850,000. Funding is being provided by CIDA.

Gabon

Energy Efficiency Seminar

This seminar has been designed around two general objectives: (a) informing the Gabonese decisionmakers of the benefits for improving energy efficiency and (b) analyzing in detail four topics in energy efficiency—air conditioning, isolated private electricity generation, electricity pricing, and the role of energy audits. This activity will be managed by the Ministry of Water and Hydraulic Resources and will involve a large input from private and public entities operating in Gabon. It is sponsored by the Agence de cooperation culturelle et technique (ACCT) and is scheduled in Libreville (Gabon) for the end of October 1990.

Ghana

Industrial Energy Rationalization Study Phase I

The activity, financed by Canada, started in May 1989 and is operationally completed. Special attention was devoted to the development of local expertise by training Ghanaian energy auditors through seminars, hands-on activities, and involving a local consulting firm. Three in-depth energy audits which received strong support from the industrial firms have been performed. Energy conservation potential has been evaluated at \$450,000 per annum. Some of the firms have already started to implement specific recommended measures. One has experienced savings of 30 percent in its energy bill. Between 60-70 percent of the savings potential will be realized from the measures currently undertaken. A follow-up project has been designed which requires financing.

Improved Charcoal Production Project

Approximately 27 percent of all forest wood removed in Ghana is used for charcoal production purposes. Although on a national basis wood is not yet scarce, the depletion of wood resources occurs on a regional basis and becomes visible in the form of deforested zones around towns. This ESMAP activity seeks to increase the supply and lower the environmental costs of charcoal by (a) inducing a shift in the production area, (b) increasing the efficiency of traditional production, and (c) introducing improved methods of carbonizing sawmill wastes. A draft final report has been forwarded to the government.

Improved Charcoal Stoves Project

An improved charcoal stoves program could have a major impact on the overall woodfuel and energy balance in Ghana. The eventual benefits of such a program should lead to savings of up to 30 percent of the charcoal used for cooking. The estimated total cost of this activity, \$250,000, is provided by the Government of the Netherlands. Two stoves have been selected for households for dissemination. The best strategies for marketing the stoves are being identified.

Guinea

Household Energy Strategy Study

This activity is to assist the Government of Guinea in the development and assessment of realistic household energy strategies which are based on currently available woodfuel resources, demand management and interfuel options, and pricing policy issues. The strategies are to be consistent with realistic expectations of growth in the country's economy and with its financial resources to minimize the cost, including environmental, to the economy and to Guinean families. The study includes (a) a survey to assemble baseline data (energy consumption, stoves, prices, kitchen technology, assessment of fuelwood resources, and definition of supply zones), (b) testing of existing stoves and, if need be, development of improved ones, (c) a market survey of consumer attitudes vis-à-vis various stove models and their fuels, (d) definition of a planning framework for the development of a minihydro system, and (e) the development of a socioeconomically feasible large-scale project to implement a household energy strategy. Fieldwork is ongoing and is expected to be completed by the end of 1990.

Guinea-Bissau

Power Sector Management Assistance

A recent ESMAP study (No. 100/89) outlined the general situation of the electric power and water supply subsectors of Guinea-Bissau, discussed options for strengthening their management, and recommended establishment of a partnership with an international utility or firm. The government subsequently decided to temporarily manage the national power and water utility, EAGB, by having expatriate experts in key positions of authority and responsibility while pursuing a more permanent option. ESMAP has now agreed to reinforce this arrangement by preparing draft service contracts and internal regulations to better define the responsibilities of the government and EAGB for the new management team. This activity is being funded by France, which is also providing grant funding for two years of expatriate management.

Urban Household Energy Strategy Study

The objective of this study is to define an integrated strategy for improving household energy use in Bissau and other major towns. The work includes woodfuel demand and supply surveys (with special emphasis on the role of women), analysis of interfuel substitution options, and a review of policies and the institutional framework. The total cost is estimated at \$384,000. The UNDP and SIDA have expressed interest in financing the study. A programming mission was conducted in April 1990.

Lesotho

Institutional and Regulatory Framework for the Power Sector

In support of the Lesotho Highlands Water Project (LHWP), ESMAP has been asked to provide assistance to the government in addressing the regulatory and institutional issues that are confronting the power sector in the development of the hydropower component of LHWP. The objective of this activity is to redefine the institutional framework for the power sector, to bring about a sustainable improvement in sector operations in a manner which efficiently accommodates the expansion of domestic supply (through the planned LHWP hydropower operations at 'Muela and minihydro stations). The activity is designed to evaluate (a) current power sector organization and issues, (b) the most efficient operational regime for 'Muela for maximizing the

benefits to Lesotho, (c) institutional alternatives for operation, ownership, and responsibility for debt service, and (d) the implications of these alternatives on the viability of power sector entities and for meeting the government's power sector objectives. The alternative arrangements for 'Muela will be evaluated to assess the implications of each for the structure of sector organization and on redefinition of mandates for each institution.

Malawi

Evaluation of Power System Losses

Demand on the power supply network is increasing, and system losses are now above an economic level. The proposed activity would provide a microcomputer and software to calculate power losses and assist in economic design of transmission and distribution extensions. Staff of the public electricity utility would be trained in the use of the hardware and software and would themselves calculate system losses and, with assistance, develop economic loss reduction programs. The activity began in August 1990.

Mali

Energy Assessment

Mali has a narrow energy resource base aggravated by recurrent droughts, weak institutions, and inadequate policies, particularly for energy demand management. The purpose of the assessment is to review the position and prospects of the energy sector and identify the major institutional, policy, investment, and technical assistance requirements for energy development. Discussions on the draft report with the government were carried out in April 1990, and the final report should be completed in October 1990.

Household Energy Strategy Study

This nine-month activity has led to the formulation of an integrated strategy for household energy. The activity includes fuel demand and supply surveys, analysis of interfuel substitution options, and review of pricing policies, with special emphasis on the role of women and the impact on low-income households. The total cost is about \$384,000, for which financing from the Government of the Netherlands has been obtained. The activity began in April 1989 and was undertaken using Malian, Dutch, and French consultants. Fieldwork was completed in October 1989. The final report is under preparation.

Follow-up is expected to start the second half of 1990 with funding from the World Bank's second power project.

Mozambique

Household Electricity Utilization Study

A fuelwood shortage has developed in urban areas of Mozambique because of war and peri-urban deforestation. Reliance on kerosene and LPG imposes high foreign exchange costs and increased household expenditures. At the same time, the country has developed very large hydroelectric facilities that are underutilized. The study will establish the technical and economic feasibility and environmental and cultural aspects of substituting electricity for other fuels, especially for cooking and lighting. The study will assess the capacity of the existing distribution systems in selected urban areas to provide additional supplies and low-cost distribution systems. The final report is to be presented by September 1990. The funds for the activity, \$165,000, were provided by SIDA.

Rwanda

Energy Assessment Update

The objective of this activity is to recommend an energy strategy for Rwanda covering the period up to the year 2000. The strategy identifies the key issues in the energy sector and assesses the least cost mix of investments necessary to satisfy viable energy demand, reviews main aspects of energy policy, and proposes steps towards institutional strengthening. A team of energy consultants visited Rwanda and have prepared energy demand forecasts, reviewed the power system investment program, analyzed household energy demand options, identified least cost petroleum supply sources, assessed the potential of indigenous methane gas and peat resources, and enumerated opportunities for energy conservation. The activity will cost \$200,000 with funding contribution by CIDA. A draft report has been forwarded to the government for review and discussions.

Charcoal Kilns Phase II

The study consists of training for traditional charcoalers on a village level. Since February 1988, more than 250 charcoalers have been trained, and the initial results look quite promising, i.e. wood savings have been shown to amount to 40-50 percent. Funding has been provided

by a UNDP IPF (\$200,000) and the Government of the Netherlands (\$450,000). The final report is currently being drafted.

Charcoal Stoves Phase II

This activity started in October 1987. Households have decided which stove type they like best, a publicity campaign will be launched, and indications are that the private sector is quickly adopting the stove model selected by the households. Average fuel savings are 35 percent over traditional stoves.

Sao Tome

Hydropower Feasibility Study

This activity would assist the government with a new hydroelectric project by performing preliminary engineering and preparing documentation required by lending agencies for financial support for the project. The study would include least cost option analysis, detailed engineering, technical specifications, and cost estimates and would look at environmental and social implications. Fieldwork began in May 1990, and a main mission is scheduled for September 1990. The Government of France is financing this activity. Costs of this study are estimated at \$310,000.

Senegal

Industrial Energy Conservation

Phase I of this activity started in 1986 and was financed by UNDP country IPF. During this phase, institutional support was provided to the Directorate of Energy of the Ministry of Industrial Development and Craft with the aim of defining an industry wide energy saving policy, of strengthening the Office of Energy Conservation, and of preparing a program of energy audits. Phase II of the activity began in October 1986. With CIDA financing, a Canadian consulting firm carried out in-depth energy audits of 12 industries. In October 1987, Canada and Senegal signed a protocol for an additional large Canadian contribution to phase II. Under this last contribution, a program of 25 in-depth energy audits has been carried out by a Canadian consulting firm in association with a local consulting firm for components of this program. The activity has been extended to (a) provide technical and institutional support to audited firms and Senegalese institutions for the implementation of measures recommended through the former audits

programs, (b) enhance development of local expertise (energy managers and auditors), and (c) supply energy services to medium-scale industrial firms. A local consulting firm and Senegalese engineers are fully involved in the execution of this phase which amounts to \$800,000 and is financed by CIDA. The implementation of the recommendations has resulted in over 45 percent conservation realized at financially profitable conditions.

Energy Strategy and Donors' Meeting

Due to internal and external developments which took place since 1985, the Government of Senegal has initiated a review of its current energy policy and plans to update it before convening a donors meeting on the energy sector. The government has requested ESMAP to provide technical support for evaluating energy policy options, defining implementation programs, and preparing documentation to be presented to the donors meeting which has been rescheduled for 1990. The ESMAP activity started in May 1989 and is financed by the Government of Netherlands and with World Bank/UNDP in-kind contributions.

Energy Efficiency in Buildings and Transport

The objective of the project is to provide Senegalese institutions with technical support for (a) preparing a program of actions to improve energy efficiency in buildings and transport and (b) designing an adequate institutional and regulatory framework to implement the program. The activity which will also aim toward developing local expertise will largely rely on professional staff already trained under the industrial energy conservation project. The activity budget is \$200,000 and will be financed by Netherlands.

Tanzania

Power Loss Reduction and Distribution Planning

Fieldwork began in October 1989. The activity involves development of economic programs to reduce the level of technical and nontechnical losses on the power system and to improve the quality and efficiency of power supplies. In addition, forecasts will be made of power demands likely to be experienced in major load centers in the mid to long term, and plans developed to expand the distribution system to satisfactorily supply the forecast demands. Funding of \$780,000 is being provided by SIDA for the study.

Uganda

Minihydro Rehabilitation Feasibility Study

The principal objective of this ESMAP study will be to determine the financial, economic, and technical feasibility of rehabilitating a mini hydropower plant near Kigagati, in the southwestern part of the country. A detailed project will be prepared to cover investments and technical assistance necessary to retrofit equipment and facilities at the site. The goal will be to restore the plant to operation to reinforce the power supply to existing load centers in that part of the country now solely dependent on a long single-line extension from the main grid. The study is estimated to cost \$130,000. The fieldwork was completed in November 1989. A final report is being drafted.

Energy Efficiency in Agro-Industries

The objective of this activity is to formulate a strategy and medium-term investment program to improve the overall efficiency of energy supply to and use by rural and agricultural enterprises in Uganda. The industries include: tea drying, coffee roasting, fish smoking, and small scale enterprises such as ceramic and clay products, bakeries and institutional catering. The immediate objectives are to conduct a variety of preinvestment tasks and pilot demonstration schemes which would serve as the basis for formulating a strategy and medium term investment program. Funding of \$390,000 is provided by SIDA.

Zimbabwe

Energy Strategy Evaluation

ESMAP and the government's Department of Energy Resource Development are jointly carrying out an energy strategy evaluation which will determine policy and investment requirements in the electricity, coal, and petroleum subsectors for the 1990-95 period and, indicatively, for the 1996-2010 period. This will serve as an input into the government's forthcoming Five-Year Development Plan. A team of Zimbabwean and international specialists has reviewed the technical, economic, financial, and institutional issues related to obtaining least cost energy supplies as well as optimal supply security. Workshops for senior policymakers and training seminars have been held to analyze the basic issues of the energy sector and to discuss the conclusions

and recommendations of the evaluation. A report was submitted to the government in August 1990.

Energy Strategy for Low-Income Communities Phase II

During phase I of this activity, ESMAP provided training to counterparts from the Department of Energy Resources Development, the Department of Community Development and Women's Affairs, and the Ministry of Finance, Economic Planning and Development on the methodologies for economic and financial analyses of

energy options for low-income target groups in Zimbabwe. The objective of phase II is to extend ESMAP assistance to fieldwork for application of the methodologies to the formulation of an integrated rural energy strategy for rural growth centers and communal areas. The fieldwork includes the design and execution of energy surveys in collaboration with the Central Statistics Office and the Department of Community Development and Cooperatives. The estimated cost of phase II is \$180,000. The Government of the Netherlands is funding the activity.

Asia and the Pacific

ASEAN Region

Financing Energy Services for Small-Scale Energy Consumers (Finesse)

ESMAP, in coordination with the U. S. Department of Energy and Environmental Protection Agency and the Netherlands Government, is conducting a joint project to identify and review innovative options for financing energy conservation and alternative energy systems for small-scale energy consumers (households, informal sector, and commercial enterprises). While the opportunities, in the aggregate, for these small-scale energy consumers are quite large, identification, appraisal, financing, and management of these opportunities have been relatively meager due to a lack of established institutional frameworks. Thus, ESMAP's objective is, first, to find out whether the current institutional framework could absorb further aid in this subsector and, second, to package a project of sufficient scope so as to attract financing from the multilateral development banks. The results of this joint effort will be a workshop in early 1991 targeted for the ASEAN (Association of Southern Asian Nations) region to help identify and promote viable projects in the sector. It is also envisioned that a project identification and evaluation handbook will be developed as an input for the workshop.

China

Rural Energy Training and Technical Assistance Phase I

Identified as a priority in the county-level rural energy assessment study, this joint ESMAP/Chinese activity seeks to enhance China's capabilities to disseminate and implement improved rural energy planning techniques and practices at local levels. The activity includes the establishment of a long-term Chinese training program on rural energy planning and the joint preparation of a national rural energy development strategy paper. A training program in survey methodology and data manipulation has been implemented, a training of trainers course has been completed, and a training course for provincial staff trainers will be completed in September 1990. A draft rural energy planning textbook, a training manual, and classroom case studies have been completed. Preparatory work has been completed for three new county-level energy assessments to be undertaken primarily by Chinese counterparts. Funding support of \$174,000 is being sought for the third year of the activity.

Technical Assistance for Planning and Management in Small Power Companies Phase I

This project is part of an ESMAP wider effort in rural energy planning. Its objective is to provide technical, planning, and managerial expertise to local power

companies to help them to (a) strengthen planning for generation and grid expansion, (b) reduce the power losses and improve system efficiency, and (c) improve management of the local power companies. The objective will be achieved by carrying out a rural power sector assessment during the first phase and pilot studies in chosen counties during the second phase, but more important, by training Chinese counterparts and helping them to disseminate the methods and techniques nationwide. An ESMAP/Chinese assessment mission took place in May/June 1989, and a workshop will be held in October 1990 to discuss the interim report. The first phase of the task will be completed by the end of 1990.

India

Irrigation-Based Minihydro Study

The objective is to formulate a detailed investment plan through which state authorities would develop a series of minihydro installations at sites along irrigation systems in the states of Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu of Southern India as well as Punjab state. The fieldwork which was to verify suitability of the sites for grid-ties and for applying alternative submersible turbine systems, evaluate physical and financial requirements, and define an organizational framework for operating the minihydro systems to accommodate the requirements of both SEBs and irrigation authorities was completed in July 1990. A multiyear investment program comprising 54 schemes with a total output of 145 megawatts has been defined for target states. A final report will be issued in October 1990.

Windfarm Development Preinvestment Study

The principal objectives of this study are to (a) identify promising sites for commercial scale (up to 100 megawatts) windfarm development, (b) assess the economic viability of windfarms at these sites, and (c) identify and assess steps for further indigenization of windfarm technology. Although this work will focus on specific windfarm sites, the broader implications of this work for windfarm development throughout India will be discussed. In April 1989, a site selection mission visited India to select the most promising sites for detailed feasibility work. In April 1990, a feasibility assessment mission traveled to India to develop an evaluation methodology, collect the required data, and initiate analysis. DANIDA has provided \$220,000 to finance the study.

Integration of Regional Power Systems Operations

This study will investigate the options for improving the use of existing and planned generating plants through improved dispatching of power according to economic merit order. Initial studies would be done for the Western Region Electricity Board and then replicated in the remaining regions. The objectives of the study are (a) to improve the technical and institutional capability to dispatch power according to merit order, (b) develop bulk supply tariffs and trading agreements to facilitate more efficient plant use, (c) to adapt available computer models to simulate the power trading operations, and (d) to develop the capability within India to carry out similar studies in other regions. The cost of the activity, \$200,000, will be met by SIDA. An initial mission took place in November 1989, and the government is considering the recommendations for the next steps. A second mission is planned for late 1990.

Rural and Traditional Energy Study

This study will assist the Government of India and selected state governments in analyzing issues and options in the rural energy sector. Among those issues to be examined are: (a) changing rural energy use patterns, (b) environmental issues resulting from use of traditional fuels, (c) the increasing diversion of modern fuels to productive uses in rural areas, and (d) the use of traditional fuels in urban areas. The cost is estimated at \$400,000.

Indonesia

Biomass Gasifier Preinvestment Study

The objectives of this activity are to assess the potential technical and economic role of biomass gasifiers in Indonesia, define the scope of their possible contribution to the needs in the energy sector, and, if significant, outline the investment requirements necessary to support their efficient utilization. The project has resulted in a report to the Government of Indonesia outlining a strategy for the deployment of the technology which is consistent with national priorities. A seminar to discuss the recommendations of the report was held in Jakarta in July 1990. The Government of the Netherlands is providing \$138,000 for this activity.

Improved Biomass Utilization Study Phase I

The overall objectives of this activity are to (a) develop a consistent and comprehensive database of

biomass resources in Indonesia, (b) locate sites where utilization of these resources could supply economic power for existing energy demand, and (c) prepare projects to demonstrate biomass energy conversion technologies in these high potential applications. Phase I will consist of a review of all recent studies on this subject and an identification of the subsectors likely to make the greatest contribution to meeting Indonesia's energy needs. The Government of the Netherlands has agreed to finance the \$133,000 cost of phase I.

Technology Transfer and Demonstration of Charcoal Ferrocement Gasifiers

The primary objective of this project is to introduce and transfer the Asian Institute of Technology (AIT) ferrocement gasifier technology to Indonesia where the potential for its further development and eventual economic application are much more promising. The Institute of Technology Bandung (ITB), given its long-term experience with wood and rice husk gasification, is the appropriate recipient point for the technology transfer to Indonesia. Transfer of the AIT ferrocement gasifier technology to ITB will also allow ITB to redirect its current research efforts in gasification technology in the direction of low-cost ferrocement gasification systems and to investigate the possibility of using lower cost fuels such as waste wood and rice husks with the ferrocement technology. The potential result would be the development of a significantly more economic gasification system for use in Indonesia and elsewhere.

Nepal

Comparative Study of International Power Sales and Water Resources Development Agreements

The export to India of hydroelectricity and the realization of related benefits is an important part of the government's strategy for the development of Nepal's water resource potential. Given the necessity of reaching sales and development agreements to enable project implementation, the government has asked ESMAP to assist Nepal in conducting a two-part comparative study of international power sales and international water resource development agreements. The study identifies issues and options regarding the key components of each type of agreement. The first part is an analysis of the structure and terms of binational power sales agreements. The second is an analysis of international water resource project treaties, concentrating not only on structures for ownership, financing, and management but also examin-

ing other key issues including the process of reaching such agreements and the role of third parties in that process, the identification, valuation, and allocation of benefits, and the treatment of environment and resettlement concerns. A draft report is in preparation. There are plans for a second phase workshop in the future.

Pacific Region

Household and Rural Energy Seminar

Another in ESMAP's series of regional household energy seminars is being planned for the Pacific Region, to be held in November 1990, in Port Villa, Vanuatu. In the planning and implementation of the seminar, ESMAP will work closely with the staff of the Pacific Energy Development Program (PEDP), the Forum Secretariat/Energy Division (FSED), and other regional institutions.

Philippines

Assistance for Updating the Nonconventional Energy Program

Since the first oil shock in the early 1970s, the Philippines have undergone an energy substitution process involving the development of indigenous energy sources for self-reliance. Oil imports were reduced to about 49 percent in 1985, substantially through exploitation of abundant geothermal resources. However, except for the use of traditional agri-residues such as bagasse and rice hulls, there have been few opportunities for economic applications of renewables. A responsive activity considered of high priority by both the World Bank 1988 Energy Sector Review and the government's Office of Energy Affairs was to update the nonconventional energy (NCE) program and integrate it into the national energy plan. The proposed ESMAP activity aims to provide expert assistance to the government in evaluating its NCE projects and programs, including expansion of the existing database and matching supply incidence with potentially commercial utilizations. The activity will attempt to realistically determine the most likely contribution of NCE in the national energy plan. The joint ESMAP/OEA effort is costed at \$275,000 for local and outside experts and supporting microcomputer equipment. An initiation mission was launched in June 1990 where agreement was made with the government on the detailed scope of the study. The study will be financed by the Government of the Netherlands.

Household Energy Strategy Study

A comprehensive planning study to assist the government in formulating urban and rural household energy policy is being conducted under the auspices of the Office of Energy Affairs. Under the study, a nationwide household energy survey has been completed by the National Statistics Office. A woodfuels marketing study for major urban areas is underway. The main mission was in August 1990. This activity will cost \$377,000 and is being financed by the Government of the Netherlands.

Solomon Islands

Energy Assessment Update

The government has requested the assistance of ESMAP to develop national energy planning and administration capacity by strengthening the Energy Division's capability in planning, evaluating, and implementing energy projects. The objective of the proposed activity is to update the energy assessment from 1983, identifying priority energy subsector investments and policy actions and evaluate the role and responsibilities of the Energy Division and recommend improvements in the organization and staffing. The cost of the activity is estimated at \$190,000, and it is financed by Japan and ESMAP core funds.

Europe, Middle East, and North Africa (EMENA)

Morocco

Loss Reduction in Transmission and Distribution

This activity is intended to provide the exposure, orientation, training, computer hardware and software, and specialized assistance necessary for effective control of electricity losses. It was jointly developed with an interministerial team comprised of the Ministry of Energy and Mines, the Ministry of the Interior, the principal generation and transmission body (ONE), and the regional electricity distribution organizations (Regies). It is coordinated with a World Bank project. Financing for the activity is being provided through \$280,000 of UNDP IPF resources.

Natural Gas Development Plan

The study will examine how natural gas most advantageously can be introduced into the Moroccan energy system. It will review the domestic potential for increased gas production as well as the import options via the planned Algeria/Morocco/Europe pipeline. The study will conduct detailed market analysis of potential gas demand where the possibility of using gas for electricity generation will be central. An initial screening of dif-

ferent gas related investment projects will be carried out. A consultant for the study will be chosen by early autumn. The project has obtained finance from the Belgian Government.

Pakistan

Household Energy Strategy Study

Although the household sector is the largest single energy consuming sector in Pakistan, relatively little is known regarding household energy use. What little evidence exists suggests that current patterns of household energy supply and consumption may be economically and environmentally unsustainable and that household welfare is declining as the use of inferior fuels becomes more widespread. Consequently, the Government of Pakistan has requested a household energy strategy study that will gather the necessary data and identify the most pressing issues in order to formulate an effective and appropriate household energy strategy. The first phase of the study, data collection and analysis, will be carried out over approximately 20 months. It will include household demand surveys, biomass fuel supply assessment comprising both remote sensing and ground surveys, a market structure survey for both modern and

biomass fuels, longitudinal studies, and the integration and analysis of data with the help of a geographical information system. The second phase will encompass policy formulation, program development, and investment feasibility studies based on the findings of the first phase and will have a duration of about seven months. UNDP is financing the \$3.04 million project. An agro-ecological zonation of the country has been completed, and supply and demand survey fieldwork will begin in November 1990. Collaboration with the World Bank's Living Standard Measurement Survey will provide a unique opportunity to establish the linkages between household energy consumption patterns and household welfare.

Energy Efficiency Study

In an effort to reduce the current costs and the investment needs of the energy sector and improve the availability of energy, the Government of Pakistan has established the National Energy Conservation Center (ENERCON) under the Ministry of Planning and Development. In carrying out its mandate to develop and implement energy efficiency improvement programs, ENERCON has requested ESMAP assistance to develop a program to improve the power factor of major users of electricity and a program to retrofit or replace industrial boilers. In parallel, ESMAP will assist ENERCON to reassess Pakistan's energy conservation strategy and to design an action plan for the next 10 years. The studies will be carried out over nine months by Pakistani and international consultants, ENERCON, and ESMAP. Funding requirements are in the order of \$350,000 of which \$200,000 is being provided by the Government of the Netherlands.

Poland

Natural Gas Development Plan

The study will provide an integrated framework for gas supply/demand balance, interfuel substitution, and gas supply optimization. The study will result in an economic ranking of projects and will provide an investment plan and training for POGC (Poland Oil and Gas Company) staff. The Government of France will finance the first phase.

Restructuring Program for the Hard Coal Subsector

The Polish hard coal mining sector is a mainstay of the national economy, providing the country's largest

single export product (currently 12 percent of total exports) and contributing a significant share to GDP (13 percent) and national employment (about 5 percent). The authorities recognize that a broad ranging review of the coal sector institutions is required to promote efficiency and accountability and to mobilize the needed investment financing against a background of rapid economic reform and severely constrained resources. A study is being carried out under the supervision of ESMAP to prepare a restructuring and institutional reform program for the hard coal subsector. The purpose of the assignment is to assist the Ministry to (a) maintain, to the extent possible, net convertible foreign exchange earnings from hard coal exports and (b) produce coal efficiently and encourage the efficient supply and use of coal in domestic markets.

Restructuring Programs for the Electricity, Lignite, and Heating Subsectors

The Government of Poland proposes major changes to the electricity, lignite, and district heating subsectors, with the aim of increasing energy efficiency and the reliability of the supply of energy. This will involve elimination of subsidies, improving financial discipline, and strengthening local accountability, which would require significant changes to institutions and incentives. The Ministry of Industry has been given the task of defining a restructuring program and supervising its execution. It has requested advice and assistance from ESMAP on the preparation of the restructuring program with the objectives of (a) promoting efficient and reliable energy supply and efficient use of energy, (b) ensuring that the public utilities have clear objectives, adequate autonomy and can be held accountable, (c) mobilizing adequate internal and external financial resources, including those from local and foreign private sources, (d) reducing the environmental, health and safety impacts of energy production and use at acceptable cost, and (e) developing the capability within Poland for the analysis of such issues.

Natural Gas Pricing and Tariff Study

The study will develop a gas pricing and tariff structure covering wellhead, transmission, distribution, and consumer prices. The activity will cost \$150,000 and is being financed by the UK Government.

Environmental Assessment

The environmental costs and benefits of alternative sources of energy including gas consumption will be

addressed in this activity which is complementary to the Natural Gas Development Plan. It will be financed by the Government of Norway and has a budget of \$200,000.

Restructuring Study of the Poland Oil and Gas Company (POGC)

The study will evaluate POGC's institutional, financial, regulatory framework, and its operations in the oil and gas sector. Recommendations will be made regarding the possible restructuring of POGC, taking into account the expected large investment plans for the sector along with current changes in the macroeconomic framework, demonopolization, price decontrol, and privatization of public enterprises. The \$550,000 activity is being funded by the ODA.

Legal and Contractual Framework Study and Training Program

The activity will develop an internationally acceptable legal and contractual framework including a hydrocarbons law and a model contract between the state and private parties for hydrocarbon exploration and production. Particular attention will be given to provisions relating to gas and to the elaboration of specific gas agreements such as a model gas sales agreement. Recommendations will be forthcoming on an appropriate fiscal and financial framework, addressing the need, if any, for additional resources including new taxes and such specific investor needs as stability and the right to freely convert and repatriate profits. There will also be a training component on the framework and contract negotiating.

Tunisia

Energy Efficiency in Households and Services

Energy and its efficient use have been assigned top priority by the government in its current development plan. The goal of this study is to formulate a strategy that will (a) improve household welfare through more efficient use of energy expenditures, (b) reduce energy costs of enterprises by encouraging substitution towards energy-conserving fuels and equipment, (c) conserve commercial fuels in both sectors in order to free up more petroleum for export, and (d) lessen the negative environmental impact of biomass utilization. The four-month study, entailing data collection, demand management work and supply assessments is receiving \$200,000 from the Netherlands. The main mission started in January

1989 with a team comprised of Tunisian, Dutch, and French consultants. Fieldwork was completed in July 1989, when a seminar took place in Tunis to discuss the findings of the study. Preparation of the final report is underway.

Power System Efficiency Study

The objective of the study is to assess the overall efficiency and capability of the electrical system and make recommendations for improvements. The project is also designed to impart the economic and technical knowledge necessary for Tunisian professionals to plan and operate their electricity system at least cost. The project is expected to cost \$225,000, and is being funded by the Government of France. Three missions took place from September 1989 to May 1990, and a preliminary report was completed in June 1990.

Yemen

Household Fuel Marketing Study

The first phase of this study consisted of data collection through household surveys and preliminary data analysis. The second phase of the study included an assessment of biomass resources, an evaluation of LPG supply, marketing, and distribution, identification of cooking needs, and the design of improved LPG burners for use in traditional tannurs. A draft final report was sent to the government in March 1990. Both phases of the study were funded with contributions from the Netherlands totalling \$356,000. The study presents a series of policy and investment options to address the three issues which emerged from the study: the (a) depletion of wood-fuel resources, (b) impediments to LPG substitution, and (c) widespread use of expensive rural power sources. The final report has been sent to the government for clearance.

Assessment of Photovoltaics for Rural Household Electric Supply

The household fuel marketing study has indicated that decentralized photovoltaic systems are the lowest cost option for typical rural household electricity needs (lighting, radio and television) in extensive areas of Yemen. The proposed activity would (a) test system components and designs using locally manufactured or assembled components wherever possible, (b) survey consumer acceptance over a six-month period, (c) develop financing mechanisms to facilitate purchase of systems by households, and (d) stimulate local private

sector capacity to assemble and market systems on a sustainable commercial basis. The Netherlands has indicated it will provide the \$310,000 for the study.

Latin America and the Caribbean (LAC)

Argentina

Regulatory and Contract Framework in the Natural Gas Sector

The activity will address the regulatory, contract, and pricing issues in the first phase and will develop an integrated gas demand supply model. The activity, costing \$150,000, is being supported by the UNDP.

Bolivia

La Paz Private Power Technical Assistance

The Ministry of Energy and Hydrocarbons and the Municipality of La Paz are preparing a concession contract for transmission and distribution of electricity in La Paz. ESMAP is assisting the government in the preparation of this contract by identifying and discussing opportunities and obstacles to stimulate the power utility to operate efficiently and invest economically. The main mission took place in May 1989, and the final report was submitted to the government in September 1989.

Energy Planning for Rural Integrated Development Project (Agroyungas)

ESMAP is completing direct technical assistance work for the energy component of a UNDP project in Bolivia. The activity will be complementary to the ESMAP national energy planning activity within the Ministry of Energy and Hydrocarbons (MEH). ESMAP has lent assistance to UNDP in (a) an evaluation of productive end uses for rural electrification in the UNDP project area (Yungas region) and (b) a technical, financial, economic, and institutional evaluation of grid extension. The evaluation should serve the MEH as a planning model for incorporating a productive demand evaluation with the technical aspects of grid extension. The activity

costs \$40,000 with in-kind technical support from USAID. A final report has been submitted to UNDP.

Technical Assistance in Energy Planning

The objective of this activity is to strengthen the planning and policy analysis capabilities of the Ministry of Mines and Hydrocarbons and implement recommendations made in the National Energy Plan. The selection and hiring of five local energy experts to form a energy policy analysis/energy planning team at the ministry is in progress. An implementation mission took place in October 1989. Funds for the activity, \$328,000, have been received from Italy and UNDP.

Household Energy Strategy Study

This activity is executed within the overall context of the ESMAP activity currently under preparation by the Energy Efficiency and Strategy Unit. The latter activity aims to strengthen the capability of the Government of Bolivia to evaluate the operation of the country's energy sector and its impact on socioeconomic development. This activity assists the Government of Bolivia to design and implement an economically rational energy strategy for the household and rural energy subsectors including data collection and analysis, technical and institutional assessments, and specific projects. A reconnaissance mission was fielded in February 1989, and fieldwork by consultants started in August 1989. The estimated cost is \$505,000, which is financed by the Government of the Netherlands. Fieldwork is expected to be completed by the end of 1990.

Private Power Generation and Transmission

Since 1925, the Compañía Boliviana de Energía Eléctrica (COBEE), a private company, has been generating, transmitting, and distributing electricity in Bolivia.

In 1988, COBEE generated 32 percent of the country's electricity. Because COBEE's concession contract for power generation and transmission expires in September 1990, the government should either extend COBEE's concession or replace COBEE by another qualified private company. The objective of this technical assistance project is to assist the Ministry of Energy and Hydrocarbons (MEH) to identify and analyze the issues surrounding the possible renewal of a generation and transmission concession contract between MEH and COBEE and to present options for the institutional strengthening of the power sector.

Natural Gas Distribution Strategy Study Phase I

Phase I of the activity will address the institutional, regulatory, and financing issues as well as forms of ownership for gas distribution in five major cities in Bolivia. The \$180,000 cost is being covered by the Government of the Netherlands. A second phase is proposed.

Brazil

Carajas Energy Supply Options Study

The Greater Carajas regional development authority supports the setting up of some 25 pig iron and steel plants and other industrial investments whose energy base would be charcoal produced mainly from primary forests of the Amazon. This would result in considerable deforestation and environmental degradation. The government is aware of the potential economic, energy related and environmental consequences of the present industrialization schemes and has requested ESMAP assistance in evaluating feasible energy alternatives. The objective of the study is to (a) evaluate the principal energy and environmental issues related to present industrialization schemes for the Greater Carajas region and (b) develop options for least cost energy supplies to the envisaged industries which are environmentally acceptable and consistent with overall energy development strategies. Cost of this study is estimated at \$300,000, and funding for this has been received from the Federal Republic of Germany and the European Community. A multidisciplinary mission is scheduled to visit Brazil in late 1990 to evaluate the issues and propose solutions.

Caribbean Region

Power Seminar

Losses in power systems are high in the Caribbean region and economical savings in consumption of imported oil and from delaying investment can be achieved through loss reduction. In addition, reducing the level of nontechnical losses produces financial savings for the utility that can help restore financial viability or reduce the need for tariff increases. The seminar aimed to sensitize utility managers to the economic costs of losses, provide training in loss reduction, provide an opportunity for utilities to share experiences and ideas, and encourage innovative solutions to efficiency problems. The seminar built upon the recent seminar in Africa and use material originally produced for the African seminar, suitably modified to local conditions. The total cost including participant travel, subsistence, and facility rental was about \$193,000. The seminar took place in Jamaica in July 1989 and was carried out jointly with OLADE. A report on the seminar will be prepared by September 1990.

Colombia

Power Sector Information System

The objective of this study is to strengthen the managerial and financial performance of the power sector. Local and international consultants are in the process of implementing the system. The cost for the prefeasibility study is estimated to be \$200,000. The first mission took place in June 1988. A workshop attended by 64 people, including the chairmen of the power utilities plus staff from the Ministries of Energy, Finance, and Planning took place during the period February 15-19, 1989. The workshop established the design basis for a sector wide information system, and the participants formed a technical committee to supervise the required studies. A final report will be produced by September 1990. The report will provide the overall design for the system as well as funding requirements to implement the system.

Power Planning Technical Assistance

The objective of this activity is to create a least cost power model that can demonstrate the power sector's link with the macroeconomy, particularly with respect to the econometric parameters, market structure, development,

and investments of the other energy subsectors. The estimated cost is \$80,000.

Interfuel Substitution and End Use Efficiency Study

This activity will assist the Government of Colombia in developing energy demand management policies. The activity has two main components: (a) the evaluation of electricity cogeneration by the industrial sector and (b) the evaluation of pricing policies in the residential sector and the impact of the introduction of more energy efficient equipment. Consultants in the areas of energy economics and cogeneration will be required. Terms of reference have been agreed with the government. A final report was discussed with the government in July 1990.

Dominican Republic

Energy Assessment

The country's energy sector is adversely affected by heavy dependence on petroleum imports and deforestation to meet fuelwood requirements, compounded by weak energy demand management, poor institutional coordination, and lack of economic priorities in investment planning. The overall economic crisis has contributed to, as well as been aggravated by, the weaknesses in the energy sector. Energy operations increasingly have a negative impact on the environment. The government is taking steps towards improving energy pricing policies especially for electricity, rehabilitating the electricity subsector, and strengthening institutions. The assessment aims at assisting the government in the process through (a) analyzing the position and prospects of the energy sector with emphasis on the interrelationships with the overall economy, (b) evaluating the short-term priorities to rehabilitate energy installations and in the medium- to long-term, to expand the productive capacity of the major subsectors, strengthen institutions, and improve policies, and (c) identify investment and technical assistance activities that support a realistic energy development strategy and are likely to attract donor assistance for the country's energy sector. The main mission took place in March 1989, and the final report will be issued in October 1990.

Ecuador

Electric Power Loss Reduction Study

This is a follow-up activity based on the recommendations in the ESMAP energy strategy study of 1988.

Electricity losses in transmission and distribution in Ecuador are presently about 23 percent of net generation. ESMAP recently agreed with the Ecuadorian national power utility, INECCEL, to execute a preinvestment study of measures required to reduce these losses. The total cost of this study is about \$600,000 of which the Government of Ecuador is expected to pay half. Additional donor funding is still being sought to pay for consultant experts and their expenses.

Guatemala

Energy Assessment

The Government of Guatemala has requested ESMAP assistance in updating its energy strategy in the context of the present economic conditions in the country. The activity would require a substantial participation by local experts under the guidance of ESMAP staff, with specialized input from international consultants. The analysis would seek to integrate the development strategies of all the energy subsectors in accordance with macroeconomic objectives. Particular attention would be given to demand management, especially energy pricing, and the scope for economic fuel substitution and resource development. Priority investments would be identified, and attention would be given to the salient issues in the fuelwood subsector. The preparatory mission took place in December 1988. The main mission was in March 1990. Total cost is \$234,000, provided by the Government of Italy.

Haiti

Household/Small Industry Energy Strategy Study

The objectives of the study are to (a) assess the potential for nationwide dissemination of improved woodfuel consuming equipment and improved carbonization techniques, (b) analyze the feasibility of using woodfuel substitutes such as kerosene and LPG as cooking fuels, (c) recommend a pricing policy for existing and new household fuels, (d) streamline the supply systems of household and small industry fuels, especially woodfuels, and (e) propose a set of measures to strengthen institutional framework. ESMAP's activities, which will draw on \$154,000 from the Household Energy Program Fund (HEPF), form part of a larger project costing \$1.2 million and funded by UNDP and OLADE. Through this activity, ESMAP also contributed to the preparation of the forestry and protection project financed by IDA. The

main mission was fielded in June 1990. A draft final report is being prepared.

Honduras

Petroleum Supply Management Assistance

This activity is a direct response to a high priority need identified in the energy assessment report for Honduras, which is that the country needs to ensure petroleum supplies are obtained at least cost through the implementation of a management information system. A petroleum supply specialist and a systems analyst were used to carry out the activity. The first mission took place in November 1988 and a subsequent mission discussed preliminary results in July 1989. A progress report was drafted and discussed with the new government in May 1990. A total cost of \$225,000 for the activity is being financed by Italy and UNDP IPF.

Jamaica

Energy Efficiency Program

\$1.2 million in funding from CIDA is now effective, and work is underway in the implementation of the three components of this project. Of highest priority for the Government of Jamaica is the energy sector investment program and strategy component. The government wishes to identify as quickly as possible a pipeline of priority rehabilitation and expansion projects in the energy sector including expansion of the petroleum refinery and storage facilities, further additions to electricity generation and distribution facilities, and a program of demand side management and industrial energy efficiency measures. Fabrication of a refrigerator and freezer test chamber for installation at the Jamaica Bureau of Standards is in progress under the appliance testing and labelling component. Following commissioning in late 1990, testing will begin of the approximately 100 different models of refrigerators and freezers offered on the local market. The facility will also be used by local manufacturers in testing improvements in their products. A limited public information and labelling program will begin in this phase of the program while additional funds are being sought for expanding the appliance testing facility and the information campaign. Jamaican engineers and architects are fully involved in the preparation and implementation of the energy efficiency building code component with the assistance of an international building energy specialist. In addition to energy consumption standards which will apply to new buildings,

energy savings are being quantified and evaluated for retrofit opportunities. Both the appliance testing and labelling program and energy efficiency building code have been developed as prototypes which can be replicated elsewhere. Emphasis is placed on involving the private sector (appliance dealers and manufacturers, engineers, architects, and building owners) in the process of designing and implementing these two project components. Similar projects are being identified in other countries.

Improved Charcoal and Kerosene Stoves Pilot Project

The overall objective of this project is to reduce the demand for charcoal and kerosene in the domestic sector thereby reducing the financial and economic cost of the consumption of fuels for cooking. Improved charcoal and kerosene stoves would be tested, and a program for the local manufacture and dissemination of selected stoves by the private sector would be developed. The estimated cost is \$350,000. Fieldwork was started in June 1990.

LAC Regional

Household Energy Planning Seminar

ESMAP, in collaboration with OLADE (Organizacion latinoamericana de energia), the OAS (Organization of American States) and the Government of Costa Rica held a household energy planning seminar in San Jose, Costa Rica, between November 27 and December 1, 1989. The seminar was attended by a total of 86 participants from among 17 countries and 10 technical assistance regional and international agencies and donors. The proceedings from the seminar will be ready by September. ESMAP's share of the cost of the seminar was \$120,000, which was provided by the Government of the Netherlands.

Mexico

Charcoal Production/Marketing within Forest Management Phase I (Veracruz)

The activity, which has been completed, will develop a statewide strategy for charcoal production and marketing within a complementary plan of forestry management. In the state of Veracruz, the strategy document assesses the state's forest resource base, technical parameters, as well as financial, economic, institutional, and environmental viability of producing natural lump

charcoal in temperate forest regions. Pilot demonstration sites and technical assistance in forestry management are envisioned as second phase activities. With the formation of a national and international team and the technical cooperation of USAID, fieldwork began in May 1989. A report will be finalized in September 1990.

Charcoal Production/Marketing within Forest Management Phase II (Veracruz)

The proposed follow-up technical assistance for the state of Veracruz is based on the preliminary findings of the charcoal production strategy activity. This second phase would focus on complementing phase I analyses with training and pilot implementation in forestry management and kiln construction in selected, low-income rural communities. The estimated cost of the follow-up is approximately \$100,000. Fieldwork is scheduled to begin in October 1990.

Peru

Energy Strategy Study

A request from Peru for assistance in reviewing its energy sector situation was received in October 1989. Thanks to a quick decision by the Netherlands to finance this task, an ESMAP preparatory mission visited Lima in December 1989. An issues paper is now being written, and a national study team is being set up to initiate the preparatory information gathering and analytic work. The main issues to be analyzed include institutional and regulatory considerations, sector enterprise management; sector enterprise finances; tariffs, prices, and demand management policies; and the macroeconomic consequences of either action or inaction on energy sector reforms. Given the current general economic situation in Peru, energy sector reforms can only be effective with an overall economic adjustment operation which is under preparation with IMF and World Bank assistance.

Global

Guidelines for Utility Management and Billing

Electricity and water utilities in developing countries often have problems to efficiently meter and accurately invoice customers for services consumed. In some developing countries, as much as 25 percent of electricity consumed is not billed due to defective metering and ineffective administrative procedures. Non-invoiced water usage can be even higher. In the past, bilateral and multilateral donors have donated or financed technical assistance, diagnostic studies, staff training, and other resources to combat the problem of non-invoiced consumption. The multitude of options presented through this assistance has raised the need for specific guidelines on customer management and metering of electricity and water utility services. In this activity ESMAP will begin to prepare these guidelines, drawing on the experiences of the World Bank, UNDP, managers of developing countries' utilities, and specialized consultants from the more advanced utilities. The guidelines would cover (a) types of meters, meter management, security, cost and specification, (b) computer systems, criteria for selecting hardware, specification of software, database management, rural invoicing, personal computers, on-site billing,

and (c) customer management, control, inspection procedures, legal factors, collection, suspension, and dealing with government accounts. The completed guidelines are expected to be available in English and Spanish by the end of 1990.

Improved Cookstove Dissemination Impact Study

ESMAP with funding from the UNDP has initiated a study to review the experience to date of improved cookstoves programs (ICPs) including existing methods of evaluating their performance. To be subsequently developed is a systematic methodology for evaluating performance based on administrative, social, economic, energy, and environmental criteria. The immediate objectives of the project are to: (a) design a preliminary methodology to evaluate ICPs, (b) evaluate the experiences to date of a few major ICPs to test the utility of the evaluation methodology and to assess the results of these selected ICPs against their original stated goals, and (c) organize a workshop for a selected number of developed and developing country ICP experts to improve and finalize a uniform ICP evaluation methodology and to design a strategy for wider implementation. It is anticipated that

the project will have four key outputs: (a) development of a comprehensive data base which documents and describes all known ICPs in developing countries along with their current status and known results, (b) creation of a preliminary evaluation methodology and criteria for assessing the impact of ICPs, (c) selection of a limited number of representative ICPs to test and refine the evaluation methodology while simultaneously uniformly assessing the results of the selected ICPs, and (d) preparation of an outline for a proposed program to more broadly apply the refined evaluation methodology and to subsequently develop a set of guidelines for more successful design and implementation of ICPs in developing countries targeted for use by policymakers, development assistance agencies, NGOs, and other nontechnical promoters of ICPs.

Energy Related Training in Italy

This activity consists of a study tour for managers and technical specialists from Latin American energy institutions to visit energy institutions in Italy. There will likely be two tours; the first tour took place in March 1989. Energy conservation, gas utilization, and power technology were major themes. A second study tour will be held in 1990.

PC Models for Energy Planning

The principal objective of this activity is to make a comparative evaluation of existing PC based models for energy planning that are suitable for use in developing countries. The comparative evaluation will be limited to those models that have been fully tested and documented and have already been applied to real life problems and that can be acquired or licensed for use in developing countries. Thirty candidate models have been received in response to a questionnaire. An initial screening has provided about 8-10 models that will be assessed in detail. Evaluation criteria have been established, and the in-depth testing will begin in September 1990. A final report is expected in the spring of 1991. Funding of \$120,000 for this project has been provided by SIDA.

Energy Efficiency Study in the Transport Sector

Despite its importance as an energy consuming sector and its negative impact on the environment, relatively few efforts have been devoted to analyzing the policies and the implementable measures which could increase the energy efficiency of this sector and reduce atmospheric emissions. This research will be focused on

road transportation since it represents most of the energy consumption used for transport in developing countries. It is expected to be carried out in three consecutive phases: (a) a review of the literature on past and current programs in developed and developing countries, (b) an in-depth analysis of the outcomes, successes, and failures, and (c) an evaluation of the impact on energy consumption and the environment of the main implementable measures. Funding of \$65,000 has been provided by the Netherlands, and the activity was initiated in June 1990.

Francophone Seminar on the Design of Energy Efficiency Programs

This seminar will provide the opportunity for sharing experiences in the development of national energy efficiency programs which are expected as a follow-up of the seminar. The one-week seminar is sponsored by the Agence de cooperation culturelle et technique (ACCT) for about 40 decisionmakers from the public sector and the utilities of Cambodia, Comoros, Laos, Madagascar, Mauritius, Seychelles, and Vietnam. It was held in Hanoi, Vietnam in July 1990.

Development Potential for Small Uses of Natural Gas

The activity will identify potential small sources and uses of natural gas and assess the economics for small uses. The institutional, regulatory, and financing issues will also be addressed. The \$190,000 cost is being borne by the Government of the Netherlands.

Unified Approach to Petroleum Contracts

Because the lack of a contractual framework is often a major obstacle to gas development, the project will survey contractual issues and solutions relating to the exploration, development, and sale of natural gas in developing countries. The Government of the Netherlands will finance the \$180,000 activity.

Environmental Costs and Benefits of Natural Gas Use

The study will address the economic costs and benefits and technical issues related to gas use relative to alternative fuels. The majority of the \$320,000 cost is being covered by the Governments of the Netherlands and Norway.

Policy Research on Interfuel Substitution in Urban Households with Special Reference to LPG and Kerosene Phase I

This research analyzes the dynamics of interfuel substitution in households in urban areas of developing countries with the particular objective of making it possible and desirable to substitute kerosene or LPG for wood-based fuels. To accomplish this, the project includes a formal analysis of consumer behavior, a study of the value of fuelwood, and an analysis of the alternative energy policies. The research includes a cross-national analysis of interfuel substitution in urban regions including the impact on urban poor and a least cost analysis for cooking with different types of fuels. The output of the research will include (a) detailed literature review, (b) paper on the methodological framework for the valuation of fuelwood, and (c) series of papers on interfuel substitution including an analysis of such factors as energy policy of individual countries, resource availability, and level of income. The estimated cost of the first phase is approximately \$225,000. The project is being partially funded by the World Bank's Research Committee.

Guidelines for Optimizing Power Distribution Network Standards

It is widely acknowledged that the planning of distribution networks has been neglected in comparison with generation and transmission planning. As a result, relatively few planning tools are in use while design manuals emphasize technical evaluation and construction practices with little reference to economic evaluation or cost optimization. Possible savings up to 50 percent have been identified in various studies by revising distribution design standards to take into account local conditions and materials. A current ESMAP project in Tanzania is helping to establish design standards and introduce computer assisted planning in TANESCO, the national power company. Despite varied activities, there has been no systematic evaluation of the possibilities for reducing distribution costs through the optimization of design standards over the broad spectrum of urban/rural load densities and low/high national income levels. The different conditions in each country, including the practices inherited from when the power systems were first established, strongly suggest that there can be no single set of standards for all countries. In recognition of this situation, ESMAP, in collaboration with World Bank staff, is beginning a project to develop guidelines for preparing power distribution standards and to assess the use of computer based planning tools for strategic planning and

the detailed engineering of distribution extensions. The study has as its objectives to (a) assess the cost savings potential for modifying existing design practices, (b) develop a checklist and guidelines for preparing distribution design standards, (c) assess computer aided design (CAD) software for strategic planning to optimize initial network plans as well as options for network reinforcement, and (d) optimize standards as a function of the economic level of network reliability depending on the type of loads to be served and the economic cost of outages. The Government of the Netherlands has provided \$100,000 in funding, and work is underway.

Global Energy and Environmental Initiative: Alternative Energy Paths

Concern for environmental degradation and potential global warming reinforce the high priority which must be accorded to energy efficiency and alternative fuels (to include renewable energy) activities. This activity will attempt to better define the means by which developing countries in the 1990s can pursue alternative paths in both the production and consumption of energy. The activity is part of ESMAP's Global Energy and Environment Initiative. The specific objectives of this alternative Energy Paths Project are to develop a systematic approach to (a) better identifying specific constraining barriers to increased energy efficiency and alternative fuel development in any given developing country; (b) clarifying in which areas or situations specific energy efficiency or alternative fuel initiatives have the highest probability of success in any given developing country (and likewise situations or areas in which initiatives should not be attempted until significant policy or other changes occur); (c) prioritizing the array of potential energy efficiency and alternative fuel options that exist at a point in time in any developing country by probability of success and by payoff according to reduced energy use per unit of output and total impact (local, regional, national) of the initiative (What are the first three actions that should be undertaken in a specific country with given characteristics? What are the next three? etc.); and (d) facilitating and increasing the implementation of high priority energy efficiency and alternative fuel activities and policy work in developing countries.

In pursuing these four objectives, the Alternative Energy Paths Project will (a) encourage additional applied research worldwide on strategies to implement energy efficiency and the use of alternative fuels (document success—document failures—and why); (b) stimulate and help facilitate the networking of the large amount

of diverse energy efficiency and alternative fuels related initiatives which are taking place worldwide; (c) assist with the synthesis of the cumulative knowledge and experience gained through the various energy efficiency and alternative fuel research and implementation initia-

tives worldwide; synthesize and summarize the lessons learned; and (d) implement, under the ESMAP umbrella, specific high priority energy efficiency and alternative fuels activities and policy initiatives in developing countries.

PROSPECTIVE ACTIVITIES

Descriptions of prospective activities provide information similar to what is included in ongoing descriptions and correspond with the statistical table, "Prospective Activities (Region)". For prospective activities seeking consultants, the types needed are noted.

All references are presented in U.S. dollars.

Sub-Saharan Africa

Africa Regional

Biomass Assessment for West Africa

This activity, derived from the earlier ESMAP biomass assessment and mapping for sub-Saharan Africa activity, is designed to provide more accurate estimates of woody biomass within selected woody biomass/vegetation types that are major sources of woodfuels in West Africa. This is a further step in understanding the woodfuels resource situation in Africa prior to sensible woodfuel development and management interventions being designed. Satellite imagery data would be used for mapping the vegetation types; ground surveys would establish tree-weight regressions and a data base for the stocking and potential yield of woody biomass. The work would involve several countries, including Burkina Faso, Chad, Mali, Nigeria, and Senegal and would be largely carried out by personnel from within these countries with training and technical assistance provided by expatriate specialists. The project would be carried out over two years at an estimated cost of \$700,000.

Biomass Assessment for Southeast Africa

This is the second activity derived from the biomass assessment and mapping for sub-Saharan Africa activity whose purpose is to provide more accurate estimates of woody biomass within selected woody biomass/vegetation types that are major sources of woodfuels in Southeast Africa. As with the biomass assessment, this is a further step in understanding the woodfuels resource situation in Africa prior to sensible woodfuel development and management interventions being designed. Satellite imagery data would be used for mapping the vegetation types; ground surveys would establish tree-weight regressions and a data base for the stocking and potential yield of woody biomass. The work would involve several countries, i.e. Malawi, Mozambique, Tanzania, Zambia, and Zimbabwe and would be largely carried out by personnel from within these countries with training and technical assistance provided by expatriate specialists. The project would be carried out over two years at an estimated cost of \$590,000.

SADCC Coal Utilization in the Household, Service, and Small Industry Sectors

SADCC countries have proven coal reserves of over 14,000 million tons compared to 15,000 million tons in all of developing Africa. Several requests have been received from SADCC countries concerning the use of coal in small-scale industry, service, and household sectors. The purpose of this proposed activity is to determine if coal is physically, economically, and environmentally suitable as a fuel in these sectors, discover the constraints in establishing coal as a substitute fuel, and make proposals for further development and regional cooperation. The budget for the project is \$178,000.

Support for the Regional Wood Energy Program

The objectives of this activity are to provide logistics and back up for regional field trips, hands-on training, seminars, networking, and documentation/publications. The Regional Wood Energy Program for Africa (RWEPA), based in Nairobi at the offices of the Kenya Environmental and Energy NGO (KENGO), has been operating for over four years. It has undertaken seminars and courses on the development and production of improved cookstoves in sub-Saharan Africa. RWEPA's objectives are to (a) help identify, develop, promote, disseminate, and market improved cookstoves utilizing local personnel and expertise; (b) train groups and individuals in stove evaluation; (c) carry out networking activities by information exchange between local groups and individuals; and (d) identify local and donor support for continued stove development, improvement, and marketing. ESMAP's role will be to provide supervision, documentation, and guidelines. Support funds will be needed for two years with a budget of \$199,000.

SADCC Woodland Management Strategy Study

The SADCC region relies heavily on woodlands to supply household and small industry energy needs. The management of these woodlands is seen as the most cost effective and socially acceptable approach to woodfuel resource development. Today, very little woodland management is undertaken, yet management plans have been drawn up by forest services in the SADCC region. The purpose of this activity is to examine past management plans and design workable silvicultural and management practices to promote sustained yield management of the various major woodland types taking into consideration other uses such as grazing, agroforestry, watershed management, species conserva-

tion, etc. Various countries will be visited to examine past and present management plans as part of the exercise, and follow-up pilot projects will be proposed. The budget is \$195,000, and the lifetime is anticipated at one year.

SADCC Assessment of Applications and Markets for Solar Photovoltaic Systems

The objective of the proposed activity is to (a) determine the conditions for economic viability for solar photovoltaic systems in the SADCC region, taking into account potential applications in both the private and public sectors, (b) estimate the total market size within SADCC for a range of applications of solar PV systems, and (c) develop a strategy for promoting solar PV systems as an option for pre-electrification in the SADCC region. The activity would be executed in two phases by ESMAP in close collaboration with the SADCC TAU and designated counterparts from each of the SADCC member countries. Two workshops would be organized during the fieldwork to provide for greater participation of representatives of SADCC member countries to review the findings. The estimated cost of the proposed activity is \$250,000.

SADCC Energy Efficiency in Rural Industries

The proposed activity responds to a request from the SADCC Energy Sector Technical and Administrative Unit (TAU) for ESMAP assistance to (a) improve the efficiency of woodfuel use in two rural industries (brick production and fish smoking) and (b) train energy professionals in SADCC countries to formulate and evaluate the financial and economic viability of wood energy projects. The proposed activity would directly support the SADCC Five-Year Implementation Strategy for Woodfuels which emphasizes the development of local capacity to perform strategy and preinvestment work on woodfuel demand management issues and opportunities in the region. The estimated cost of the proposed activity, which will be executed over a 24-month period, is \$1 million. The expected outputs include a "Handbook on the Design and Evaluation of Wood Energy Efficiency Projects for Rural Industries in SADCC" and an associated medium-term strategy and investment program for SADCC.

Angola

Rural Energy Technical Assistance Training

Further to a recommendation made in the Angola energy assessment report of May 1989, the Ministry of

Energy and Petroleum has requested ESMAP assistance to strengthen the in-house capabilities of the Department of New and Renewable Sources of Energy (DNRSE). The principal objective is to provide technical assistance and training to enable the DNRSE to formulate strategies and plans to integrate woodfuels and other renewable energy sources into the national energy program and to design and coordinate the implementation of energy projects to support socioeconomic development in the rural and household sectors. The estimated cost of the prospective activity, which will be executed by ESMAP over a 24-month period is \$300,000.

Botswana

Strengthening the Energy Unit

The purpose of the proposed activity is to assist the Botswana Energy Unit in analyzing the results of the urban household energy project and to undertake more surveys, monitor energy supply and demand, give training, and recruit a biomass energy adviser. The proposed lifetime is two years with a possible extension. The estimated budget is \$199,000.

Burundi

Power Distribution Cost Reduction Study

The objective of this activity is to identify ways to reduce the unit costs of the ongoing Bujumbura power distribution expansion program. The activity will review distribution standards, planning methods, and procedures and will identify options for improving their efficiency. Alternatives for reducing the financial cost of connections to households will be examined and recommendations made for a financially sound least cost approach. The study will be executed by a team of two consulting distribution engineers and a specialist in commercial utility management. The activity is expected to cost \$200,000.

Cameroon

Energy Efficiency Program in Public Buildings and Industries

Energy savings in the large public buildings and industries of Cameroon are estimated to be important while not requiring large investments. Efforts in these areas could therefore very likely achieve high economic returns. This activity will focus on achieving concrete and sustainable energy savings starting with little and no cost measures. The first phase will include demonstration

projects in a limited number of public buildings. It is expected to be carried out by a team of consultants working with Cameroon energy service companies and the personnel of the Ministry of Mines, Water and Energy.

Chad

Household and Biomass Energy Strategy Study

The overall objective of the proposed activity would be to strengthen government capability to analyze issues and develop options in the supply of fuel to households and small-scale industries and services. It will also help to draw up sound national strategies, programs, policies, and projects to minimize the economic, financial, and environmental costs of energy consumption in these sectors. A reconnaissance mission visited Chad in July 1989 to discuss the design and content of the activity with the government. A preparation mission visited in June 1990 to finalize components of the study and confirm logistical/administrative arrangements. Pending confirmation of cofinancing, the main study should begin in September 1990. The estimated cost is \$500,000.

Comoros

Design of Biomass Energy Strategy

A comprehensive energy plan outlining all forms of energy does not exist in the Comoros. Energy plans currently exist for petroleum fuels and the electricity sector only. Biomass fuels, which are the major energy sources consumed in the household sector, are presently not subject to planning. The objective of the proposed activity is to create a capability for comprehensive planning for the energy sector, for which EEDC (Eau et électricité des Comores) is the most suitable organization with which to cooperate. The output of the project will be an investment plan comprising a strategy for priority actions in the energy sector. The proposed project will assist the government in creating a database on consumption and supply of biomass fuels in Comoros, focusing initially on the household sector and the artisanal sector of Anjouan and Grande Comore. Upon completion of the data collection phase and subsequent evaluation of these data, a comprehensive energy development strategy will be constructed which incorporates both conventional fuels (electricity and petroleum fuels) and traditional fuels. The total estimated cost is \$300,000.

Congo

Technical Assistance for Energy Planning

The objective of the project is to strengthen the Energy Planning Unit of the Ministry of Mines and Energy (MME) by: (a) renewing the institutional issues related to its organization and responsibilities, (b) assisting in the collection of data to prepare energy balances, and (c) carrying out an energy strategy study with on-the-job training of personnel. The total estimated cost of the activity is about \$336,000 in two branches: institutional issues and energy balances, \$147,000, and energy strategy, \$189,000. The task was formally requested by the Congolese Government in April 1990.

Dissemination of Improved Stoves

Although the Congo has an abundance of biomass resources, local deforestation occurs around the major urban areas in the southern part of the country where 80 percent of the two million inhabitants live. Biomass fuels represent 46 percent of net energy consumption, petroleum products another 45 percent, and electricity and crude oil account equally for the remainder. A relatively large surface of wood plantations exists in the southern region, which will be used for energy purposes. To alleviate deforestation problems, three types of intervention are possible—reducing demand from biomass fuels, using wood from wood plantations instead of from the natural forest, and enabling interfuel substitution. The proposed project will address these three types of intervention and identify the relative importance that they should be given. Households who use improved stoves will increase their standard of living because they will be able to save money due to a reduction in fuel use and because the use of improved stoves will have a positive impact on indoor pollution (reduction of smoke, speedier cooking, etc.).

Ethiopia

Fuelwood Forestry Feasibility Study

The proposed activity would assist the Government of Ethiopia to analyze issues and options relating to the design of a wood energy/forestry project which would improve the household energy situation, mainly in urban areas. It would also improve the energy situation in rural areas by enhancing the supply of woodfuels, interfuel substitution, and demand management. The output of the activity will be the preparation by the government with

ESMAP support of a project suitable for external donor funding. The cost is estimated at \$350,000.

Ghana

Industrial Energy Rationalization Study Phase II

Based on the results of phase I, the objective of the ESMAP activity will be to provide the National Energy Board of Ghana as well as other Ghanaian institutions with technical support for continuing and expanding the Industrial Energy Conservation Program. The activity will focus on (a) setting up sensitization, incentive, and financing schemes aimed at promoting energy conservation investments, (b) developing local expertise in energy auditing and management, (c) carrying out pilot and demonstration projects, and (d) providing energy services to about 15-20 medium-scale industrial firms. The total budget is estimated at \$500,000.

Malawi

Urban Household Energy Strategy Study

No firm data are available on the supply and demand of urban energy in Malawi and, in particular, urban household energy. Before a reliable household energy strategy can be formulated, this data must be gathered and assessed. The objectives of this proposed activity are to (a) undertake urban household and non-household energy surveys, (b) examine the supply of all urban energy and in particular biomass energy, (c) examine the marketing of energy, especially fuelwood and charcoal, (d) look at substitution possibilities, and (e) draw up a strategy for the urban household energy sector. The budget is estimated at \$495,000.

Rwanda

Power Loss Reduction Project

The objective of the study is to identify the sources of energy losses in the electric power system and develop a program to reduce these losses to economic levels. The resultant benefits would be a reduction in outages and a more regular supply of electric power to the subscribers, an improvement in revenue collection, and a postponement of investments in new generating facilities. The scope of the work would include mapping of the entire transmission and primary distribution system, development of a program to reduce technical losses, recommendations for improvements in the present metering, meter reading, billing and collection policies and procedures, and development of a program of transformer load

management. Total cost of the activity is tentatively estimated at \$365,000.

Sierra Leone

Household Energy Strategy Study

The proposed activity would assist the government in developing a strategy to provide households with energy at least economic cost and in improving the efficiency of fuel use in the household sector. Promising approaches include the increased use of locally manufactured improved stoves and of steps to enhance wood supply through better supply management and marketing. The cost is estimated at \$436,000.

Swaziland

Power Development and Electricity Tariffs

The energy assessment study on Swaziland identified the preparation of a development plan for the electricity sector as a high priority task, for which the government has requested assistance from ESMAP. The objective of the proposed activity is to evaluate a range of options for meeting electricity demand over the medium to long term. A least cost expansion program for generation and transmission would be identified including increased power generation from biomass residues and power imports from Mozambique. The alternative scenarios would provide the government a consistent basis for assessing the trade-offs between increased self-sufficiency in electricity and investment needs. A study of regulatory mechanisms and electricity tariffs would also be initiated. The government recently reaffirmed its interests in this activity and requested ESMAP support. A reconnaissance mission took place in March 1989. Funding is being sought for this study which is estimated to cost \$300,000.

Household Energy Strategy Study

Following recommendations made in the 1986 energy assessment, the Swaziland Government obtained bilateral assistance to carry out a national household energy consumption survey and a forest inventory. The consumption survey has been completed, and the forest inventory was completed by mid 1989. ESMAP has been asked to assist the government in analyzing the results of both surveys to determine potential problem areas in the subsector and devise policies and programs to address them. In addition to analyzing supply/demand data and formulating selected strategies, the proposed activity

would assist in initiating some pilot projects in the household energy area which the government considers important at this stage. Of high priority is the possibility of expanding the use of coal in households. Constraints that need to be considered are the lack of appropriate and affordable cooking devices and potentially high environmental impacts. The estimated cost is 220,000.

Tanzania

Industrial Energy Efficiency Implementation

The Tanzania Industrial Research and Development Organization (TIRDO) is preparing a follow-up to the energy efficiency technical assistance activity consisting of additional semi-detailed energy audits and further training in areas outside the capital city. It would also evaluate financial options and mechanisms for promoting industrial energy efficiency improvements. Additional financing of \$600,000 is being sought.

Minihydro Feasibility Study

The objective is to help the Ministry of Energy and Minerals and the power utility, TANESCO, put together a comprehensive investment program in order to develop previously identified minihydro power prospects in the isolated western and southwestern regions of Tanzania. The activity will involve a critical review of pre-feasibility studies for some 20 sites associated with rivers that drain into Lakes Nyasa, Rukwa, and Tanganyika. Power supply would be used to displace diesel generation in the towns of Kigoma, Songea, Sumbawanga, Tunduru, Uvinza, etc. The estimated cost of the prospective activity is \$200,000.

Zaire

Design of Biomass Energy Strategy Study

A comprehensive energy plan outlining all forms of energy does not exist in Zaire. Energy plans exist for petroleum fuels and the electricity sector, although these two comprise less than 12 percent of the total energy demand. The major source of energy consumed in the country, biomass fuels, are not subject to planning. By governmental decree (1987), four energy units were created: Cellule technique pétrolière, Cellule technique électricité, Cellule technique pour le bois et les énergies nouvelles et renouvelables (CBENR), and Cellule technique pour l'utilisation rationnelle de l'énergie. Of these four units, only the two on petroleum products and electricity are operational and the other two remain inac-

tive. Deforestation around some of the major towns in Zaire has become a serious problem, particularly around the capital, Kinshasa. Ideas exist to supply woodfuels from sources other than the remainders of the rain forests, but data on the consumption and the supply side are lacking. It is therefore necessary, first of all, that fuel consumption data in Kinshasa, and possibly a few other large townships, be collected and, secondly, that figures on the supply of biomass fuels be collected focusing on firewood and charcoal. The objective of the proposed activity is to create a capability for comprehensive planning in the energy sector. The output of the project will be a plan or strategy for priority actions in the energy sector which will focus on biomass fuels that until now have been neglected. The project will work through the CBENR, which will be operationalized and strengthened. The proposed activity will assist the government in creating a data base on consumption and supply of biomass fuels in Zaire, focusing initially on Kinshasa. Upon completion of the data collection phase and subsequent evaluation of these data, a comprehensive energy strategy will be constructed which incorporates both conventional fuels (electricity and petroleum fuels) and traditional fuels. This energy strategy should ideally be updated regularly. The total cost is estimated at \$253,000.

Zambia

Enhancing Charcoal Production, Distribution, and Energy Management

The urban household energy strategy study recom-

mended a number of follow-up activities estimated in the region of \$6 million. ESMAP will have a continuing role to ensure these projects are coordinated properly and that four specific activities are undertaken as quickly as possible. These activities include (a) a study of the wood resources of land in the TAZARA rail corridor being cleared for agriculture, (b) the strengthening of the charcoal producers' organization, (c) the strengthening of the Department of Energy, and (d) study tours of the region. The purposes of the proposed activity are to examine the potential for charcoal production on 200,000 hectares of land to be cleared for agriculture, look at ways of organizing charcoal producers more efficiently, help with logistic support for the Department of Energy in order to carry on with survey work, expose Zambians to improved charcoal manufacture, stove production, and woodland management in the region. The cost of the activity is \$286,000.

Zimbabwe

Industrial Energy Efficiency Study

Because of outmoded technologies and aged equipment, the energy efficiency of the industrial sector is very low. Institutional and policy constraints aggravate the situation. The proposed activity would strengthen government institutions to promote higher energy efficiency and support energy audits and possibly demonstration projects in the industrial sector. Approximate cost would be \$300,000.

Asia and the Pacific

China

Rural Energy Training and Technical Assistance Phase II

Funding support of \$174,000 is being sought for implementation of the third year of this ongoing activity (see section on ongoing activities). The principal components of the third year include (a) implementation of three new county-level energy assessments, primarily by Chinese counterparts, with a special focus on energy conservation in rural industry, (b) a workshop to evaluate these assessments, and (c) joint ESMAP/Chinese

preparation of a national rural energy development strategy paper.

Energy Efficiency and Environmental Strategy Study

The Energy Research Institute of the State Planning Commission of China has requested ESMAP assistance in preparing a strategy for improving the level of energy efficiency as well as producing substantial economic savings. Such a strategy would have a significant impact on reducing the effect of energy production and use on the environment. In view of the complexity of issues

involving institutional responsibilities, linkages with industries, and technical and economic matters, a phased approach is proposed. Building upon major existing and ongoing studies and particularly the World Bank's coal utilization study, the joint ESMAP/Chinese experts' assessment would focus on the major aspects of energy conservation potential. Among them are the identification of segments of the potential which can be realized within the existing framework, design of follow-up energy conservation activities, and identification of further policy-oriented studies required for setting up an energy efficiency and environment strategy. Roughly \$350,000 would be needed to carry out the initial assessment. Further phases would then be defined for follow-up activities which would occur over several years.

India

Power Efficiency Technical Assistance

Preparation is underway of a technical assistance activity which would support pilot activities to reduce losses in networks in Uttar Pradesh, prepare thermal generating plant rehabilitation projects, and develop a program for management of power consumer demands. Preinvestment studies would be carried out to the maximum extent by Indian counterparts and consultants, supported by international consultants and ESMAP staff, and would be designed for replicability. The activity budget is around \$500,000. The activity may comprise separate components and be phased over two years. An ESMAP identification mission took place in June 1989.

Indonesia

Diesel Efficiency Preinvestment Study

The proposed study would evaluate the technical and economic feasibility of converting a number of existing diesel engine generators in the Indonesian province of Kalimantan to burn natural gas instead of diesel oil (distillate No. 2). The natural gas resources in certain areas of that province are not being productively utilized, while international marketable diesel oil is the fuel used to generate electric power. Conversion of the engines driving the generators to burn natural gas has the potential for economic benefits to the country while providing electric power at lower financial cost and less adverse environmental effects. The study would, among other things, (a) review the projected load demand in Balikpapan and Samarinda over the next 15 years, (b) investigate the operating condition of the larger, newer diesel generating units in the two cities, develop cost estimates of any rehabilitation which may be required to restore

each unit to optimum condition, and estimate the remaining economic life of each unit, (c) calculate the cost of providing natural gas at the generating sites in adequate quantities and at acceptable pressures to supply the electrical needs of the geographical areas involved for the next 15 years, and (d) estimate the cost of converting the generating units under consideration to burn natural gas as the primary fuel and the annual energy generation (kWh) which may be realistically expected after the conversion.

Rural Household Energy Strategy Study

One of the follow-up activities recommended by the recently completed urban household energy strategy study is a similar study of rural households. Such a study would result in a comprehensive picture of residential energy use nationwide as a basis for formulating effective household fuel pricing and distribution policy. The proposed activity would begin with a review of previous rural energy studies and analysis of existing time-series data showing how fuel expenditure patterns of rural households has changed in the 1980s. Overall, the study is designed to (a) assist the government in assessing the impact of rural electrification, (b) analyze the financial burdens of fuel use on households in various income categories under different policy scenarios, and (c) assess the environmental sustainability of woodfuel supplies in each region in light of growth and fuel substitution trends.

Lao People's Democratic Republic

Urban Residential Fuel Substitution Study

The Government of Lao PDR has expressed interest in receiving ESMAP technical assistance to investigate household fuel use patterns in Vientiane with particular attention to electricity. The government would like to ensure that electricity, which is one of the country's leading exports, is used efficiently in the fast growing household sector. The study design includes a modest energy use survey of electrified and non-electrified urban households with a complementary review of the woodfuel supply system to Vientiane. A coherent picture of residential fuel supply and use in Vientiane should result from this work in a relatively short time. This activity should be completed in less than one year and is estimated to cost \$130,000.

Malaysia

Natural Gas Sector Study

The study will include an integrated supply and demand balance, allocation of gas to high value uses, international gas trade in Asia, and comparison of a gas pipeline to Thailand with conversion of gas to power and export of power. The estimated cost of the activity is 150,000.

Nepal

Energy Efficiency Study

The major objective of this study is to assess the potential and the costs of improving the efficiency and reliability of Nepal's energy sector by evaluating options and proposing concrete and implementable energy efficiency measures. A second objective will be to reduce the negative environmental impacts particularly from wood consumption. The analysis is expected to be conducted in two phases. The first phase will draw largely on previous analyses carried out for Nepal, and the second will focus on detailed analyses and on the implementation of the most promising energy efficiency measures. About \$250,000 to \$300,000 is needed for this activity.

Rural Energy Technology Study

This activity would renew ongoing efforts to conserve fuelwood and promote productive activities in the rural sector. It would also determine the assistance required to improve program performance as well as ensure that the benefits of such interventions are more widely available. The estimated cost is \$200,000.

Pacific Region

Seminar on Electric Power System Losses

ESMAP is assisting the Pacific Energy Development Program (PEDP) in this seminar, which will focus on the evaluation and economic control of losses on electric power systems. It is intended for persons involved in the management, regulation, or monitoring of electric power utilities in the countries of the Pacific Islands region. The seminar will extend over three days. The topics to be covered include, inter alia: (a) cost of losses, (b) sources of losses, (c) loss reduction measures, (d) economic evaluation of loss reduction projects, (e) the microcomputer as a loss reduction tool, and (f) efficient power generation.

Europe, Middle East and North Africa (EMENA)

Algeria

Industrial Energy Efficiency Study Phase I

The objective of the first phase of the activity is to provide Algerian institutions with technical support for (a) defining the institutional framework within which energy efficiency and related environmental benefits could be promoted in the industrial sector and (b) preparing medium- and long-term programs of actions in the direction of the industrial sector. Subsequent phases of the activity would consist of helping Algerian institutions implement these programs. The budget of phase I is \$200,000.

Maghreb Region

Preparation of an Energy Efficiency Building Code

The proposed project would develop an energy efficiency building code which would be applied to public, commercial, and private residential buildings. The cost would build upon the experiences in other countries having similar conditions. The norms and standards to be developed would be based on current international engineering practices but would be adapted as appropriate to local conditions in terms of cost, construction methods, and maintenance requirements. Energy efficiency would be measured in terms of overall life

cycle cost, taking into account initial investment and recurrent costs based on the economic cost of energy, equipment, and materials. Total funding of about \$300,000 is required from prospective donors.

Regional Energy Problems Seminar

The main objective of this seminar, formally requested by the region governments, is to promote (a) the exchange of experiences among the countries of the region, (b) loss reduction and energy conservation strategies in the region, (c) natural gas utilization, and (d) innovative technical and institutional solutions to cope with the regional energy demand at least cost while minimizing the environmental impact. Technical papers will be prepared by high level experts, in close coordination with energy sector decisionmakers, to address common issues in the Maghreb countries and identify cooperation opportunities. These papers will be discussed in a seminar reuniting 40 to 50 participants (energy sector executives, nongovernmental institution representatives, and invited experts). The total cost of the activity is estimated at \$200,000.

Improvement of the Power Interconnection Operation

The main objective of this activity is to assist the COMELEC (Comité maghrebien d'électricité) in (a) reviewing the current problems and constraints to realizing the maximum benefit from the power interconnection between the countries of the region and (b) identifying the proper technical and institutional solution to improve its operation. The estimated cost of the project is \$300,000.

Poland

Energy Efficiency and Environmental Protection Study

The objective is to assist the Government of Poland in improving end use energy efficiency and related environmental protection focusing on policy related issues and investment preparation for project financing. The activity would provide the government with specific support to (a) review, assess, and shape its policy options on end use energy efficiency and related environment

protection and (b) prepare follow-up technical assistance and investment programs to be funded by the World Bank and/or other financing institutions. The activity is expected to play a catalytic role for the definition of energy policy options by the government and for the promotion and implementation of follow-up investment projects. It would encompass three main components: (a) preparation of an Energy Conservation Unit, (b) formulation of policy measures, and (c) design of technology transfer programs and investment projects to be funded by international financing institutions. The overall activity budget would amount to about \$1,000,000.

Tunisia

Environmental Evaluation of Long-term Energy Sector Development

The activity is intended to help integrate the environmental considerations in the energy planning and decisionmaking process. Its main objective is to assist Tunisia in the following activities: (a) identification of needed environmental standards related to the supply, transmission, and utilization of energy, to be included in comprehensive and homogeneous national environmental legislation, (b) environmental assessment of chosen energy facilities based on regional or national existing standards, and (c) carrying out an evaluation of the environmental burden of the long-term energy development plan. The total estimated cost of the activity is \$200,000.

Yemen

Commercialization of LPG Appliances

The Yemen household fuel marketing study concluded that wood supplies are being rapidly depleted and that this depletion could adversely affect household welfare. Since most wood is consumed for household bread baking in the tannur, the traditional bread oven, the study recommended the development and commercial dissemination of an affordable LPG tannur that would replace the wood tannur. The objective of this activity is to develop and test an appropriate LPG tannur and provide venture capital and management advice for the commercial production and dissemination of the appliance. A mission is planned for September 1990, pending confirmation of cofinancing.

Latin America and the Caribbean (LAC)

Bolivia

Natural Gas Development Study

As a continuation of the gas distribution study of five major cities in Bolivia, a second phase has been proposed to develop an integrated gas development plan. The proposed activity will cost an additional \$450,000.

Energy Efficiency Strategy Study

The objective of this technical assistance project is to raise the level of energy efficiency in Bolivia. ESMAP would prepare, together with the new Bolivian government that took power in August 1989, a national energy efficiency strategy for the period 1990-2000 and an action plan for the period 1990-1993. The energy efficiency strategy would concentrate on: (a) setting energy prices at a level that covers the economic cost of energy supply, (b) introducing policies to provide information, reduce transaction costs, correct fiscal disincentives, mandate energy efficiency standards, and provide market related incentives to consumers, (c) equipping strong, autonomous and adequately funded institutions to promote economically justified energy efficiency programs and evaluate and disseminate program results, (d) improving the flow of finance for energy efficiency projects by strengthening the ability of existing financial intermediaries to process energy efficiency projects and by developing new, essentially private sector, sources of finance and energy efficiency services, (e) ensuring closer integration of energy efficiency measures into the energy investment process, and (f) promoting economic fuel substitution specially taking advantage of the cheap indigenous natural gas. The estimated cost is \$263,000.

Caribbean Region

Diesel Efficiency Improvement Seminar

The objective of the proposed task is to prepare, present, and evaluate a seminar which would help the participants plan, operate, and maintain diesel generating installations economically and reliably and with reduced

adverse environmental impact. The initial seminar would serve as the prototype of a continuing series by ESMAP. The seminar would be residential and presented over a period of three days. Participants would be selected primarily from electric utility management staff with responsibility for planning, operating, or maintaining diesel generating installations. The topics to be covered would include, among others, (a) technical specifications for reliable and economic operation, (b) guidelines for efficient operation, (c) routine maintenance, (d) major overhauls and rehabilitation, (e) effective instrumentation and condition monitoring, (f) fuel oil selection and treatment, (g) environmental considerations, (h) appropriate training, (i) maintenance scheduling, and (j) inventory management.

Ecuador

Minihydro Feasibility Study

The proposed activity seeks to build upon selected recommendations from ESMAP work in Ecuador on appropriate renewable energy systems for rural areas. The activity will assist the National Energy Institute of Ecuador (INE) in developing a strategy for the application and linkage of minihydro power systems with private sector investment for decentralized energy needs. The activity is intended to develop a framework and specific investment packages for the promotion and development of viable minihydro power systems. The system should be suited to the natural resource endowment, local technical and managerial capabilities, as well as private sector financing. The costs are approximately \$200,000.

Honduras

Utilization of Wood Residues

Over 80 sawmills operate in Honduras, processing a mix of softwoods and hardwoods for both domestic consumption and export. However, of the twenty or so larger mills, only a few currently make use of their residues as a source of energy. An even larger quantity of potentially utilizable wood wastes is left in the forest as a result of logging operations. The proposed ESMAP

activity will assist the Government of Honduras to rigorously identify and evaluate several promising opportunities for increasing the use of forest industry residues to (a) substitute for diesel fuel presently consumed by off-grid sawmills (the majority) with potential electrification benefits to surrounding communities and (b) substitute for firewood consumed in the commercial sector using either unprocessed or briquetted residues. The study parallels an ESMAP activity on the sawmill industry in Ghana and is expected to cost \$160,000.

LAC Regional

Energy Consumption in Low-Income Urban Households

The activity will analyze the level and structure of energy demand in the residential sector of selected Latin American countries with special emphasis on low-income urban households. Most of the urban population in Latin America has, to a great extent, switched over to modern fuels. The types of fuels vary, but often the fuel use in urban areas is largely a function of availability. The proposed activity would collect and analyze data on (a) current levels and patterns of fuel use in (especially low-income) urban areas, (b) the available and economically accessible energy resources, (c) the economic and financial cost of fuels, and (d) the production, distribution, and marketing of these fuels. The study will also assess the capacity of the governments concerned to effectively achieve energy conservation and substitution policy objectives. The work would be partly based on past and ongoing activities in the energy sector, partly on surveys to be executed under this project in consumer centers in the participating countries. Also, where necessary, cooking equipment will be market tested to obtain consumer reactions regarding fuel and equipment preferences. In addition, monitoring of selected city quarters will take place to determine the level and nature of nontechnical electricity losses and fraudulent connections. Environmental, poverty, and institutional constraints will be identified both at the national and the local level. Possible solutions will be analyzed and recommended, taking into account, amongst other things, the

macroeconomic and budgetary situation of the country. The cost of this activity is estimated at \$1.1 million.

Venezuela

Power Sector Restructuring and Loss Reduction

With about 18,400 MW of installed electricity generation capacity, Venezuela has the second largest power system in South America (after Brazil with approximately 50,000 MW of capacity). Yet in spite of this impressive investment in electricity supply, Venezuela is faced with serious problems in the power subsector that hinder ongoing efforts for macroeconomic recovery. Power system losses are among the highest in the world at 28 percent, theft of electricity is rampant, fuel efficiency and reliability of thermal generation plants are low, little effort is made to promote electrical end use efficiency, and there is only superficial coordination in the planning processes of the different power utilities. Venezuela is one of the few developing countries with a high proportion of private ownership in power generation and distribution. The utility serving the capital of Caracas is fully privately owned, has installed steam capacity of about 2,200 MW, and 700,000 customers (including subsidiaries). In addition, there are several smaller privately owned utilities. The current economic crisis in Venezuela has made the government more receptive to the problems of the power subsector and there appears to be a desire to take positive action, as demonstrated by recent resolutions to regionalize CADAPE (a national utility) and the establishment of a national tariff committee. However, the government is faced with a wide array of positions as to what should be done, many of which are driven by special interests. The objectives of the proposed ESMAP activity would center around two areas: (a) power system operational efficiency with emphasis on loss reduction and (b) subsector institutional structure, investigating possibilities such as the structure of a centralized planning body, regionalization of electricity distribution, access to a national transmission grid, establishment of a regulatory commission, and draft legislation required for the subsectors. The first study is estimated to cost \$190,000 and the second \$280,000.

Global

Evaluation of Past Woodfuel Projects

A review of woodfuel projects indicates a necessity to have a critical review of ongoing and past woodfuel projects to determine the reasons for their success or failure. The study would examine the relevance of projects from a national woodfuels strategy point of view, rationale and feasibility of the project objectives, extent to which these objectives were achieved, and reasons for the overall success or failure of specific projects. The knowledge so obtained would enable more effective definition of project objectives and the correct designing of projects to achieve these objectives. The evaluation would involve an initial desk review of woodfuel projects and other related evaluations culminating in an interim report and a proposal for several in-country case studies, which would then be carried out to substantiate the interim report findings and recommendations. Total cost is estimated at \$415,000 with the desk review costing \$110,000.

Handbook on Design and Evaluation of Minihydro Schemes on Irrigation Canals and Dams

The need for the proposed handbook to be used as design guidelines on mini hydropower development, and

for in-service training to re-orient practicing engineers became apparent during a project preparation review workshop that was organized by ESMAP at Bangalore, India, in May 1990. During the workshop, which was part of the ongoing preinvestment activity on minihydro schemes on irrigation dams and canal drops, the counterparts from electricity supply organizations in India stressed the need for a comprehensive handbook on all aspects of the planning, design, and evaluation of minihydro schemes, especially schemes that are associated with irrigation dams and canals. Although there are a number of comprehensive books on hydroelectric engineering, the subject of minihydro is dealt with in a cursory manner, usually as a secondary subject. The proposed handbook would provide a more comprehensive and systematic treatment of the subject, would expand on an earlier working paper by the World Bank, "Small Hydroelectric Components in Irrigation and Water Supply Projects", Energy Department Note No. 60 (dated July 1985), and would incorporate case studies, reference lists on alternative equipment, etc. About 20 man-months of the services of a team of consultants and an editor would be required to prepare the handbook at an estimated cost of \$150,000.

Appendix 1

OPPORTUNITIES FOR DEVELOPING COUNTRIES

While a recipient country must make a request for assistance before an activity can begin, the idea for a new ESMAP activity can come from various sources. Many of the early ESMAP activities were a direct response to issues identified in the Energy Assessment Program. Many of the more recent activities, however, have been the result of findings and recommendations made as follow-up to an ESMAP study or as a complement to a study. Other sources of ideas for ESMAP activities include developing country ministries or national enterprises, the operations divisions of the World Bank, the UNDP and in particular its resident representatives with IPF funds, other UN agencies, and the bilateral aid groups that liaise closely with and sometimes support ESMAP.

It is important that the governments of the developing countries be active participants in the selection and implementation of activities. Recipient country government officials are encouraged to contact ESMAP managers directly or indirectly through the World Bank regional divisions, the UNDP country resident representative, or representatives of aid agencies of donor countries to discuss possible ESMAP assistance. For representatives of those countries that have never received ESMAP assistance or that have not been active participants in the program in recent years, the statistical tables in Section V of this report and their subsequent summary descriptions in Section VI can be a starting point to ascertain the types of activities in which the program has become involved.

Appendix 2

OPPORTUNITIES FOR CONSULTANTS

This section describes the types of expertise most often used by ESMAP. While there may not be many unfilled opportunities available in ongoing activities, those which are in search of consultants are noted. The most likely sources of consultancy opportunities can be found in prospective activities. Listed on the next few pages are profiles of some of the commonly used types of consultants.

It is ESMAP policy over time to attempt to use consultants from donor countries in proportion to country contributions to the program. ESMAP also tries to use as many consultants and experts as possible from the developing countries.

All prospective consultants should have good writing skills in English. Fluency in French, Spanish, Portuguese, or Arabic is often needed for particular assignments. Consultants should be able to work productively as members of a multidisciplinary team and may be required to train local personnel. Most assignments are short-term and require participation in field missions and in subsequent preparation of reports.

Individuals and firms meeting the above requirements should complete the Consultant Profile Form at the back of this appendix which requests such details as fields of experience, education, language skills, and nationality. The form should be accompanied by a CV.

Roster of Consultants

There is no formal requirement for a consultant to register with either ESMAP or the World Bank to be eligible for consulting assignments with the ESMAP program. It is in the interests of consultants and ESMAP, however, that information on consultant qualifications and experience be available to ESMAP staff.

Generally, consultants are selected by the ESMAP task manager for each activity, and selections are approved by the program's managers in accordance with established policies on consultant procurement. Individual consultants rather than firms are usually employed.

About 300 curricula vitae (CVs) are received each year from consultants interested in working on ESMAP tasks. To enable consultants' CVs to be retrieved quickly from files, a computer based system to index consultant skills and experience is in operation for the ESMAP program. Unlike the DACON and CASI systems used by the World Bank, this system is not intended to record all the

information on a CV but rather to enable ESMAP task managers to have quick access to the CVs of consultants with relevant skills and experience. The DACON and CASI systems are still used on the occasions when firms and individuals with the required profiles cannot be located within ESMAP's files.

In addition to the ESMAP Consultant Profile Form and CV, other brochures or materials may be sent, but special proposals are not needed. CVs should be up to date. When consultants have accumulated substantial additional experience or developed new expertise, a revised CV and form should be forwarded to ESMAP.

Many more CVs are received than consultants selected. ESMAP has tried to make entry on its roster of consultants as simple and as costless as possible. The ESMAP program cannot guarantee the choice of any consultants but will review all applications.

Specially Needed Consultant Skills

ESMAP is currently in need of several rather specific consultant skills. Identified below are descriptions detailing the type of knowledge and experience required:

Electricity Institutional Reform and Finance

Increasingly, governments are approaching ESMAP to assist in designing new institutional and financial arrangements for the power sector that involve securing local and foreign sources of private finance, streamlining regulatory arrangements, and providing clear pricing and operational guidelines for non-utility electricity generation. Consultants are needed who can prepare advice to governments on establishing arrangements for private sector involvement in the power sector, ranging from leasing of affermage arrangements, to cogeneration, to full scale divestiture. The potential scope of work is wide and includes advice on regulatory options, pricing arrangements, identification of investors' risks and measures to address them, contractual arrangements, and prefeasibility work.

Energy Efficiency in Buildings

Consultants are needed with experience in the design of energy efficient buildings in tropical or semitropical climates. Potential work involves audits of modern commercial and institutional buildings, designing building energy efficiency programs, and the preparation of energy efficient building design standards.

Power Utility Commercial Operations

Typically, around half of the losses in power systems are nontechnical: theft, meter errors, billing irregularities, and deficiencies in customer records. ESMAP power efficiency studies require consultants who have experience in preparing advice on technical and administrative measures to reduce nontechnical losses and in streamlining the commercial aspects of power utility operation.

Consultant Profiles

Biomass Energy Specialists must have a good knowledge of the operational and institutional aspects of the application of the various biomass energy conversion technologies, and have a sound knowledge of project economic and financial analysis techniques. They should be able to evaluate future demand for biomass fuels, to estimate sustainable biomass energy supply, and to assess options for conserving biomass fuels. The skills required include: biomass resource assessment and energy forest project design, analysis of the socio-cultural aspects of tree farming and biomass use, and financial and economic analysis of household fuel substitution and conservation options.

Charcoal Specialists must have an excellent knowledge of carbonization techniques and extensive practical experience with both production and marketing of charcoal in developing countries. They should also have a sound working knowledge of project economic and financial analysis techniques.

Coal Production and Utilization Engineers need experience in evaluating the financial and economic cost of coal production, treatment and transportation and an understanding of the technical, economic, and financial aspects of coal utilization analysis. Depending on the individual country, tasks may require experience in analyzing the cost, quantity, and quality of potential coal supply from under-

ground and/or open-pit mining operations and identifying potential improvements in production efficiency. Some experience of coal beneficiation techniques and costs is necessary, as is experience with coal handling and transportation. Familiarity with coal user requirements and with the end-use cost of coal for various purposes is also required.

Energy Conservation and Substitution Specialists need expertise in evaluating options for conserving energy, particularly in the industrial and commercial sectors, and in analyzing options for fuel substitution. A knowledge of industrial and commercial energy needs and of technical options for reducing energy consumption is required. So too is skill in the financial and economic analysis of potential energy conservation and substitution investments.

Energy Economists are also needed in the handling of household, rural, and renewable energy issues in developing countries. They should have experience in the evaluation of energy supply options and demand management strategies in the household sector (both rural and urban) and in rural industries. In particular, they should be familiar with the economic issues and techniques involved in determining the optimal fuel mix for these sectors, including the evaluation of policies for fuel pricing, interfuel substitution, fuelwood conservation, afforestation, and the use of crop residues for fuel.

Energy Planners/Economists must have a good understanding of both commercial and noncommercial energy supply and demand issues in developing countries. They need experience in energy demand forecasting and in evaluating alternative energy supply options and demand management strategies. Specifically, they should be familiar with techniques for estimating the economic and financial cost of supply of alternative fuels, particularly hydrocarbons, electricity, coal, and biomass fuels; with techniques for forecasting the long-term evolution of energy demand under conditions of uncertainty; with the evaluation of energy conservation and substitution options; and with the financial and economic analysis of fuel prices and taxation policies, including the application of long-run marginal cost analysis.

Forestry Economists will have practical experience in energy forest project design and/or implementation or in the design and evaluation of an agroforestry, sylvopastoralist or natural forest cover management systems in developing countries. They should be well-versed in the socio-cultural aspects of subsistence agriculture and range management, and should also be familiar with project financial and economic analysis techniques.

Marketing Specialists must be familiar with the technical, economic, and social issues involved in household and rural industrial energy use in developing countries, and have extensive experience in sampling and survey techniques, the supervision of the conduct of surveys, and the processing and analysis of survey data. Promotional techniques for consumer goods is often a useful asset.

Petroleum and Gas Development Specialists are required for work in countries with exploitable hydrocarbon reserves. They should be familiar with contractual arrangements for oil and gas exploration and development and with the economic analysis of oil and gas utilization options. Experience in the estimation of depletion premiums and in netback analysis typically is required.

Petroleum Supply/LPG Distribution Specialists need a detailed understanding of the international oil and gas market and experience in the analysis of crude oil and petroleum product procurement, and analysis of oil and gas transportation, processing, distribution and marketing op-

tions in developing countries. Specifically, they need expert knowledge of alternative sources of hydrocarbon supply, of supply cost analysis, and of alternative procurement arrangements; of hydrocarbon transportation systems and costs, including tankers and pipelines; of the technical characteristics and economic costs of alternative processing facilities and the economics of product distribution and pricing. They should also be versed on optimal fuel mix for specific uses and able to evaluate policies for fuel pricing and interfuel substitution.

Power System Planners must be capable of critically analyzing proposed investments in power generation, transmission and distribution facilities and evaluating the level and structure of power tariffs. They need experience in forecasting future demand for electric power; estimating the costs and benefits of constructing new facilities and/or rehabilitating and reinforcing existing facilities to meet that demand; estimating the financial and economic cost of power supply; and constructing appropriate power tariffs based thereon. Experience in long-run marginal cost analysis, shadow pricing, and project evaluation is essential; familiarity with the use of computer spreadsheet and generation expansion programs for load forecasting and investment analysis is advantageous.

Renewable Energy Technology Specialists (in areas such as photovoltaics, solar hot water, wind turbines, windpumps and micro-hydro systems) must have extensive knowledge and experience with the technical, economic, financial, social, and institutional issues which affect the use of the particular technology in developing countries and a familiarity with project economic and financial analysis techniques.

Stove Technologists should have extensive knowledge and field experience with the wide range of biomass, kerosene, LPG, and coal stoves in use in developing countries, their combustion properties and relative thermal efficiencies, and the characteristics of the various fuels. They should also have a good understanding of artisanal and semi-industrial production techniques for both ceramic and metal stoves and of kitchen technology and food preparation techniques in developing countries.

ESMAP

CONSULTANT PROFILE FORM *

Name: _____
Last/First/M. Initial

Date of Birth: _____

Gender: _____
(M/F)

Nationality: _____

Social Security No: _____
(if applicable)

Firm: _____

Address: _____

Country: _____

Phone Number: _____

Fax Number: _____

(For official use only)

Date of CV: / /

Date of Entry: / /

Remarks: _____

References:
Box File

Book File

(Please check all applicable items)

FIELD S OF EXPERTISE

Energy

- Economics
- Environment
- Efficiency
- Modeling
- Planning
- Conservation

Power

- Utility
- Planning
- Generation
- Transmission
- Distribution
- Economics

Petroleum

- Exploration
- Production
- Refining
- Marketing
- Gas

Biomass

- Gasification
- Combustion
- Residue
- Briquetting
- Charcoal/Carbonization
- Biogas Digestors
- Bagasse

Renewable Energy

- Solar/Photovoltaics
- Thermal
- Wind/Electric
- Wind/Pumping
- Hydro

Household Energy

- Survey
- Rural
- Urban
- Traditional Fuel
- Commercial Fuel

Rural Energy

- Tea
- Brick/Tile
- Tobacco
- Household

Forestry

- Forestry
- Social Forestry
- Agronomy
- Residues

Stoves

- Design
- Wood
- Charcoal
- Kerosene
- Electric
- Coal

Training

- Energy Planning
- Conservation
- MIS

Other

- Financial Analysis
- Institutional Reform/
Restructuring
- Coal
- Sociology
- Computer
Programs
- Environment

Support

- Editing
- Translation

LANGUAGES

	Spoken	Written	Fluent
English	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
French	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spanish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Portuguese	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Arabic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-----	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-----	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ACADEMICS

First Degree

Higher Degree

Other

EXPERIENCE

Years of experience: _____

Countries of experience: _____

(If previous IBRD consultant or former IBRD staff

Consultant Number _____ Staff Number _____)

**RETURN COMPLETED FORM AND A
COPY OF YOUR CV* TO:**

**Industry and Energy Department
The World Bank
1818 H Street, N.W.
Washington, D.C. 20433 USA
Fax Number (202)477-0547**

* CV must accompany roster form

Appendix 3

PUBLICATION REQUEST FORM

Listed on the next pages are working papers published by the World Bank Industry and Energy Department in which ESMAP is located. The two pages are designed as a request form. If you desire any of the publications, **check** the boxes before the report titles and return the completed form to the address indicated below.

Because ESMAP reports are identified in Section V "Completed Activities (Region)", they are not relisted here. On the back of this form, space is provided for ordering the ESMAP reports you require. Simply list the reports by title and number. Those completed studies without a number have no final report available.

Send to:

Industry and Energy Department

The World Bank
1818 H Street, N.W.
Washington, D. C. 20433
U.S.A.

ENERGY SERIES PAPERS

- No. 1 Energy Issues in the Developing World, February 1988.
- No. 2 Review of World Bank Lending for Electric Power, March 1988.
- No. 3 Some Considerations in Collecting Data on Household Energy Consumption, March 1988.
- No. 4 Improving Power System Efficiency in the Developing Countries through Performance Contracting, May 1988.
- No. 5 Impact of Lower Oil Prices on Renewable Energy Technologies, May 1988.
- No. 6 A Comparison of Lamps for Domestic Lighting in Developing Countries, June 1988.
- No. 7 Recent World Bank Activities in Energy (Revised October 1989).
- No. 8 A Visual Overview of the World Oil Markets, July 1988.
- No. 9 Current International Gas Trades and Prices, November 1988.
- No. 10 Promoting Investment for Natural Gas Exploration and Production in Developing Countries, January 1989.
- No. 11 Technology Survey Report on Electric Power Systems, February 1989.
- No. 12 Recent Developments in the U.S. Power Sector and Their Relevance for the Developing Countries, February 1989.
- No. 13 Domestic Energy Pricing Policies, April 1989.
- No. 14 Financing of the Energy Sector in Developing Countries, April 1989.
- No. 15 The Future Role of Hydropower in Developing Countries, April 1989.
- No. 16 Fuelwood Stumpage: Considerations for Developing Country Energy Planning, June 1989.
- No. 17 Incorporating Risk and Uncertainty in Power System Planning, June 1989.
- No. 18 Review and Evaluation of Historic Electricity Forecasting Experience (1960-1985), June 1989.
- No. 19 Woodfuel Supply and Environmental Management, July 1989.
- No. 20 The Malawi Charcoal Project - Experience and Lessons, January 1990.
- No. 21 Capital Expenditures for Electric Power in the Developing Countries in the 1990s, February, 1990.
- No. 22 Review of Regulation of the Power Sectors in Developing Countries, February 1990.

INDUSTRY SERIES PAPERS

- No. 1 Japanese Direct Foreign Investment: Patterns and Implications for Developing Countries, February 1989
- No. 2 Emerging Patterns of International Competition in Selected Industrial Product Groups, February 1989.
- No. 3 Changing Firm Boundaries: Analysis of Technology Sharing Alliances, February 1989.
- No. 4 Technological Advance and Organizational Innovation in the Engineering Industry, March 1989.
- No. 5 Export Catalyst in Low Income Countries, November 1989.
- No. 6 Overview of Japanese Industrial Technology Development, March 1989.
- No. 7 Reform of Ownership and Control Mechanisms in Hungary and China, April 1989.
- No. 8 The Computer Industry in Industrialized Economies: Lessons for the Newly Industrializing, February 1989.
- No. 9 Institutions and Dynamic Comparative Advantage: Electronics Industry in South Korea and Taiwan, June 1989
- No. 10 New Environments for Intellectual Property, June 1989.
- No. 11 Managing Entry into International Markets: Lessons from the East Asian Experience, June 1989.
- No. 12 Impact of Technological Change on Industrial Prospects for the LDCs, 1989.
- No. 13 The Protection of Intellectual Property Rights and Industrial Technology Development in Brazil, September 1989.
- No. 14 Regional Integration and Economic Development, November 1989.
- No. 15 Specialization, Technical Change and Competitiveness in the Brazilian Electronics Industry, November 1989.
- No. 16 Small Trading Companies and a Successful Export Response: Lessons From Hong Kong, December 1989.
- No. 17 Flowers: Global Subsector Study, December 1989.
- No. 18 The Shrimp Industry: Global Subsector Study, December 1989.
- No. 19 Garments: Global Subsector Study, December 1989.
- No. 20 World Bank Lending for Small and Medium Enterprises: Fifteen Years of Experience, December 1989.
- No. 21 Reputation in Manufactured Goods Trade, December 1989.

ENERGY SERIES PAPERS Cont'd.

- No. 23 Summary Data Sheets of 1987 Power and Commercial Energy Statistics for 100 Developing Countries, March 1990.
- No. 24 A Review of the Treatment of Environmental Aspects of Bank Energy Projects, March 1990.
- No. 25 The Status of Liquefied Natural Gas Worldwide, March 1990.
- No. 26 Population Growth, Wood Fuels, and Resource Problems in Sub-Saharan Africa, March 1990.
- No. 27 The Status of Nuclear Power Technology - An Update, April 1990.
- No. 28 Decommissioning of Nuclear Power Facilities, April 1990.
- No. 29 Interfuel Substitution and Changes in the Way Households Use Energy: The Case of Cooking and Lighting Behavior in Urban Java, June 1990.

INDUSTRY SERIES PAPERS Cont'd.

- No. 22 Foreign Direct Investment from the Newly Industrialized Economies, December 1989.
- No. 23 Buyer-Seller Links for Export Development, March 1990.
- No. 24 Technology Strategy & Policy for Industrial Competitiveness: A Case Study of Thailand, February 1990.
- No. 25 Investment, Productivity and Comparative Advantage, April 1990.
- No. 26 Cost Reduction, Product Development and the Real Exchange Rate, April 1990.
- No. 27 Overcoming Policy Endogeneity: Strategic Role for Domestic Competition in Industrial Policy Reform, April 1990.
- No. 28 Conditionality in Adjustment Lending FY80-89: The ALCID Database, May 1990.
- No. 29 International Competitiveness: Determinants and Indicators, March 1990.
- No. 30 FY89 Sector Review Industry, Trade and Finance, November 1989.

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The World Bank

Headquarters

1818 H Street, N.W.
Washington, D.C. 20433, U.S.A.

Telephone: (202) 477-1234

Telex: WUI 64145 WORLDBANK
RCA 248423 WORLDBK

Cable Address: INTBAFRAD
WASHINGTONDC

European Office

66, avenue d'Iéna
75116 Paris, France

Telephone: (1) 140-69-30-00

Telex: 842-620628

Tokyo Office

Kokusai Building
1-1, Marunouchi 3-chome
Chiyoda-ku, Tokyo 100, Japan

Telephone: (03) 214-5001

Telex: 781-26838



UNDP

New York

United Nations Development Programme
1 United Nations Plaza
New York, New York 10017

Telephone: (212) 754-1234

Telex: 125980 (domestic)
232-422 (overseas)

Cable Address: UNDEVPRO
NEW YORK

Geneva Office

Palais des Nations
CH-1211 Geneva 10
Switzerland

Telephone: 98-84-00

98-58-50

Telex: (UNDP) 28.96.20 or (UN) 28.96.96.

Cable Address: UNDEVPRO
GENEVA (SWITZERLAND)

Tokyo Office

Shin Aoyama Building
Room 2255
1-1, Minami-Aoyama 1-Chome
Minato-Ku
Tokyo 107, Japan

Telephone: 03-475-1619/20

Telex: 128 334

AB TKOPI J28 334
Cable Address: UNDEVPRO
TOKYO (JAPAN)

