

Annual Report

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ESMA

Energy Sector Management Assistance Programme

ESMAP Annual Report 1996

Joint UNDP/World Bank Energy Sector Management Assistance Programme
INDUSTRY AND ENERGY DEPARTMENT, THE WORLD BANK

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RPTES	Review of Policies in the Traditional Energy Sector
SADC	Southern African Development Community
SAPP	Southern Africa Power Pool
SDC	Solar Development Corporation
SO₂	sulfur dioxide
SSM	supply-side management
TA	technical assistance
TAG	Technical Advisory Group (of ESMAP)
toe	tonnes of oil-equivalent energy
TPA	third-party access
UN	United Nations
UNDP	United Nations Development Programme
UNCED	United Nations Commission on Environment and Development
USAID	United States Agency for International Development

I. Introduction

This annual report covers the calendar 1996 activities of the Energy Sector Management Assistance Programme (ESMAP), jointly sponsored by the United Nations Development Programme (UNDP) and the World Bank. The present chapter provides an introduction to ESMAP activities, after which chapter 2 discusses ESMAP operations in detail. Chapter 3 reviews the evolution of ESMAP's management and the Programme's financial position.

The report also contains several annexes, in which ESMAP customarily provides detailed data and documentary material. Annex 1 reproduces the ESMAP Consultative Group's 1996 communiqué. Annex 2 provides data on ESMAP activities (completed, ongoing, and newly launched) during calendar year 1996. Annex 3 provides a comprehensive listing of ESMAP's reports on completed activities.

In addition, this report contains a special section, Annex 4. The section summarizes ESMAP's strategy for tackling vital energy-efficiency issues and related environmental concerns. The annex is intended as a briefing note in preparation for discussions among donors and other stakeholders at this year's roundtable, on energy and development, scheduled for the end of April 1997.

ESMAP in 1996 remained a vital and highly relevant program of technical assistance for developing countries and economies in transition. The overall context in which ESMAP operated in 1996 differed little from the one described in the introduction to last year's report. It may be useful to recall, however, a salient feature of the global energy scenario: energy use in non-OECD countries, which today equates to only about 80 percent of that in OECD countries, will amount to more than twice the OECD countries' energy consumption within 20 years (see Box 1.1). This rapidly rising demand in the non-OECD countries, which ESMAP serves, will require investments estimated at \$120 million a year to supply electric power, oil, and natural gas. The need to rely mainly on private financing—local and international—remains a formidable challenge. ESMAP activities contribute significantly to creating the framework necessary to finance and ensure energy development on a sustainable basis.

ESMAP's Priorities

In assisting developing countries in recent years, ESMAP has focused on six principal issues, briefly noted below and expanded upon in chapter 2. In 1996, the Programme consolidated its work on these issues and extended it to countries where it had not been active, including Lao PDR and Malawi.

Energy Efficiency

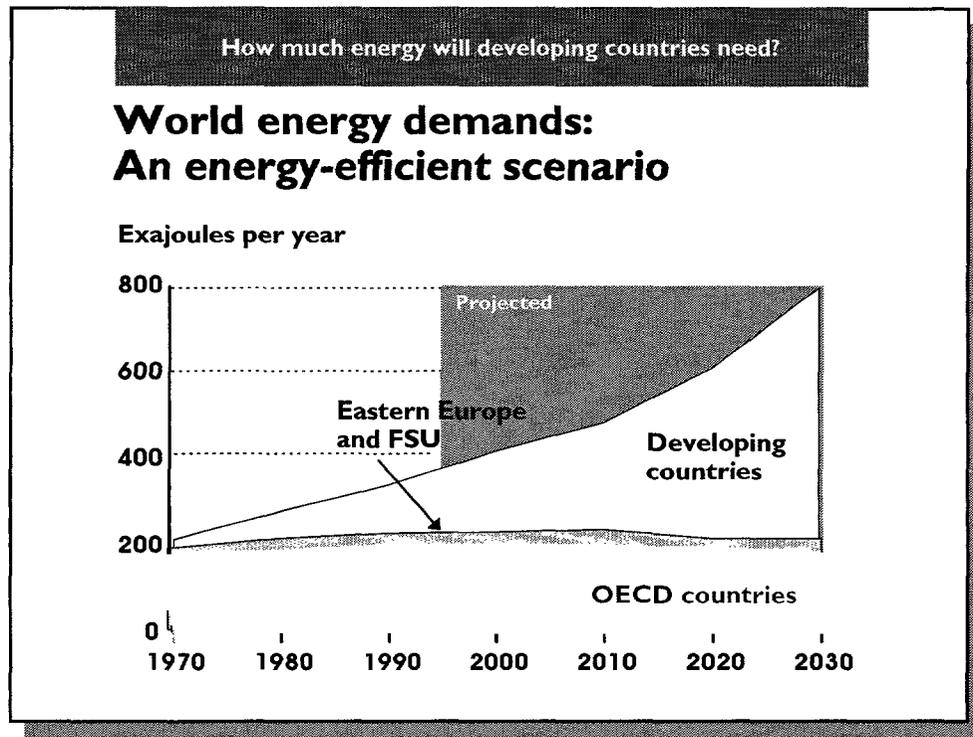
Considerable potential still exists in developing countries and transitional economies for energy savings in both supply and demand. Top-down sector reforms with respect to price and industry structure will remain key in this area, but bottom-up, grass-roots programs facilitating the introduction and implementation of energy-saving technologies and practices are equally critical and receive considerable attention from ESMAP.

Linkages between Energy and the Environment

Protection of the environment has become a particular focus in the drive toward overall sector reform. Because energy production and use have such a great potential impact on the environment, supply-side sector reform and demand-side efficiency improvements both can contribute substantially to reducing

detrimental environmental consequences. Over the past year, ESMAP has addressed these objectives through the launching of the Clean Coal Initiative; the implementation and dissemination of the *Environmental Manual for Power* (EM); and the inception of projects to promote the use of natural gas and reduce gas flaring and mitigate the adverse impacts of the consumption of fuels in transport. ESMAP's contribution to the World Bank's Solar Initiative, its greatly enhanced energy-efficiency and renewable energy activities, and its work on energy trade and rural energy have also contributed importantly to the environmental agenda.

Box I.1 Energy Trends



Energy Sector Reform and Restructuring

Governments of developing and transition economies have now accepted the necessity of commercially oriented reform and restructuring to facilitate the expansion of their energy sectors and to secure the investments required for financing that expansion. Although many governments have already embarked on significant reform programs, reforms are far from complete and still need continued attention and support by governments and donors alike.

As in previous years, ESMAP has made facilitation of sector reform a core priority by helping its clients to identify and evaluate options for reform and restructuring. Through conferences, consultations, and publications, ESMAP has also continued to share the experience accumulated and lessons learned by countries that have pioneered in energy sector reform. It has become quite clear from such experiences that no single formula for reform exists, given the great diversity of energy resources, the widely varying sizes of energy sectors, and the distinctive political and economic conditions of developing and transition economies. Nonetheless, from an accumulating pool of case studies, ESMAP has been able to develop typologies of reform strategies that can help countries make their own way toward the goals of

environmentally sustainable and efficient energy production and use, better economic performance, and improved standards of living.

Energy Trade

It is now commonly accepted that energy trade—particularly the interconnection of electric power networks and trade in natural gas—contributes to more efficient use of energy. This view can now be said to have superseded an emphasis on energy security that had flourished during the Cold War and Oil Crisis periods.

Interconnection of electric power networks is considered today a powerful instrument for efficient production and use of energy. Based on commercial principles, interconnection on a regional or international basis implies transparent pricing mechanisms reflecting real economic costs. Moreover, by enlarging the pool of power resources from which utilities can draw, it has the potential to rationalize distribution and to reduce the need for new investments through more efficient use of installed capacity. ESMAP work in this area intensified markedly in 1996.

For economic reasons, natural gas will most likely remain the fuel of choice for electricity generation for many years to come. Combustion of natural gas also represents a much-reduced threat to the environment in terms of emissions of particulate matter and carbon dioxide, but natural gas must be exploited and transported properly to ensure its economic benefits and to prevent release of ozone-damaging methane and CO₂. Transport and trade of gas pose a challenge in particular because the resources are often not close to the centers of consumption. Constructing the infrastructure needed to bring resources and consumers together will require large investments that will not be made without an appropriate institutional and policy framework in both the producing and consuming countries. In addition, increased attention must also be paid to maintaining existing gas transmission and distribution lines to ensure their environmental safety.

Rural and Household Energy

The publication of *Rural Energy for Development: Improving Energy Supplies for Two Billion People* in the World Bank's Development in Practice Series coincided with renewed interest in energy as a tool to reduce poverty as well as to protect the environment in rural areas. The new paper, based in large part on ESMAP's significant record of work in rural and renewable energy, shows that dependence on traditional biofuels often goes hand in hand with poverty. It also makes clear that inefficient use of biofuels is associated with serious health hazards for households—particularly women and children—as well as damage to the local and global environments. In addition, lack of access to modern fuels such as electricity deprives rural people of access to services such as electric lighting, refrigeration, and telecommunications. Although the rate of electrification exceeds population growth in regions such as East Asia, it lags far behind in many other regions, such as Sub-Saharan Africa and South Asia.

The new rural energy paper makes clear that practical and affordable solutions now exist along a wide continuum of energy choices. These include increasing the efficiency, safety, and sustainability of continued use of biomass by the large number of people, particularly in Africa, who have easy access to biomass and few affordable alternatives. But the solution also must include a full menu of options to provide modern energy services to rural populations by broadening consumers' choices, ensuring cost-effective pricing, helping to overcome high up-front cost barriers, encouraging local participation, and implementing good sector policies. ESMAP, which has often pioneered in the rural energy field, continued to support this approach in 1996.

Renewable Energy

Over the past year, ESMAP contributed significantly toward mainstreaming renewable energy into the World Bank's program and more generally advancing interest in renewables. Noteworthy achievements included the completion of planning documents and funding for the preparation of a Solar Development Company (SDC) to be implemented jointly by the Bank and the Rockefeller Foundation, and the establishment of an expert committee to advise on and plan programs of research, development, and demonstration of renewable energy technologies.

These new initiatives were paralleled by important renewable energy project work in China, Brazil, and elsewhere.

Governance and Management Issues

The Annual Meeting of the ESMAP Consultative Group (CG) took place in Washington, D.C., at the end of April 1996, just before the Donors' Roundtable on energy and development issues in Sub-Saharan Africa (see chapter 3 and the CG communiqué, Annex 1). During the year, two new members were appointed to ESMAP's Technical Advisory Group (TAG), and the TAG conducted for the first time a review of past activities in two countries: China and Vietnam.

With the establishment of a system of "professional networks" in the World Bank, ESMAP is gearing itself toward taking full advantage of a more open institutional structure. This offers an opportunity to link ESMAP's work more closely to the Bank's operations, a step that many ESMAP donors have urged. To facilitate this process, ESMAP management has introduced contracts with units and task managers responsible for conducting ESMAP activities, thus opening up the possibility of implementing selected ESMAP activities outside the Industry and Energy Department of the Bank.

ESMAP Finances

Donor support to ESMAP remained strong in 1996, with contributions up to \$8.5 million from \$7.8 million in 1995. Of the total funds received in 1996, approximately \$1.5 million or about 18 percent represented the Bank's contribution to the Programme, down from 24 percent in 1995, due primarily to a recalculation of office occupancy charges related to ESMAP staff. In addition to the Bank's direct contribution to ESMAP, some \$11 million in Bank administrative resources were applied to energy sector priority areas, in line with ESMAP priorities. Contributions to core (net of the Bank's contribution, all of which is considered core) accounted for \$2.7 million in 1996 against \$2.0 million in 1995. At \$8.5 million, overall expenditures equaled contributions in 1996, in line with projections set out in the *ESMAP Annual Report 1995*. Both contributions and expenditures are expected to increase somewhat in 1997, reflecting the donors' continued commitment to the Programme and the anticipated acceleration of project activity in particular under the "umbrella" funding arrangements that will be opened to a wider group of Bank task managers under the supervision of ESMAP thematic coordinators.

Environment, Energy Efficiency, and ESMAP

As noted above, both energy efficiency and mitigation of the environmental impact of energy production and consumption are major themes in the ESMAP program. Annex 4, intended for discussion at the 1997 ESMAP roundtable on energy development, explores the linkage between these two activities and its relevance for ESMAP and for policymakers more generally.

2. ESMAP Operations

During 1996, the ESMAP portfolio comprised 78 projects, grouped under the following areas (Annex 2 has data tables on projects completed, launched, and ongoing in 1996):

- Energy efficiency and conservation
- Energy and the environment
- Sector reform and restructuring (with subsections on power and on hydrocarbons)
- International trade in electricity and natural gas
- Rural and household energy
- Renewable energy.

Activities are discussed by thematic area in this chapter.

Energy Efficiency

Achieving efficiency in both the production and consumption of energy remains a key focus of the ESMAP program.

ESMAP Strategy

The most significant gains in energy efficiency over the past decade have resulted from reform and restructuring at both macroeconomic and sector levels, including price and regulatory reforms. ESMAP's strategy has been to complement these top-down initiatives with grass-roots projects intended to enhance responses to broad sector reforms. Most projects are designed to reduce or remove obstacles to the market-driven introduction of new and more energy efficient practices, equipment, and technologies. Toward this end, ESMAP projects seek to increase host-country or regional access to, and understanding of, the potential for efficiency gains, the alternatives available, and "best practices" in energy management. This has been accomplished through a combination of pilot projects and programs for the exchange and dissemination of information. Strengthening of institutional capacity in both government and the private sector is also an important part of ESMAP's energy-efficiency programs. The sector reforms now under way in many countries have changed the role of government from central planner to market facilitator, and ESMAP programs as a consequence are increasingly focused on the private sector initiatives of industry trade associations and individual enterprises. Finally, educating the local financial sector on the opportunities presented by efficiency projects has proved a critical program component.

Box 2.1 describes Monitoring and Targeting (M&T), the principal approach adopted by ESMAP in designing and implementing efficiency projects, particularly those directed at achieving demand-side or end-use efficiencies.

Box 2.1 Monitoring and Targeting to Control Energy Costs

Monitoring and Targeting (M&T) is a management technique for controlling energy costs. It focuses on the industrial and commercial sector at the firm level and on public sector entities where energy-efficiency opportunities are evident. Beginning with pilot projects developed by a lead energy-efficiency organization, M&T programs have been successfully extended in Great Britain, where they originated, to the point where trade associations can take over. This approach is now being used in Latin America.

M&T begins with a review of individual processes or monitoring to establish benchmarks for energy use. A target is then established for reduced energy use based on industry best practice and on what is achievable in the particular circumstance. Ongoing monitoring is easily automated through the use of computers and can readily be incorporated into management information systems.

In Latin America, M&T has been particularly successful in creating credible local teams comprising host-industry staff and local consultants to achieve low-cost utility savings. As an extension of the M&T program, a second phase is focusing on bringing in Energy Service Companies (ESCOs) to develop medium-cost efficiency projects. The use of M&T is being extended to other regions.

Ongoing and Planned Activities

In 1996, ESMAP was involved in 18 energy-efficiency projects or projects with significant energy-efficiency components in 15 countries. Energy-efficiency projects accounted for about one-quarter of the total ESMAP portfolio in 1996. Efficiency projects ongoing or launched in 1996 are summarized in Table 2.1, which also shows the considerable impact of these projects in catalyzing follow-on activity.

In Latin America, ESMAP, in partnership with the Inter-American Development Bank (IDB), the EU's THERMIE and SYNERGY programs, and international NGOs, pursued the implementation of a regional M&T project launched in 1995. The countries involved are Peru, Colombia, and Brazil. Initial results indicate considerable success. This can be attributed in good part to the fact that each of the countries is in the process of introducing sectorwide reforms supportive of efficiency projects. Other key factors have been the active participation of target groups, particularly in the private sector, and their willingness to invest in pilot projects. Obstacles encountered to date include the limited capacity to prepare financial and economic analyses of potential projects, the lack of follow-on programs, and the difficulty of accessing finance for efficiency measures.

Based on the success of M&T in Latin America, ESMAP is planning to introduce or expand the program in other regions. Most Latin American programs have also led to follow-on activities within the region. In Brazil, the work completed under the M&T project will be extended under a \$300 million energy-efficiency project now in preparation. The project, which will be cofinanced by the World Bank and other institutions, is scheduled for appraisal in November 1997 and will include the following components:

- A pipeline of pilot demonstration efficiency projects on the supply and demand sides that will be implemented by distribution utilities, ESCOs, and energy contractors.
- A mechanism for financing and institutional development to replicate successful pilot projects in other states in Brazil
- An information component to disseminate best practices.

In Africa, ESMAP has a number of efficiency projects under way. Directed at the power subsectors in Zambia, Tanzania, and Kenya, the projects are expected to result in efficiency gains on the supply side, through reductions in power generation losses, and on the demand side, through better load-use management and end-use efficiency retrofits. The projects promote cooperation between power utilities

and consumers to identify and implement efficiency measures that would alleviate current bottlenecks in power supply and allow deferral of capital expenditures on new generating capacity.

Table 2.1 ESMAP Technical Assistance Activities in Energy Efficiency

Region/country	ESMAP activity		Follow-on activity	
	Type of TA	Proposed ESMAP TA	Lending and efficiency components	
AFRICA				
Regional Electricity Demand Management TA Phase II (Ghana, Kenya, Tanzania), US\$100,000	<ul style="list-style-type: none"> • Identification and support of demand management measures • Application of lessons from experience 		Ghana Thermal Power Project Electricity Efficiency and Load Management, US\$8.5 million	
Tanzania Power Loss Reduction and Distribution Expansion, US\$765,331 TA to DOE & Tanesco, US\$757,284	<ul style="list-style-type: none"> • Development of loss reduction programs (tech. & nontech.) • Assistance on Demand Side Management (DSM) techniques and assessments of DSM 		Tanzania Power VI DSM Measures, US\$2.7 million SSM Rehabilitation and Maintenance, US\$40.9 million	
Zambia Energy Sector Restructuring, US\$563,071	<ul style="list-style-type: none"> • Development of energy-efficiency & conservation programs 			
ASIA				
China Institutional Strengthening & TA in Rural Power	<ul style="list-style-type: none"> • Power efficiency pilot study 		World Bank power loss reduction project under discussion with government	
Mongolia Energy Efficiency Program, US\$690,150	<ul style="list-style-type: none"> • Development of an energy-efficiency strategy and action plan for district heating and power sector 	Efficiency Services Pilot Projects on Electricity Energy Efficiency, US\$258,274	Loss Reduction Project District Heating Conversion Project (ADB), US\$40 million (approximate)	
Vietnam Domestic Fuel Efficiency TA, US\$199,300	<ul style="list-style-type: none"> • Improvement of energy efficiency in the domestic fuel sector 	Energy Effic. & Conserv. Energy-efficiency strategy Implementation of DSM Codes and Labeling, US\$286,581		
LATIN AMERICA				
Bolivia Energy Efficiency and Environment, US\$388,205	<ul style="list-style-type: none"> • Evaluate energy consumption • Environmental effects of energy consumption 			
Brazil Bahia End-Use Energy and Effluent Management Strategy TA, US\$50,000	<ul style="list-style-type: none"> • Energy-efficiency strategy • Development of a strategy and action plan on Monitoring and Targeting (M&T) for energy mgmt. In industries 		Energy Efficiency Project US\$300 million	
Electricity Efficiency Phase II FINEP, US\$90,000	<ul style="list-style-type: none"> • Definition of key elements of strategy to transfer M&T technology to Brazil 		Efficiency Pilot Demonstration Subprojects Financing for Utilities, ESCOs SSM Rehab. and Maintenance IDB Pilot Project (ongoing), US\$20 million	
Mexico Energy Efficiency Management Assistance, US\$107,587	<ul style="list-style-type: none"> • Address deficiencies identified in review of CONAE's performance 			
Peru Training Energy Management Services, US\$215,000	<ul style="list-style-type: none"> • Institutional straightening • Development of energy-efficiency programs 		IFC project under consideration	
Regional Energy Mgmt. Services (Brazil/Peru/Colombia), US\$70,790	<ul style="list-style-type: none"> • Preparation of an action plan to demonstrate state of the art technique on end-use energy and effluent mgmt. operations 			
End-use Energy Management (Colombia/Peru), US\$50,000	<ul style="list-style-type: none"> • Development of comprehensive tech. transfer strategy 			(Will merge with above regional project on Energy Management Services)
CENTRAL & EASTERN EUROPE				
Regional District Heating I and II, US\$625,000	<ul style="list-style-type: none"> • Comparative assessment of various heating systems 			
Slovak Republic Efficiency TA, US\$312,500	<ul style="list-style-type: none"> • Demonstration of monitoring and targeting techniques 			

The African projects have been only partially successful. Failure to implement power sector reforms was partly responsible. Inappropriately low tariffs reduced or vitiated incentives to invest in energy efficiency. Lack of support by government entities charged with promoting and implementing energy-efficiency programs was also a contributing factor. In most cases, energy audits designed to highlight areas for improvements in efficiency were not successful due in large part to the lack of technically qualified consultants. In several cases, commitment of utility management to achieving supply efficiencies was lacking, or efficiency consultants were not sufficiently experienced to implement demand-side management measures. On the positive side, industry receptiveness to efficiency programs has been high, and a number of enterprises have taken steps on their own to reduce energy consumption through improvements in efficiency.

In Asia, political uncertainties in Pakistan have contributed to the inability of the government to introduce fundamental reforms needed and agreed upon with ESMAP to enable the National Energy Conservation Center (ENERCON) to carry out its work as the lead agency for energy-efficiency work. ESMAP managers have recently concluded that, unfortunately, the efficiency project in its present form should be terminated. Pakistan has, however, implemented a number of reforms in the power sector that create opportunities for cogeneration and ESCO operations. ESMAP is now investigating how the remaining project funds can be used to reformulate the project to develop these opportunities, primarily through the private sector.

In Mongolia, field work has been completed to prepare an energy-efficiency strategy and action plan for implementation in district heating and power sectors.

In China, ESMAP staff is supporting the World Bank's operational division in designing a US\$190 to \$240 million energy-efficiency project that focuses on several tasks:

- Creating three pilot Energy Management Companies (EMCs) in three provinces: Beijing, Liaoning, and Shandong. The EMCs will identify, finance, and execute energy-efficiency projects in targeted industries.
- Strengthening the energy information dissemination efforts by developing best practices and technical guides for financial and technical managers in the industrial sectors. The Energy Information Center will function under a performance contract between the government and the Center.
- Creating financial mechanisms to replicate the experience in other provinces during a second phase.

ESMAP energy-efficiency work in Central and Eastern Europe is directed at district heating (DH), a major source of heat there for households and for the commercial sector. ESMAP staff has been increasingly involved in preparing and appraising DH projects for financing by the World Bank and others. Assessment and review of the DH sector highlights the need for extensive rehabilitation of many systems to alleviate efficiency losses as high as 50 percent and to reduce harmful air emissions. Most DH studies and projects focus on rehabilitating existing plants and transmission and distribution systems to reduce the high energy and water losses. More work must be done on the demand side of DH systems, where high losses occur, as well as on assessing the long-term cost effectiveness of alternative heating systems.

A first step by ESMAP toward improving efficiency on the demand side was made in the Lithuania Housing Rehabilitation project, for which a \$10 million loan was approved by the World Bank in 1996. ESMAP provided basic information used in preparing the project, including a household energy and appliance survey and a pilot feasibility study on the potential for rehabilitating apartment buildings to reduce heat losses and improve heating controls at the building level.

Also during 1996, ESMAP launched six case studies as part of a study, Increasing the Efficiency of Heating in Central and Eastern Europe, that investigated heating options that are technically and economically efficient, environmentally sound, applicable within the existing institutional structure, and financially viable. Initial results from these studies are now available and are summarized in Box 2.2.

**Box 2.2 Increasing the Efficiency of Heating in Central and Eastern Europe:
Preliminary Results from the Six Case Studies**

Six case studies are nearing completion in cities in Bulgaria, Lithuania, Poland, Romania, Russia, and Ukraine. The purpose is to evaluate options for heating that are efficient, affordable, and environmentally sound.

Initial findings indicate that

- District heating (DH) systems will provide the lowest cost options where heat and water losses are relatively low and opportunities for cogeneration are high. This may be true even when heat densities are not particularly high.
- Decentralized options may be preferred where network losses are very high and cogeneration opportunities are limited. This is especially likely where fuel (gas) costs are low.
- Cogeneration (heat and electricity) can substantially lower the costs of district heat, but heat and electricity must be priced to cover long-run marginal costs and reflect the relative benefits of cogeneration between heat and electricity.
- DH may be preferred even without a high share of cogenerated heat when cheap fuels are available (e.g., local biomass or industrial waste heat) or when the heat density is very high.
- There is considerable scope for economic investment in improving the efficiency of DH generation, transmission, and distribution, complemented by investments to improve the energy efficiency of buildings.

In addition to its work on DH in Central and Eastern Europe, ESMAP is providing technical assistance to the Slovak Republic to demonstrate the application of M&T techniques to stimulate the development of energy management systems. This activity has been extended in 1996 to assess the feasibility of third-party financing to promote the use of M&T in Slovakia.

Energy and the Environment

ESMAP activities in the energy and environment thematic area expanded in 1996 to include the following:

- The Clean Coal Initiative to reduce the adverse environmental impacts of coal production, transport, and use
- The management of the Environmental Manual for Power Development project
- A study of opportunities to reduce the flaring of natural gas associated with petroleum production
- A study of measures that can be taken primarily from within the energy sector to reduce the environmental impacts of motorized transport.

Parallel ESMAP programs in support of efficiency, energy trade, and renewables complemented these initiatives in addressing environmental concerns.

Clean Coal Initiative

Over the next 15 years, world coal use is expected to grow by more than 2 percent annually. Growth in China and India alone will account for more than 60 percent of this incremental coal demand and 40 percent of world coal use projected for 2010. The adverse environmental impacts of coal production and use range from the displacement of populations and land degradation associated with mining to smoke and acid rain from combustion. Many developing countries have been reluctant to implement pollution prevention programs out of a concern that this would require the sacrifice of productive investments in economic growth. Increasingly, however, developing countries are recognizing that pollution itself imposes a high cost in health impacts, damage to buildings, and potential losses in forest and agricultural production caused by sulfur deposition. Global warming is also a serious issue associated with coal combustion. Although they are not yet obliged to take specific steps under the Framework Convention on Climate Change, developing countries are recognizing the need to reduce the rate of growth of greenhouse gas emissions, notably carbon dioxide. If coal is to remain an important fuel for the medium term, it must be used in a manner that mitigates its harm to the environment.

The response of the World Bank and ESMAP to this challenge is the Clean Coal Initiative (CCI), a joint activity aimed at promoting the use of clean coal technologies throughout the “coal chain”—from mining and production through transportation, conversion in power and heating stations, and waste disposal. The CCI is intended to assist client countries in (a) identifying barriers to improving the efficiency and environmental performance of the coal energy chain; (b) removing these barriers by developing and implementing reforms and restructuring in the coal transportation, and conversion sectors; (c) developing and enforcing appropriate environmental standards; and (d) demonstrating clean coal technologies.

The CCI was formally launched at a roundtable in June 1996 sponsored by the World Bank and ESMAP. Participants at the roundtable were unanimous in their support. The World Bank undertook to investigate mechanisms for funding the CCI as well as opportunities for pilot projects and activities to undertake jointly with client countries.

Since the roundtable, discussions have been initiated with the government of China concerning a study to identify the scope for efficiency and environmental improvements in the coal sector. To support the Initiative, a senior power engineer who specializes in clean coal technologies has joined Bank/ESMAP staff and is now working with other ESMAP staff on a study being carried out jointly with the Beijing Electric Power Institute to assess the environmental impacts of various power sector development scenarios, including the implementation of clean coal programs. This work is being carried out as part of a broader study by the World Bank, *China's Environment in the 21st Century*.

Partnerships and informal collaborative relationships on clean coal issues have been established with the IEA (Working Party on Fossil Fuels and the Coal Research Board), the U.S. Department of Energy, the CARNOT program of the European Commission, and the Electric Power Research Institute (EPRI).

Environmental Management for Power Development

The Environmental Management for Power Development Program began in 1993. Its primary purpose was to develop the Environmental Manual for Power Development (EM), with particular emphasis on preparation of a computer model for estimating life-cycle emissions across the full power chain. The EM's computer model was released in mid-1995. The project was then brought under ESMAP for management of the dissemination and training phases. The EM has since been distributed to about 250 potential users by post and through the Internet. A World Wide Web site has been established to provide access to the EM model and EMPower Info, an information base on fuels, technologies, environmental standards, and

evaluation methodologies. A user network to provide the opportunity for general information exchange and access to expertise on particular questions has been designed and will soon be implemented.

The Environmental Management for Power Development home page
on the World Wide Web:

<http://www.worldbank.org/html/fpd/em/emhome.htm>



EM implementation and dissemination activities include training workshops and case studies, which are being carried out in close collaboration with the German technical assistance corporation, the Gesellschaft für Technische Zusammenarbeit (GTZ). Activities supported by other organizations, including the ODA (Vietnam Power Sector Study and in a study on India, Environmental Issues in the Power Sector) and USAID (an analysis in the Office of Energy and Environment of effectiveness of projects in reducing greenhouse gas emissions), are using the EM model and EMPower Info system. ESMAP has also carried out several studies jointly with World Bank support, notably in the Philippines (Environmental Assessment of the National Power Development Program and Pricing Study for the Use of Natural Gas) and in China, in connection with the study China's Environment in the 21st Century. The Chinese team working on this study has prepared inputs to the EM model on more than 100 power plants and transportation portions of the coal chain for Hunan province.

It was recognized at the time the model was released that linkage with planning models for power system generation would be needed to increase the usefulness of the EM. Through the work on power studies for the Philippines, an extensive spreadsheet model was prepared that permits the assessment of emissions over a 20-year period based on the annual generation by each type of power plant according to its position in the merit order for dispatch. This model, together with the EM, is being used to assess strategies for abating greenhouse gas emissions being undertaken as part of the Global Environment Facility (GEF) Global Overlays Program and the Carbon Backcasting Study, funded in part by ESMAP donors. Additional work is under preparation for a World Bank/ESMAP assessment of the environmental impacts of the proposed Southern Africa Power Pool (SAPP).

Natural Gas and the Environment

Natural gas has been the focus of much attention during the year. In comparison with other fossil fuels, natural gas produces far less pollution from CO₂ and SO₂ when burned. However, when gas is flared or leaked, it contributes to the greenhouse gas burden of the atmosphere and to global warming. Careful and efficient use of the resource is thus essential.

The Africa Gas Initiative (AGI) attempts to increase the local utilization of clean-burning indigenous gas in Sub-Saharan Africa while reducing gas flaring and excessive use of biomass that results in deforestation. The AGI continues to progress. Projects currently include the development of LPG for domestic uses and the use of natural gas for power generation. Extensive work has been started in Angola, Cameroon, Congo, Côte d'Ivoire, Equatorial Guinea, and Gabon to create a proper enabling environment for gas utilization.

During the last quarter of 1996, ESMAP initiated a project aimed at reducing the flaring of natural gas that is produced in association with crude oil. The flaring of this "associated gas" has been common practice. By identifying workable combinations of incentives and enforceable regulatory measures, the project is expected to promote utilization of associated gas. A number of the countries included in the

study are listed in Box 2.3. The evaluation conducted in Angola has already begun to produce results. Gas associated with oil production in Cabinda can be recovered and used for LPG production, power generation, and other industrial uses. Today, AGI with Chevron and Sonangol, are preparing tenders for an energy intensive industrial park, to use up to 10 million cubic feet per day of natural gas in the manufacture of products for local consumption. Over a dozen potential tenants have been identified or expressed interest in the proposed park. Flaring will be reduced and gas used to the benefit of the local economy. Gas is already being used for power generation.

Box 2.3 Reduction of Gas Flaring

Substantial quantities of gas associated with petroleum production continue to be flared throughout the developing world because of a lack of a ready market for that gas. Flaring is a significant global source of greenhouse gas emissions, contributing annually about 10.5 million tons.

ESMAP studies have already been started in West Africa, and further opportunities are being identified elsewhere. Current priorities are as follows:

- *Angola.* As of mid-1995, more than 455 BCF of associated gas was being flared. This figure will reach more than 525 BCF by the year 2000. A large potential to use flared gas exists, but mechanisms need to be established for the government and international oil companies to make use this resource.
- *Cameroon.* Offshore associated gas has been flared for more than 17 years. The state oil company, Société National des Hydrocarbures, and government agencies are exploring the best ways to eliminate or minimize flaring, including processing the gas for LPG recovery. Possible approaches are to work with the international oil companies operating in the country, suppliers of gas treatment facilities, and, to a lesser extent, international development agencies.
- *Congo.* Gas is either used on offshore drilling rigs to generate power or flared with no domestic consumption. If flaring continues at current rates, one-half or more of current reserves will be flared between 1996 and 2017. Policies are being developed so that sufficient quantities of gas can be used for power generation and LPG production.
- *India/Bombay High.* Natural gas flaring fell to 7.45 percent of production in 1995 from 38.33 percent in 1985, but about 159 MMcfd continues to be flared. The World Bank provided a loan of \$450 million and was instrumental in catalyzing the effort to use formerly flared gas productively, but gas consumption is still being held back because of lack of an adequate transmission and distribution infrastructure.
- *Malaysia.* Effective use of gas was minimal until the early 1980s, when Malaysia began to reexamine the role of associated gas. Extensive efforts have been made to reduce flaring, particularly through the Baram Delta Gas Gathering System. An extensive legal and regulatory framework has been developed, and this system will be analyzed in greater detail, by ESMAP, to assist other countries.
- *Nigeria.* This country is responsible for over 25 percent of associated gas flared or vented all over the world, with an estimated 2 BCF of gas being flared daily. Elimination of flaring at the Escravos project alone could reduce global CO₂ emissions by approximately 18 million tons over its lifetime. Large-scale LPG production for export is another possibility. An LNG project at Bonny Island that would utilize associated gas has also been launched.

Unplanned emissions and leakage of natural gas to the atmosphere are not only wasteful but also environmentally damaging, since methane is a potent greenhouse gas. Much of this leakage occurs in the pipeline systems of oil and gas producing developing countries. A project is planned for 1997 to survey the natural gas systems in these countries, to assess the likelihood of leakage, and to recommend monitoring and mitigation measures that would minimize future unplanned emissions.

Energy, Transport, and the Environment

In an effort to focus on energy and transportation and the associated environmental issues, ESMAP is currently pursuing a lead phase-out program in Latin America and a study on energy and transport.

This past year, the ESMAP project, Elimination of Lead in Gasoline in Latin America and the Caribbean, has been very successful in facilitating the phase-out of lead additives throughout the region. Lead, one of the most toxic substances still widely used in gasoline today, has serious health effects, particularly on children. The project has acted as a catalyst for accelerating the formulation and implementation of national lead phase-out action plans in Peru, El Salvador, Jamaica, and Trinidad and Tobago. In addition, the project has provided a forum for: collecting up-to-date information; encouraging dialogue among officials from central and regional governments, ministries, and nongovernmental organizations; and assisting inter-country communication and cooperation. Since 1990, the use of lead in gasoline in Latin America and the Caribbean has decreased from 27,400 tons to 10,300 tons in 1996, and is projected to decrease to 6,400 tons by the year 2000.

Finally, the hands-on training session for policymakers provided under the auspices of this project raised awareness on the main pollutants and the primary health effects associated with motor vehicles, and major types of measures for controlling air pollution. As a result, complementary activities have begun under the project to address air quality standards and monitoring and reformulation of fuel specifications. Thus the countries in the region have drawn up plans not only for lead phase-out, but also for integrated air pollution abatement strategies. Plans are now under discussion for introducing lead phase-out projects in other regions.

Recently, in response to wishes expressed by several members of the CG, ESMAP commissioned a study, Energy, Transport, and the Environment, to assess options within the energy sector for abatement of the adverse environmental impacts of transport activities. In preparing the terms of reference for the study, it was apparent that many intersectoral issues relating to urban and transport planning, road-user charges, traffic management, and the location of economic activities affect the ultimate impact of transport on the environment. The full range of these issues will be examined, although the study will provide extensive treatment of only market-based instruments and policy based measures operating primarily from within the energy sector. The study will focus on local and regional impacts arising from particulates, NO_x, low-level ozone, and volatile organic compounds. It will assess the transferability to developing countries of technologies and policies used in industrialized countries.

Energy Sector Reform

Interest in energy sector reform in developing countries and transition economies remains high. Governments have been seeking to enhance the performance of their energy sectors by expanding the role of the private sector in both management and finance.

Power Sector Reform

Reform of the power sector in many developing countries continued to progress rapidly during 1996. Latin American and South East Asian countries are leading a trend toward increasing involvement by private investors as governments open up their power sectors to competition by unbundling existing utilities and seeking to create independent regulatory mechanisms.

In Latin America, strategic investors have purchased existing assets through competitive tenders, and some companies have sought stock listing. New investment has been encouraged by private investors especially in power generation. The formerly government-owned utilities have been sold off, power pools formed, and open access provided to generators. The latest country to move forward has been Brazil, which has begun to sell state and federal utilities and plan for regulation and creation of a more competitive power sector.

In South East Asia, the single buyer model is clearly becoming the model of choice. Existing utilities are being broken into separate companies, starting first with generators, for example, in Thailand, Indonesia, the Philippines, and China. Each of these countries has prepared new electricity laws covering regulation or is in the process of doing so. Reforms will not stop here, though. It is expected that they will be extended to provide open access to transmission systems and to competition at the supply level especially for larger consumers. Power pools and regional power markets will evolve. In other regions, several countries made substantial progress in reforming their power sectors, notably Bangladesh, the State of Orissa in India, Ukraine, Hungary, Georgia, and Morocco.

During 1996, as summarized in Table 2.2, ESMAP played an increasingly important role in supporting private power development, new electricity laws, and regulation. These efforts were carried out in projects specifically identified as reform activities and through reform components of other ESMAP activities. As in other areas, ESMAP's support of power reform at the country level can be expected to result in significant follow-up activity. On a more general level, in May 1996, ESMAP, in conjunction with the ESMAP CG meeting, cosponsored the Third Annual Roundtable on Independent Power Projects (IPPs) in Washington, D.C. This event was attended by more than 200 delegates from the private sector, governments, developing-country officials, IFC, MIGA, and the U.S. Department of Energy (also a cosponsor). This meeting reviewed recent history of the growth of the industry and concluded that governments need to do more to foster private power development through creation of better laws and regulations, and transparent competitive bidding and selection processes. So far, only a handful of countries have created suitable enabling environments. Sessions were arranged to obtain the perspectives of the leading developers and emerging market governments. Special attention was given to the potential for IPPs in small power systems typically found in many African and Central American countries and opportunities and challenges facing developers of private hydro plants. A final session discussed power sector reform and financing options for IPPs.

In Kenya, ESMAP conducted its first private power seminar in Africa for officials from Kenya, Tanzania, Uganda, and Ethiopia. All these countries are showing strong interest in development of IPPs, and some projects are at an advanced stage of preparation and development, though none have yet reached financial closure. The program included highly experienced bankers, technical and legal advisors, and Bank staff.

Another activity focused on the discussion and review of ESMAP's Energy Assessment for Uganda, which was completed last year. Participants were invited from the government and the private sector to meet with Bank staff and international experts. Panel discussions took place on the issues, findings, and recommendations covering a proposed legal framework for the power sector, petroleum, renewable, and traditional forms of energy. The conclusions and recommendations of the panels were disseminated to participants following the workshop.

ESMAP support for development of an energy law and establishment of an Energy Regulatory Authority continued in Poland, financed principally by the Dutch Ministry of Economy and the U.K. Know-How Fund. The law was passed toward the end of 1996 by the lower house of Parliament, and final approval appears imminent. This will clear the way for appointment of a regulator and establishment of a regulatory body. In parallel with ESMAP's work in Poland, the European Union and the Overseas Development

Administration (ODA) of the U.K. have been supporting development of secondary legislation and more open electricity markets and power pooling mechanisms. These changes will help to open the Polish energy markets to substantial private groups that are interested in investing in energy projects.

Table 2.2 Impact of ESMAP Technical Assistance Programs: Power Sector Reform

Region	ESMAP activity		Follow-on activity		
	Country	Type of TA	ESMAP TA	Lending	Other
AFRICA	Guinea	<ul style="list-style-type: none"> • Decentralized networks • Regulatory • IPP Workshop • Cogeneration • Study tours 		IDA credit	2 IPP contracts signed
	Kenya				
	Malawi		Commercialization		
	Southern Africa		Electricity market development		
	Uganda	Energy assessment	Restructuring options		IPP under consideration
	Zambia	Commercialization			
ASIA	Cambodia	Commercialization			IPP under consideration
	Laos	Decentralized networks			
	Vietnam	<ul style="list-style-type: none"> • Restructuring options • IPP Workshop 	Legal & regulatory framework	IDA credit	2 IPPs under review
REGIONAL	Africa	Power sector reform symposium			
	Central Europe	Review of power sector reform			
GLOBAL		IPP roundtable			

Notes:

1. Regional projects have had considerable impact on influencing the need and scope of power sector reform, private participation, and regional electricity trade.
2. Power Sector Reform Symposium held in South Africa for all of Sub-Saharan Africa has generated technical assistance projects geared to sector reform in Rwanda, Guinea, Senegal, Uganda.
3. The Annual Bank/IFC IPP Roundtable has led to opening of the power sector and IPP proposals and contracts in Kenya, Uganda, and India.
4. An ESMAP report on the legal and regulatory frameworks in selected Central European countries is under preparation.
5. The scope and potential for decentralized networks in small countries is being studied under ESMAP rural energy projects. These projects are included here because of the "private participation links" for designing replicable financing models for developing such networks.

Also during 1996, ESMAP commenced work on a project to assist the Ministry of Industry in Vietnam in preparing an electricity law and regulations. This follows up on the recent restructuring of the sector through formation of Electricity of Vietnam (EVN), a holding company responsible for electricity supply in Vietnam, and an ESMAP-sponsored workshop in 1995 that reviewed options for further reforming the power sector in Vietnam. A draft of the new law has already been prepared, and a timetable has been established for its consideration by the government.

Reform in the Hydrocarbon Sector

Reform in the hydrocarbon sector has taken various courses in developing countries and transition economies. Many countries, including Argentina, Bolivia, Russia, and China, have opened upstream oil activities (development and production) to the private sector. Further downstream, petroleum refining and marketing have also been opened to the private sector in some countries (e.g., Argentina, Peru, Chile, Thailand, Malaysia), although the governments continue to control or regulate certain aspects of the industry.

Reform in the gas sector has progressed more slowly. Although some countries have opened upstream activities to the private sector, the downstream segment has traditionally remained largely under state ownership. Recently, however, a number of gas-producing countries have initiated programs to open transmission and distribution activities to the private sector. Developing countries will need substantial assistance in this area, particularly in learning about the experiences of industrial countries.

In the past, ESMAP has provided major assistance to developing countries in reforming their petroleum sectors. In recent years, ESMAP has placed special emphasis on reform of the gas sector. In 1996, two reports, on Bulgaria and Romania, were issued, each providing recommendations on gas sector restructuring. In Vietnam, ESMAP provided assistance to the government in preparing production-sharing contracts and contractual arrangements for government and private sector development of offshore gas deposits (see Box 2.4). In projects such as the one in Vietnam, where just-in-time advice is provided to countries, no blue cover ESMAP report will be issued.

Box 2.4 Hydrocarbon Reforms in Vietnam

A project for exploiting significant quantities of nonassociated gas from fields in Nam Con Son Basin is currently being negotiated between the producers and PetroVietnam. In its initial phase the gas is planned to be utilized for power generation and urea. The basis for the development of new gas fields would be a gas supply agreement with the producers. To facilitate the contractual framework, the state-owned electricity company, Electricity of Vietnam (EVN), and PetroVietnam requested technical assistance from ESMAP, including terms for natural gas production-sharing contracts, gas purchase contracts, and a review of their gas master plan.

ESMAP assisted the government, EVN, and PetroVietnam by (1) reviewing reserves and achievable production scenarios, (2) proposing a legal and regulatory framework, and (3) suggesting reforms in industry structure. ESMAP also arranged training workshops for the staffs of EVN and PetroVietnam in relation to gas fiscal regimes and production-sharing contracts in other parts of the world, as well as on international practices in gas sales and purchase contracts.

ESMAP has been active in the privatization of Bolivia's hydrocarbon sector for several years. In 1996, an ESMAP project to design tariffs for gas transmission and prepare regulations to support the Hydrocarbon Law was completed. In a follow-up project, the government requested assistance to review and develop regulations for implementing the new Hydrocarbon Law and the associated regulatory legislation. The principal task included a review of existing safety and environmental regulations and their adaptation to the principles of the hydrocarbon law. New draft safety and environmental regulations for exploration and production, drilling, construction, and operation of petroleum facilities were also provided. World-class expert consultants were hired by ESMAP to provide hands-on advice to the government lawyers who prepared the official regulations.



“Pigging” a natural gas pipeline, Sarajevo.

Photograph courtesy of Ian Morrison

International Energy Trade

Electricity Trade

The potential benefits of international trade in electricity are numerous, as illustrated in Box 2.5.

Box 2.5 Benefits of Regional Electricity Trade

Regional electricity markets are attracting growing attention. A number of regional trading arrangements are now under discussion or implementation. The potential benefits of such arrangements are considerable and include the following:

- Increased reliability of national networks and, as a result, reduction of national reserves. For example, Zimbabwe estimates that it will be able to reduce its reserve capacity by 5 percent with the advent of the Southern Africa Power Pool (SAPP) regional market.
- Reduction of investment costs stemming from achievement of economies of scale.
- Reduction of operational costs through complementary load requirements (in the Nordel market of Scandinavian countries, for example, the average saving is about 20 percent).
- Diversification of energy sources (thermal versus hydro).
- Postponement of investment made possible by imports (for example, Botswana is contemplating delaying a 200 MW investment for several years after the opening of a new interconnection between Zimbabwe and South Africa through Botswana).
- Reduction of adverse environmental impacts made possible by regional cooperation and access to the most environmentally benign sources of production in a given region (hydro in particular).

To date, however, international trade in electricity has been limited and, where it has occurred, confined to long-term bilateral contracts for firm energy supplies. This is attributable partly to the result of a lack of economic and political cooperation between countries and partly to the absence of power sector reforms in individual countries that would support more flexible trading relations. Recent years have seen changes in both areas.

The opening of borders and the increasing development of economic cooperation, competition, or both between countries are providing new opportunities for international transport and trade of electricity.

Further, the ongoing worldwide restructuring of power markets and the increased participation of the private sector are providing more flexibility, more competition, and a new look at international power trade issues. Vertical unbundling of the power sector frees the distribution function from generation and unlocks transmission bottlenecks. Horizontal unbundling promotes competition at the production and distribution levels. International wheeling agreements based on compatible legal and regulatory systems allow distribution companies to look for the cheapest sources of production, including importation.

Several regional electricity trading markets are presently under implementation or discussion. In Southern Africa, the 12 countries of the Southern African Development Community (SADC) are implementing a pooling structure between several of them (at least six countries are involved in a first step: Zambia, Botswana, Zimbabwe, Mozambique, South Africa, and Zaire). In East Asia, the countries of the Mekong valley—in particular, Thailand, Laos, Vietnam, Cambodia, and the Yunnan Province of China—are contemplating the development of trading facilities. In Latin America, the countries of the Mercosur area (Argentina, Brazil, Paraguay, and Uruguay) are discussing similar development between themselves and with Chile. In Central America, Guatemala, El Salvador, Honduras, Nicaragua, Costa

Rica, and Panama are reactivating an old trade project (SIEPAC). In the North African region, countries of the Maghreb and Mashreq subregions are also interested in developing regional electricity markets.

ESMAP has been at the forefront in studying the prerequisites and constraints related to regional power markets and pooling arrangements. Workshops and seminars, both within the Bank and outside, have been organized to support and disseminate the accumulated experience and knowledge in these matters.

With the support of the U.K.'s Overseas Development Administration, ESMAP undertook a review of the organizational and economic issues faced in different regions of the world with respect to enhancing international electricity trade markets. The analysis was based on experiences accumulated in different regions of the world. The lessons learned, conclusions, and recommendations were recorded in a series of comprehensive reports and are summarized in Box 2.6.

Box 2.6 Prerequisites to International Electricity Trade

An ESMAP analysis of international electricity trade experience, cofinanced by the U.K.'s ODA, identified a number of lessons for future projects, including the following:

- The development of any international electricity market requires trust and compatibility (on technical standards as well as legal and regulatory structures) between the different partners.
- The national power sectors should be both vertically and horizontally unbundled.
- The role of the transmission companies is crucial. At the national level, third-party access (TPA) is a key factor for competition both on the supply and demand sides.
- Implementation of pooling structures, particularly in the form of "loose pools." In a loose pool, a regional coordinating center provides a permanent flow of technical, economic, and financial information between the different national dispatching centers. The coordinating center can also play the role of clearinghouse for the financial transactions, provide transparency to the trading activities, and facilitate the financial settlement of exchanges and the arbitration of conflicts.

ESMAP's current efforts are directed at support of the South Africa Power Pool (SAPP). Support to projects in the Mekong, Central America, the Maghreb, and Central Africa is under consideration.

International Gas Trade

Proposals to build transnational gas pipelines have emanated from many sources. Many of these projects would provide substantial benefits to both importing and exporting countries and involve reputable sponsors. However, these projects have been in a state of flux for the last 5 to 10 years.

The large, fixed nature of pipeline investments makes them risky. The main difficulty with transnational projects is that the perceived risks increase exponentially when two or more countries are involved. Attracting equity and loan finance to such a project requires a coincidence of desirable political and economic conditions in all countries linked to the pipeline, the probability of which is far smaller than in the single-country case.

Because the required conditions occur only rarely, development of transnational projects has been limited. It tends to be concentrated in certain producing and consuming countries that sustain stable conditions. In the past, this has translated into situations where both the exporter and the importer are industrialized countries, or in a few cases, where exports originate from a developing country but are destined for an industrialized country. Transnational projects involving only developing countries have rarely materialized despite the significant benefit they could have for both the exporting and importing

countries. The Bank's dialogue with potential investors and financiers indicates that such projects are unlikely to materialize unless they are supported seriously by the governments concerned and by the global and regional development banks.

However, before transnational projects become bankable, the major players must be coordinated, the viability of the project must be established, and the contractual framework between the exporting and importing countries must be structured. ESMAP is in a unique position to provide assistance in these areas.

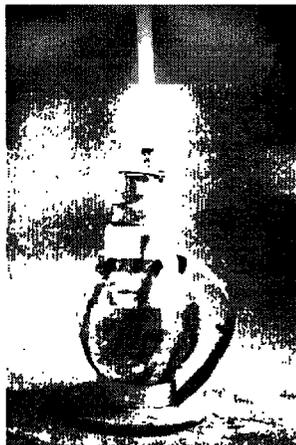
In 1996, ESMAP and the World Bank cooperated to organize a roundtable of major interested parties in Washington, D.C. The forum provided an opportunity for private companies, financiers, and corresponding governments to review constraints to implementing transnational gas projects. Also in 1996, ESMAP started a study on the gas export potential of Central Asia. The first phase of this study focuses on Kazakhstan and is aimed at developing a strategy for gas utilization in the country as well as gas trade with neighboring countries.

Rural and Household Energy

Rural Energy Action Plan

Rural and low-income urban dwellers want expanded energy services and often are willing to spend a substantial part of their disposable incomes to obtain them. These investments result in significant benefits in productivity and quality of life. Unfortunately, rural and urban populations have limited access to modern energy sources. Their energy choices need to be enlarged through developing and providing access to a greater variety of energy services, and overcoming the high up-front costs of better energy services.

Rural and household energy issues have received increased attention in recent years. This is the result of the growing importance of poverty reduction, environmental protection, local participation, and economic development. In the past, government and multilateral lending efforts in this area often involved central planning, substantial subsidies, and low levels of local involvement and support. These interventions have contained useful components, but it has become clear that sustained success requires a reorientation of rural energy strategy. ESMAP has stressed the need for a demand-driven strategy more explicitly based on local needs and local markets and emphasizing multiple fuels, multiple borrowers, sometimes smaller projects, greater local participation, and higher local investment. This strategy, which has been adopted by the World Bank, is summarized in Box 2.7.



Artisanal kerosene wick lamp. Sri Lanka. The lamp provides only about one-sixtieth of the light of the incandescent bulb from which it was made.

Energy for the Poor, p. 104

Box 2.7 Rural Energy and Development: The World Bank's Action Plan

Nearly two billion people are without access to modern forms of energy, such as electricity and petroleum products, and an equal number of people are reliant on biomass for cooking all of their meals. The emerging strategies that promise to make a real difference for rural people require a new and powerful commitment by the World Bank and its partners. The Bank is committed to devoting significantly more attention and resources to the alleviation of the "energy poverty" of large portions of the developing world's population. The Bank intends to base its efforts to provide better access to energy for rural people on five main principles:

- Provide for greater consumer choice.
- Ensure cost-reflective pricing.
- Overcome the high-first-cost barrier.
- Encourage local participation in projects and energy development schemes.
- Implement good sector policies.

The action plan for implementing the above principles involves a multidimensional approach. Technical assistance, training, regional workshops, and other means of developing local ownership of programs are essential. The Bank needs to mainstream rural energy in its lending and assistance projects. Best practices in this field need to be promoted, particularly in the light of past projects that have failed because of unsound design and management. Bank staff also need training to improve the institution's capacity to deal with rural energy issues. Special efforts should also be directed toward Sub-Saharan Africa, where rural energy development has lagged behind the rest of the world. Finally, because of the enormity of the task, the Bank needs to enter into partnerships with donors, NGOs, and other organizations to implement projects and programs to deal with rural energy problems.

Source: World Bank, Rural Energy and Development: Improving Energy Supplies for Two Billion People, Washington, D.C., 1996.

In rural electrification, the main focus of ESMAP's energy agenda is to go beyond conventional grid extension by exploring and supporting effective and economic ways of increasing provision of service to low-density rural areas and to the urban poor. These include (1) technical measures to reduce connection and wiring costs; (2) microfinancing, leasing, and other means of reducing up-front acquisition costs; (3) encouragement of private, cooperative, and joint private-public off-grid and micro-grid systems; and (4) support of solar and other renewable energy technologies together with back-up services, as increasingly important and cost-effective options for the supply of electricity in rural areas.

This approach is reflected in a number of rural energy decentralized rural electrification projects that aim to overcome market failures, avoid unwarranted subsidies, emphasize participation and institutional development, and create an environment that will give rural populations a greater choice of energy services. Box 2.8 illustrates the successful application of new rural energy approaches in Cameroon.

ESMAP has been pursuing such initiatives effectively for some time, but wider efforts are needed. The recent endorsement by the World Bank of the 1996 Development in Practice Paper, Rural Energy and Development, has significantly increased the scope for mainstreaming of rural energy. This report, which relies heavily on the experience gained through ESMAP activities, makes the crucial point that many excellent opportunities exist for improving rural energy, with high economic, social, and environmental benefits. Clusters of rural energy specialists, supported by ESMAP, have pioneered work on rural energy within the Bank and are now building a broader alliance both inside and outside the Bank. The creation of "networks" within the Bank will enable such greater cross-fertilization and Bankwide cooperation.

Box 2.8 Cameroon: Decentralized Rural Electrification through the Private Sector

Following a national workshop on decentralized rural electrification in which various government agencies, the power company, the commercial private sector, NGOs, and representatives from small towns and large villages participated, an action program was developed to achieve greater access to modern energy services under better enabling conditions.

The government agreed to review the existing regulatory framework and formulate a new set of rules that would promote rather than constrain energy development in the rural areas. The power company confirmed its commitment to promote rural electrification and made matching funds available. The private sector likewise wanted to participate, and NGOs offered expertise and contacts in the rural world to facilitate project identification and execution. The representatives of the consumers welcomed the new approach.

Currently, a pico-hydro program is under way in collaboration with the local private sector that aims not only to demonstrate the viability of this technology for Cameroon but also to transfer manufacturing technology, develop credit schemes, and popularize improved management methods.

Similarly, the development of rural electrification through solar PVs and diesel gensets is being tested. This involves the training of local villagers in operating generators and managing billing, and it also entails the organization of the village as a single consumer group. With the participation of the private sector, the delivery mechanism (import, distribution, installation, credit, and after-sales service) and the main target areas are being developed and field tested. For low-income households, one major retailing firm has decided to market a portable solar lantern at its own risk (after some initial assistance from ESMAP), drawing on ESMAP experience with this product in Kenya and Niger. The action program will result in a bankable investment project.

Currently, ESMAP is engaged in a number of activities that not only aim at developing innovative approaches to bring modern energy to rural populations but also complement planned Bank lending operations. This means that the expected output of these ESMAP operations will be mainstreamed and implemented as part of Bank lending operations. Countries in which such ESMAP activities are taking place include Benin, Bolivia, Cape Verde, Cameroon, Chad, Guinea, India, Laos, Mali, Peru, Senegal, and Togo. In each of these countries decentralized rural electrification programs have been developed or are being developed. Also, all of these programs will be executed either through the private sector, or via the public sector, but on a commercial basis and in close collaboration with the Bank's operational staff. The matrix shown in Table 2.3 illustrates a range of recent ESMAP activities in rural and household energy, including renewable energy, and the follow-ups that these activities have catalyzed.



Rural Fuelwood Market, Niger.

Photograph courtesy of Willem Floor

Table 2.3 ESMAP Rural and Renewable Energy Technical Assistance and Follow-Up Activities

Region	Country	ESMAP project		Follow-up activity	
		Type of TA	ESMAP TA	Lending	Other
AFRICA	Benin	Solar Electrification	Market survey, study	IDA credit	Private investments
	Burkina Faso	Household Energy Strategy	Household energy study	IDA credit	
		Solar Electrification	Market survey, study	IDA credit	Private investments
	Cameroon	Decentralized Electrification	Market survey, study	IDA credit	Private investments
		Pico Hydro	Market survey, study		Private investments
	Cape Verde	Wind Power Generation	Preinvestment study	IDA credit	
	Chad	Solar Electrification	Market survey, study	IDA credit	Private investments
		Household Energy project	Household energy study	IDA credit	
	Comoros	Solar Electrification	Market survey, study		IPP, private investment
	Guinea	Solar Electrification	Household energy study,	IDA credit	Private investments
		Pico Hydro	market survey, study		
	Kenya	Solar Electrification	Market survey, study,	possible IDA credit	Private investments
		Financing Mechanism	field tests		
	Kenya/Niger	Solar Lanterns	Field & marketing tests		Private investments
	Madagascar	Rural Power Generation from Biomass	Preinvestment study	IDA credit	IPP, private investment
		Rural Energy & Environment Plan	Rural energy study		
	Malawi	Rural Power Generation from Biomass	Preinvestment study		IPP, private investment
		Rural Energy Plan	Study	IDA credit	
	Mali	Household Energy Study	Study	IDA credit	
		Solar Electrification	Market survey, study	IDA credit	Private investments
Niger	Solar Electrification	Market survey, study	IDA credit	Private investments	
Senegal	Solar Electrification	Household energy study	IDA credit	Private investments	
		Market survey, study			
Togo	Solar Electrification	Market survey, study	IDA credit	Private investments	
Uganda	Rural Electrification Study	Energy assessment	IDA credit	Private investments	
		Market survey, study			
ASIA	China	Energy Assessment	Study		The 100 County Rural Energy Program (Local, State, & Central Govt. financed, \$1 billion)
		Rural Energy	Market survey, training, and TA	IDA credit	
		Renewable Energy			
	India	Nonconventional Energy Strategy		IDA credit & World Bank loan + follow-up World Bank loan	Private investments
		Mini-Hydro Assessment Bagasse Cogeneration			
		Urban Energy Study			
	Rural Energy Study				
Laos	Decentralized Rural Electrification Study		IDA credit	Private investments	
Vietnam	Rural Energy Strategy		IDA Credit		
LAC	Argentina	Renewable Energy Strategy	Study	World Bank Loan	
	Bolivia	Rural Energy Strategy	Study	World Bank Loan	
		Rural Electrification Strategy	Study	World Bank loan	Private investments
	Brazil	Renewable Energy Strategy	Study	World Bank loan	
	Peru	Rural Electrification study	Study	World Bank Loan	

Biomass

In the area of biomass, the main focus of ESMAP has been to initiate better management of wood resources by local populations. Household energy strategy studies in Burkina Faso, Chad, Guinea, Mali, Mauritania, Niger, Senegal, and other countries have been carried out and followed up by IDA credits, in many cases developed with assistance from ESMAP or the Review of Policies in the Traditional Energy Sector (RPTES). IDA credits are in place in Burkina Faso, Mali, and Niger and are under preparation in the other countries. An ESMAP activity in Madagascar led to two biomass components in an IDA

Energy Sector Development credit. The use of biomass for power generation has also been pursued in Madagascar and Malawi, and IPP-type operations are expected to follow.

Renewable Energy

ESMAP activities during 1996 have resulted in significant progress toward the goals of mainstreaming renewable energy in the Bank's agenda and contributing to international efforts to provide clean energy use. Highlights of achievements made in the past year include the following:

- *China.* Completion of a comprehensive renewable energy assessment study and initiation of a World Bank investment project
- *Solar.* Completion of planning documents for a Solar Development Company for joint implementation by the World Bank and the Rockefeller Foundation
- *Energy and Environment Steering Committee.* Creation and activation of an expert body to plan international research, development, and demonstration (RD&D) efforts on clean energy and renewables.

Project Development

ESMAP activities geared toward the development of World Bank investment projects continued to be a priority effort. Particularly significant in advancing the effort or illuminating key project development issues were the following three projects:

- *China.* This joint effort between the World Bank's Asia Technical Department Alternative Energy Unit (ASTAE) and ESMAP was completed in 1996, and a formal Bank report was issued in September 1996. The study identified immediate-term investment opportunities in grid-connected windfarms in Inner Mongolia, solar home systems in Western China, and bagasse cogeneration projects in Guanzhi province. Mainly as a result of this study, the Bank and the Chinese government have agreed to initiate the process of identifying a fiscal 1999 World Bank lending project in renewables. The study also was a successful demonstration of internal and external partnerships in a complex undertaking. Aside from ASTAE, collaboration was also made with the U.S. National Renewable Energy Laboratory (NREL), which contributed four experts during the main mission. Throughout the study, the Chinese not only provided official counterparts but made active technical and analytical contributions through three working groups.
- *Brazil.* The prospect of developing a renewable energy project in Brazil was advanced last year through ESMAP assistance provided to World Bank regional staff. The initiative fit well with ongoing efforts by the Bank to address the likely adverse consequences of the privatization of the power sector on incentives to invest in the supply of electricity to dispersed, low-income populations in rural areas of Brazil's Northeast. It was agreed to develop a market-based mechanism, to be financed by a Bank loan, for disseminating PV systems to household and productive sectors of Bahia, Ceara, and Minas Gerais. To aid investment decisions, it was agreed to conduct four background studies on domestic and productive sector markets, the adequacy of solar and wind resource data, and institutional and policy impediments to the introduction of renewables. The French government recently agreed to finance two of the market studies.
- *Bolivia.* Through previous ESMAP work, the government of Bolivia had formulated a rural electrification plan that would expand household coverage from the present 54 percent to about 78 percent by 2006. After a formal request by the Ministry of Energy for an IDA credit to finance the plan, the Bank region requested ESMAP to assist in the preparation of project concept documents, analysis of GEF cofinancing possibilities, and design of a World Bank/GEF project. ESMAP, Bank regional staff, and the Bolivians have put considerable effort into project preparation. Currently,

however, the project is on hold pending resolution of internal Bank issues related to the use of IDA credits. The main issue was whether rural electrification was the best use of scarce IDA resources, given competing demands from Bank sectors working on the provision of water supplies, roads, other infrastructure, and rural health facilities.

Other project development efforts were continued or initiated in 1996, including a renewable energy project in rural Argentina and grid-connected solar-thermal power systems in Morocco and Egypt.

Private Sector Financing of PV Systems

Photovoltaics can provide many individual households with electricity long before the central power grids reach them. The issue is how to transform the considerable private sector interest in this approach into investment through innovative delivery and financing mechanisms. In the past year, the World Bank and the Rockefeller Foundation have teamed up to address this issue. In turn, ESMAP staff have worked with IFC and Rockefeller staff to develop a forward-looking but practical business venture that could produce a quantum leap in present efforts to finance solar home systems projects worldwide. Work undertaken during concept development has led to the conclusion that a venture involving no subsidies and purely commercial financing would be premature. An alternative approach has been devised that involves quasi-commercial financing at the outset but that may be converted onto a full market basis if it proves successful (Box 2.9).

Box 2.9 The Solar Development Corporation

The concept is to form a stand-alone company, the Solar Development Corporation (SDC), as a business development and financing entity for PV operations with the potential to become commercially sustainable. Because many of the constraints to the development of PV are related to policy and institutional matters, the SDC would have an appropriate link to the World Bank. The SDC will define target countries where the potential exists for significant early market expansion. In those countries it will provide the following services:

- Market and business development assistance that will accelerate the growth of private firms in the PV business and deepen the penetration of solar home systems and other rural PV applications in the market.
- Access to precommercial and parallel financing for private firms to expand their capability in PV distribution businesses and to strengthen their ability to provide credit to end-users. The SDC itself will not engage in direct financing of the final consumer. It is intended that, as far as possible, SDC's finance will be provided in parallel with financing from financial intermediaries (FIs).

The target initial capitalization of the SDC is US\$50 million, of which US\$15 million is intended for the market and business development functions and US\$35 million for the finance window. This capitalization would serve SDC's business development needs for about the first three years of operation and prove the concept to a point where, if successful, the SDC could be spun off as a commercial enterprise. It could then raise commercial financing as well as be a candidate for the usual products of the IFC and other private sector development lenders.

ESMAP's role has been largely catalytic in providing initial funding during concept development. Funding to cover the development of the project up to the launch of the SDC has been agreed between the Rockefeller Foundation and the Bank Group on a 50/50 basis.

Technology: Forging Energy and Environment Alliances

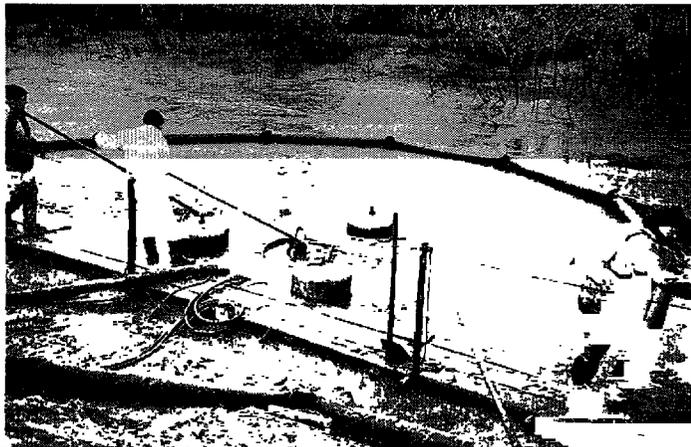
In April 1996, as part of the ESMAP-assisted Solar Initiative, the Bank convened an Energy and Environment Steering Committee (EESC) to launch a new effort to achieve the widespread adoption of

a range of affordable, cost-effective, and sustainable energy technologies. In this effort the Bank joined forces with key institutions who are actively involved and who have important contributions to make in the field. The EESC is chaired by Richard Balzhiser, who is the emeritus president of the U.S. Electric Power Research Institute (EPRI) and includes members from Kenya, India, China, Indonesia, Brazil, the Russian Federation, the United Kingdom, United States, Germany, the Netherlands, Princeton University, the International Institute for Applied Systems Analysis, the EU, UN, and IEA.

Issues proposed by the Bank for consideration at the first meeting included exploration of collaborative activities among committee members dealing with the RD&D programs of the developed countries. The potential for innovation is no less today than in the past and there are important economic and environmental returns available from such work. Clean coal technologies, renewable energy, and energy-efficient technologies share this important characteristic. Research on these technologies takes place largely in the developed countries, whereas—increasingly—their application will be in developing countries. Therefore, research itself is not enough. Rather, it must be complemented by efforts to demonstrate its commercial potential. One of the key points that emerged from the April meeting was a consensus that greater emphasis on institutional innovation is needed. In particular, collaborative work on institutional mechanisms for actually delivering new technologies in the energy marketplaces of developing countries is needed. Further, the EESC agreed to pursue work that focuses on Africa.

In February 1997, a second meeting of the EESC was held in Palo Alto, California, to focus the EESC's work on specific initiatives. It was decided to develop Committee action plans for four areas of work:

- *Biomass.* As a first step to accelerate commercial use of biomass conversion technology, the existing deployment plans of the organizations represented on the Committee will be assembled and compared.
- *Networking.* Existing information networks covering clean coal, efficiency, and renewables and specifying missing links and content deficiencies will be identified.
- *Clean coal.* The Committee will explore with China opportunities to evaluate and deploy integrated gas combined-cycle (IGCC) technology as a means of reducing greenhouse gas emissions.
- *Energy efficiency.* The scope of the efficiency work will be defined following the Bank's Energy Efficiency Roundtable to be held April 24 and 25, 1997. In all cases, as immediate follow-up to the meeting, these tasks are now being refined and made more operational.



Oil spill cleanup efforts in the Komi region of Russia.

Photograph courtesy Ian Morrison

3. ESMAP Finances and Management

Programme finances remained stable in 1996. ESMAP receipts and expenditures were about equal at \$8.5 million and were largely in line with plans set out in the ESMAP Annual Report 1995. Aggregate donor contributions (i.e., net of the World Bank's contribution), reached \$7.0 million, up from \$5.8 million in 1995. Contributions to core, which play an essential role in maintaining the Programme's cohesion and advancing its strategic agenda, increased to 38 percent of total donor funding in 1996 from 34 percent in 1995. In absolute dollar terms, core receipts totaled \$2.7 million in 1996 versus \$2.0 million in 1995. The "hybrid" agreement with the United Kingdom, which allows for both core funding and "add ons" for specific projects, continued in 1996 and resulted in the mobilization of the largest overall individual donor contribution for the year, including \$1.8 million for specific projects (of which about one-half was directed at a single project—India Environmental Issues in the Power Sector) and approximately \$615,000 in core resources.

In 1996, no new private sector funding was mobilized, although the balance of funds from the Marubeni Corporation, pledged in 1995, were received during the year.

Staffing and Administration

Implementation of the ESMAP work program was carried out by some 47 specialists, shared with the World Bank, who comprise a critical mass of energy expertise for both programs. Expertise contributed by these specialists included restructuring, efficiency, renewables, rural and household energy, oil, gas, and the environment. Of the total, 10 experts were made available to the Bank and to ESMAP through secondment or special assignment arrangements with organizations including Electricité de France, Gasunie of the Netherlands, Mobil, TransCanada, the Energy Technical Support Unit (ETSU) of the United Kingdom, and the National Renewable Energy Laboratory (NREL) and the Export Council for Renewable Energy (ECRE) from the United States. In addition to energy sector specialists who contributed to the implementation of specific ESMAP activities, the Programme was able to draw on the services of a new practice management team housed in the Industry and Energy Department's front office. Services provided by the practice management team include the redesign of the ESMAP Web site (www.worldbank.org/html/fpd/esmap/esmap.html), and the distillation and dissemination of recent global and country-specific developments related to high-priority energy sector topics. It is expected that the efforts of the practice management team, carried out in conjunction with Bankwide initiatives in sector "knowledge management" will increase the exposure of ESMAP's products and best practices. At the same time, ESMAP will benefit from availability of just-in-time information on recent developments in the energy sector.

ESMAP funding was applied to activities identified as priorities in previous communiqués of the Consultative Group (CG), ESMAP's annual report, and other communications from ESMAP management to the donors.

ESMAP maintains a separate accounting system for budget monitoring and donor reporting, and in 1996, efforts were initiated to integrate and coordinate ESMAP's administrative procedures and accounting practices with the World Bank's standard systems. Such integration is needed to continue improving the speed and consistency with which the Programme can meet donors' and task managers' monitoring and reporting requirements, and it ultimately will reduce the transaction costs associated with the administration of the Programme.

Technical Advisory Group

Membership

The year 1996 saw significant change in the membership of the Technical Advisory Group. For personal reasons, Professor Emil Salim resigned from the TAG in February 1996 without completing his two-year term. Mr. Gerald Leach relinquished his TAG duties in May 1996 to become an energy advisor in the Power, Energy Efficiency and Household Fuels Division of the Industry and Energy Department. At the CG meeting in April 1996, at which time Professor Salim's resignation was already known, the members of the CG expressed the strong preference that the next TAG appointment be offered to an expert from Africa. Following an extensive search and in consultation with the donors and with Mr. Eugene Godley, moderator of the TAG, the chairman of ESMAP offered appointments to the TAG to two new members with expertise and experience to complement those of the existing TAG members. In November 1996, Dr. Youba Sokona and Mr. Andrew Barnett joined Mr. Eugene Godley and Mr. Bruno Philippi as members of the ESMAP TAG.

- Dr. Sokona, a Mali national, is an energy planner with expertise in a wide range of areas including energy policy, environment, institutional building and strengthening, and climate change. He is currently the Head of Energy and Environment Programme at Environnement et Développement du Tiers Monde (ENDA-TM) in Dakar, Senegal. He coordinates a number of research programs related to energy, environment, and development in Africa.
- Mr. Barnett, a U.K. national, is an economist with more than 20 years of experience in development. He is known internationally for his work on technology policy and energy. Currently director for technology policy at the Intermediate Technology Development Group (an international nongovernmental organization), he has played a major role in the development and management of the Cooperative Program on Energy and Development (COPEDE), one of the largest international networks of energy policy research institutes working on development.

The first meeting of the TAG in 1996 took place just before the April CG meeting, at which time the TAG finalized the presentation of its general assessment of the Programme. In the course of 1996, Mr. Godley continued to convene regular meetings with the management and staff of ESMAP to review current issues and overall program focus and implementation. He chaired a series of meetings held in December 1996 which served to introduce the new TAG members to the ESMAP program and staff, and to take stock of ESMAP activities in each of its thematic areas. In particular, the December meetings provided a review of ESMAP activities in Latin America and Caribbean.

Evaluations

As described in ESMAP's 1995 annual report, the TAG conducted in-depth reviews of past ESMAP operations in China and Vietnam in February and March of 1996. The reviews assess ESMAP's with respect to the following parameters:

- Delivery of timely technical advice to governments
- Focus on high-priority needs of recipient countries
- Extent to which activities promoted local institutional capacity
- Extent to which assistance facilitated sustainable policy reform in the energy sector
- Impact on operations of the World Bank and other donors.

The TAG evaluation included a field mission to review two projects in Vietnam—Rural and Household Energy Issues and Options, and Improved Coal Briquetting and Biomass Stoves, and three projects in China—Rural and Household Energy; Planning and Management of Decentralized Power Companies; and Energy Conservation and Pollution Control in Township and Village Enterprises. In both countries the TAG mission met with local officials who were or had been directly involved in the projects and with representatives of the World Bank, UNDP, and donors that supported ESMAP projects.

In its assessment, the team from the TAG wrote that “ESMAP comes through this review with flying colors. In the mission’s opinion, most of the projects reviewed score well, or fairly well, in most important respects.” The TAG pointed out the following possible generic weaknesses:

- An apparent lack of coherent strategies within ESMAP activities in a country or in their articulation with the mainstream World Bank operations, or with other donors
- A possible lack of follow-up and quality control, perhaps caused by premature switching of staff, which resulted in long delays and vague recommendations that hampered project effectiveness
- Occurrences of hasty use of apparently poor data as a foundation for conclusions in a preliminary version of a report that could result in misleading recommendations, given the weight carried by ESMAP reports.

The TAG review led to a constructive dialogue between the reviewers and ESMAP staff and management. It was agreed that although some unavoidable professional differences on the perception of a project and its impact may exist, the review had been helpful in alerting ESMAP management to possible Programme weaknesses. The TAG evaluation was subsequently circulated to all ESMAP staff, with the view that the lessons from the review should serve in particular to ensure closer coordination between ESMAP and Bank operations. Donors agreed that such TAG reviews were useful and should continue.

A review of ESMAP’s work in Bolivia had been proposed for 1996. This review was not carried out, however, mainly because of difficulties in scheduling a mutually convenient time with the country representatives and TAG members. A TAG review is planned in 1997 of ESMAP’s household energy activities in Chad, and a general review of ESMAP work in Latin America is also scheduled.

Management and Coordination with World Bank Operations

ESMAP is continuing its efforts to streamline its activities and to improve the administration of the Programme. Although the strategic orientation of ESMAP remains clear, it is recognized that its administration can be further improved, and steps are being taken to become more efficient. Last year, a deputy manager was appointed to oversee the Programme and improve the interaction with the TAG. The intention now is to expand the scope and responsibilities of this position. In particular, it is planned that increased emphasis will be placed on the monitoring of the progress of studies to ensure timeliness of delivery of technical advice. A formal contracting procedure will be put in place, and task managers, and their managers, will be made directly accountable for executing a project within the agreed budget and on a time schedule consistent with the Project Proposal. Additional portfolio reviews for the various thematic areas are also planned to ensure high quality of the studies being published. Further, a review of the administration of the program is planned with the goal of further streamlining procedures and eliminating duplication of work, particularly with respect to budget and monitoring. These and other changes will ensure that ESMAP provides better service to its clients and continues to meet its contractual obligations to its donors.

The World Bank is currently in the process of launching an initiative in which sector specialists across the organization are grouped into professional “networks.” These networks are a way of linking staff for the purpose of bringing global best practices to bear in meeting country-specific needs. The networks will help put best knowledge on development in the hands of each task team by making it easier to get the right information quickly—from inside and outside the Bank. Members of the networks will also be expected to contribute to the Bank’s global knowledge base more systematically. It is expected that the networks will facilitate communication between ESMAP and other energy specialists across the Bank, help promote ESMAP priorities, and further enhance the coordination of ESMAP’s work with Bank operations.

Funding

In broad terms, ESMAP’s funding can be categorized into four types, differentiated by the restrictions that donors impose on the use of the funds. These categories are unrestricted, “core” funding; “thematic” funding; “country program” funding; and “project-specific” funding, as described in Box 3.1.

Box 3.1 Funding Types

- *“Core” funding* These funds are unrestricted and may be used for any project or activity of the Programme
- *“Thematic” funding.* These funds are restricted in that they are approved only for activities which share a common theme, such as household, rural energy, renewables, but are less restrictive than project-specific funding (see below).
- *“Country Program” funding.* Use of these funds is restricted to providing technical assistance to a specific country
- *“Project-specific” funding.* These funds may be used only for projects or activities for which specific approval has been obtained from the donors, prior to the commencement of work

The flexibility offered by core (and, to some degree, thematic) funding allows ESMAP to plan its work more efficiently, initiate projects and activities in a timely manner, and maintain access to appropriate expert skills. Because the application of core and thematic funds to specific projects does not require the execution of individual agreements, it reduces the administrative burden associated with monitoring and reporting on separate agreements for both ESMAP and the donor.

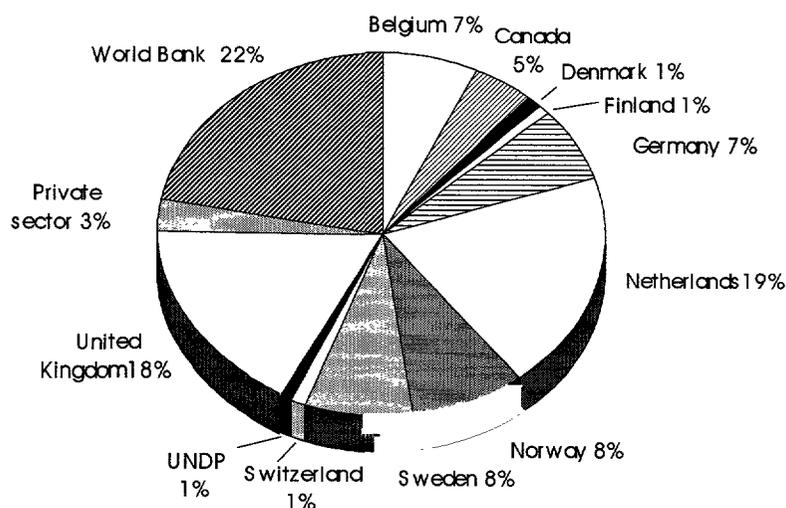
Contributions Received

ESMAP receipts totaled approximately \$8.5 million in 1996, an increase of about 10 percent over 1995 levels. The increase was in part attributable to the receipt in early 1996 of Norway’s 1995 pledge. Donors exceeding or maintaining 1995 contribution levels in 1996 included Belgium, Canada, Germany, Norway, and the United Kingdom. Although total ESMAP receipts increased, the World Bank’s contribution dropped by about \$400,000 for the same period (from \$1.9 million in 1995 to \$1.5 million in 1996). The Bank’s 1996 contribution represented approximately 18 percent of total receipts, down from 24 percent in 1995. (The Bank’s share of total receipts had been as high as 55 percent in 1992.) At the same time, however, some \$11 million in Bank administrative resources were also applied to energy sector priority areas in line with ESMAP’s agenda.

ESMAP’s donors have done extremely well in continuing their funding of ESMAP—in some cases enhancing it—within tight development assistance budgets. This is greatly appreciated by the ESMAP management and by the Programme’s clients. Table 3.1 shows actual ESMAP receipts by donor by year for 1994–1996. Figure 3.1 shows the aggregate shares of each donor’s contribution for the same period.

Table 3.1 ESMAP Receipts, 1994–1996 (US\$'000)

Donor	Year			Total	of which, core	% of total core
	1994	1995	1996			
UNDP	100	82	0	182	0	0
World Bank	2,182	1,862	1,496	5,541	0	0
Belgium	700	399	647	1,746	496	7
Canada	0	356	809	1,165	0	0
Denmark	105	142	0	246	0	0
Finland	0	221	0	221	221	3
Germany	996	335	350	1,680	1,040	15
Netherlands	1,995	1,864	1,045	4,904	0	0
Norway	1,034	0	1,088	2,122	2,122	30
Sweden	876	716	371	1,964	578	8
Switzerland	302	0	0	302	0	0
United Kingdom	892	1,231	2,382	4,505	1,896	27
Private sector	0	430	300	730	730	10
TOTAL	9,182	7,638	8,488	25,308	7,083	100

Figure 3.1 Receipts by Donor, as a Percentage of Total ESMAP Receipts, 1994–1996

Core and Thematic Funding

In 1996, core contributions totaled \$2.7 million, or 38 percent of donors' overall contributions for the year (these numbers exclude the World Bank's contributions, all of which are considered core funding). This is up from 34 percent in 1995 but in line with the previous three-year range of 34 to 38 percent. Only Germany, the Marubeni Corporation, and Norway provided their entire ESMAP contribution as core funding. All other core contributors—Belgium, Sweden, and the United Kingdom—provided core funding along with project-specific funding carrying restrictions on the use of their contributions in certain recipient countries.

Thematic funding dropped in 1996 to \$200,000 from \$1 million in 1995, primarily because of the tranching of the Netherlands funds for the Household and Rural Energy Trust Fund. The Netherlands was the only thematic donor during 1996, although the country contributed to project-specific funds as well.

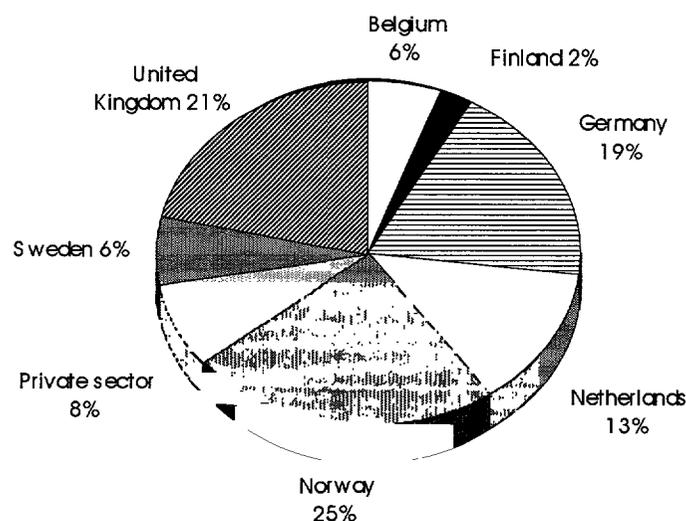
Core and thematic contributions by donor for 1994–96 are shown in Table 3.2 and graphed in Figure 3.2.

Table 3.2 Core and Thematic ESMAP Donor Contributions, 1994–1996

Year	Donor contributions (\$ million)			Core as % of total donor contributions	Core + thematic as % of total donor contributions
	Total	Core	Core + thematic		
1994	7.0	2.5	3.1	35	44
1995	5.8	2.0	3.0	34	51
1996	7.0	2.7	2.9	38	41
TOTAL	19.8	7.2	9.0	36	45

^aDoes not include the World Bank's contribution.

Figure 3.2 Core plus Thematic Contributions by Donor, as a Percentage of Total ESMAP Core plus Thematic Contributions, 1994–1996



Country Program Funding

Country program funding totaled about \$150,000 in 1996, related entirely to a Canadian contribution to the Peru Country Program.

Project-Specific Funding

Project-specific funding totaled approximately \$4.3 million, or about 61 percent of 1996 donor contributions. Only Canada's contribution was exclusively on a project-specific basis. As mentioned earlier, other project-specific donors, including Belgium, the Netherlands, Sweden, and the United Kingdom, contributed a mix of project-specific and either core or thematic funds.

Expenditures

Expenditures in 1996 totaled \$8.5 million, about the same as in 1995. Of the total, expenditures related to the World Bank contribution were down approximately \$400,000 (from \$1.9 million in 1995 to \$1.5 million in 1996), resulting primarily from a consolidation of front-office administrative functions (especially in the areas of planning and budgeting) and a change in the attribution of office occupancy expenses. The 1997 ESMAP Agenda and Work Program calls for expenditures to increase to approximately \$8.8 million (and the World Bank's contribution to the program to reach \$1.8 million) as access to ESMAP thematic funds becomes available to a wider group of World Bank task managers, and as the Programme seeks to accelerate individual tasks to ensure the timeliness of its advice to governments.

Table 3.3 summarizes ESMAP's actual operational and overhead expenses for 1994–96 and provides an estimate for 1997. Table 3.4 shows 1994–97 CG and TAG actual and expected expenses. As shown, TAG expenses increased sharply in 1996, reflecting the addition of the two new TAG members (in effect, the TAG had operated with only three active members in 1995), and are expected to increase further in 1997 to reflect the cost of a four-member TAG for a full year and as an active evaluation program is undertaken.

Table 3.3 ESMAP Operational and Overhead Expenses, 1994–1997 (US\$'000)

Expense item	Year			
	1994	1995	1996	1997 (est.)
Staff costs				
Donor funded	2,484	2,230	2,120	2,200
World Bank funded	1,075	1,060	885	900
Subtotal	3,559	3,290	3,005	3,100
Consultant fees				
Donor funded	3,192	2,965	3,489	3,400
World Bank funded	167	41	30	200
Subtotal	3,359	3,007	3,519	3,600
Travel				
Donor funded	706	620	977	950
World Bank funded	202	70	79	100
Subtotal	907	690	1,056	1,050
Other expenses				
Donor funded:				
Training	169	209	209	240
Equipment, premises	151	109	70	80
Communications, reporting, translations	43	38	40	50
Miscellaneous	103	3	22	20
Subtotal	467	359	341	390
World Bank funded:				
Equipment	52	4	15	30
Internal computing	23	13	26	60
Communications	15	8	25	45
Office occupancy	616	616	350	380
Miscellaneous	2	1	20	40
Subtotal	709	642	436	555
TOTAL operational and overhead	9,001	7,988	8,357	8,695
CG and TAG expenses	80	58	116	165
TOTAL ESMAP EXPENSES	9,080	8,019	8,473	8,860
<i>Of which: contribution from World Bank</i>	<i>2,182</i>	<i>1,862</i>	<i>1,496</i>	<i>1,860</i>

Table 3.4 ESMAP Consultative Group and Technical Advisory Group Expenses, 1994–1997 (US\$'000)

<i>Expense item</i>	<i>Year</i>			
	<i>1994</i>	<i>1995</i>	<i>1996</i>	<i>1997 (est.)</i>
CG meeting – Bank funded	30	40	42	50
Technical Advisory Group (TAG) meetings				
Honoraria	19	10	13	16
Travel	31	8	21	32
Miscellaneous	0	0	1	2
Subtotal TAG meetings	50	18	35	50
of which: Donor funded	50	10	32	30
Bank funded	0	8	3	20
Technical Advisory Group (TAG) evaluations				
Honoraria	0	0	11	20
Fees	0	0	16	15
Travel	0	0	13	25
Miscellaneous	0	0	0	5
Subtotal TAG evaluations	0	0	40	65
of which: Donor funded	0	0	18	30
Bank funded	0	0	22	35
TOTAL CG AND TAG EXPENSES				
of which: Donor funded	50	10	50	60
Bank funded	30	48	66	105

Cash Position

At December 31, 1996, ESMAP's cash balances in externally funded accounts totaled \$12.1 million, an increase from the 1995 and 1994 levels of \$9.7 and \$10.5 million, respectively. Of the total cash on hand at end-1996, nearly \$1 million was received in December. Aside from \$1 million for which project approvals were pending, about \$2 million in core funding that the Programme holds in reserve, and about \$250,000 that is in the process of being returned to donors because of project cost underruns or cancellations, all of the cash balance had been allocated to projects.

**Preparing Brazil nut hulls for use as fuel.***Photograph courtesy of Anke Meyer*

Annex I: Meeting of the Consultative Group of ESMAP, Final Communiqué

Washington, D.C., April 30, 1996 — The fifth meeting of the Consultative Group (CG) of the Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) was held at the World Bank's headquarters in Washington, D.C., on April 29 and 30, 1996, under the chairmanship of Mr. Jean-François Rischard, the World Bank's vice president for finance and private sector development.

The meeting included a roundtable on energy and development issues attended by representatives of donors and by energy experts from countries receiving technical assistance for the management and development of the energy sector. The roundtable started with presentations and discussions on present issues in developing countries and economies in transition with respect to power sector reform, energy efficiency, rural energy, renewable energy, and environmental problems in the oil and gas sectors. Most of the roundtable discussions were devoted to energy issues in Sub-Saharan Africa with respect to the situation in the power sector, oil and gas sector, renewable energy, household fuels, and energy efficiency. Energy experts from Botswana, Chad, Côte d'Ivoire, Ghana, Kenya, Malawi, Mozambique, Senegal, Tanzania, and Uganda participated in the roundtable. The discussion was chaired by Professor Edward Ayensu of Ghana, president of the Pan-African Union for Science and Technology.

The need for the continuation of energy sector reform in Sub-Saharan Africa was emphasized during the discussions. Such sector reform would facilitate the entry of new actors such as private entrepreneurs and cooperatives. It was also clear that local resources should be tapped and innovative approaches and financial mechanisms be developed to meet the needs for energy in the region. There is room for massive innovation, building upon local capacities and devising new delivery mechanisms both to serve the rural and less-privileged population and to benefit from technological advances in renewable energy and fossil-fuel-based generation. The potential for energy trade in both natural gas and power was also recognized. Such energy trade would be enhanced by the building up of international grids and the provision of assistance to improve institutional power pooling capabilities and to realize the potential of considerable hydro resources.

It was also emphasized that governments will continue to have key roles to play in facilitating the emergence of private enterprises, mobilizing local resources, deregulating to create markets, and ensuring that the energy needs of the poorest segment of the population are met. Particular attention should be given to helping governments ensure that reform benefits consumers and that difficulties during the transition period are mitigated.

During the meeting of the CG, ESMAP donors reviewed the work accomplished by the Programme in 1995 and the present work plan for 1996. The CG heard a report by the Technical Advisory Group (TAG) on the general functioning and management of the Programme, which the TAG found flexible and responsive to opportunities for meeting the needs of recipient countries. The CG received another report from the TAG on evaluation by the TAG of ESMAP projects in China and Vietnam. The TAG estimated that the ESMAP work in these two countries was generally of high quality and had proved useful to the recipient countries as well as to the donor community. In connection with the project reviewed, the TAG remarked that continuity in ESMAP's assistance was essential and should be emphasized.

The CG commended the management of ESMAP for last year's accomplishments, as reported in the *ESMAP Annual Report 1995*. Donors felt that ESMAP remains a useful program, both as a forum to

exchange views on energy and development and as a vehicle for technical assistance to developing economies and economies in transition, with particular focus on six principal sets of issues: energy sector reform and restructuring; energy efficiency; household energy and energy supply to the rural and urban poor; renewable energy; energy trade; and the linkages between energy and the environment. It was felt that ESMAP should continue to sharpen its focus on priority energy issues, while remaining flexible enough to respond to the emerging needs of recipient countries.

The CG confirmed ESMAP's broad orientations for 1996, described in the ESMAP Work Program and Budget for 1996. The Group endorsed the intention of the management to devote an increasing part of ESMAP's resources to activities aimed at mitigating detrimental effects of energy production and use on the environment, notably in the oil and gas sector. It was also agreed that Sub-Saharan Africa should continue to be ESMAP's major regional priority.

Funding from ESMAP donors was at some \$7.8 million in 1995, compared with \$9.2 million in 1994. The apparent decline in ESMAP's resources was a by-product of technical delays in the transfer of 1995 contributions from several donors and was not felt to correspond to a real decrease in support from donors. The first contributions to ESMAP from private entities were received in 1995 and welcomed by donors. The CG encouraged the management of ESMAP to continue its effort to mobilize funding from the private sector. Indications received from donors during the meetings showed that funding should reach at least \$10 million in 1996. It was considered important that UNDP make every effort to play a very active role in providing core financing for ESMAP activities.

In addition to the cosponsors of the Programme—the UNDP and the World Bank—the following donors were represented at the CG meeting: Belgium, Canada, Denmark, Finland, France, Germany, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom, the United States, the Marubeni Corporation of Japan, and the European Union.

The Consultative Group will reconvene in about a year.

Annex 2: Activities Completed, Launched, and Ongoing During Calendar 1996

Table A2.1 Activities Completed During Calendar 1996

<i>Region/country</i>	<i>Description</i>	<i>Date completed</i>	<i>Total cost^a (US\$)</i>
Bolivia	Implementation of Natural Gas Strategy	February 96	325,100
Bulgaria	Gas Development Plan	May 96	376,000
Cameroon	Energy Strategy	December 96	426,500
China	Assessment of Opportunities for Investment in Renewable Energy	June 96	173,500
Egypt	Energy Sector Institutional Development	October 96	407,400
Egypt	Gas Pricing Study Phase II	January 96	91,000
Global	Impact of Power Reform on International Electricity Trade	December 96	222,600
Global	Independent Power Project (IPP) Roundtable	May 96	66,500
Mexico	Energy Efficiency Management Assistance	May 96	103,100
Pakistan	Natural Gas Study	January 96	192,800
Peru	Institutional Restructuring	April 96	123,200
Romania	Gas Development Strategy and Gas Pricing Study	August 96	707,900
Tunisia	Renewable Energy (RE) Strategy Study	November 96	327,300
Uganda	Energy Assessment (Revision)	March 96	369,500
Vietnam	Gas Development Contract Provisions	May 96	130,500

^a Includes all sources.

Table A2.2 Activities Launched During Calendar 1996

<i>Region/country</i>	<i>Description</i>	<i>Date launched</i>	<i>Funds received (US\$)</i>
Africa	Regional Electricity Demand Management TA Phase II	January 96	100,000
Bolivia	Development of Regulations for the Hydrocarbon Sector	March 96	369,500
Bolivia	Renewables for Rural Electrification	April 96	67,000
Brazil	Bahia End-Use Energy and Effluent Management Strategy TA	March 96	50,000
Brazil	Electricity Energy Efficiency Phase II FINEP	January 96	90,000
Brazil	Northeast Renewable Energy Identification	March 96	96,500
Cameroon	Decentralized Rural Electrification	May 96	250,000
Central and Eastern Europe	Power Sector Reform	October 96	35,000
Global	Electricity Benefits Assessment	April 96	108,000
Global	Energy and Environment Steering Committee	April 96	138,000
Global	Energy, Transport, Environment Study	February 96	28,000
Global	Lighting Services for the Rural Poor	February 96	75,000
Global	MC Solar Techniques For Financing Photovoltaics	August 96	30,000
Global	Regional Project Identification Strategy II	February 96	53,200
Global	Rural Electrification Success Factors	June 96	50,000
Lao PDR	Decentralized Rural Electrification	April 96	135,000
Latin America and the Caribbean	Lead Elimination in the Americas (Phase I)	February 96	378,800
Malawi	Rural Energy Development	February 96	250,000
Mongolia	Energy Efficiency Program	January 96	590,200
Peru/Colombia	End-Use Energy and Effluent Management Strategy Study	May 96	50,000
Southern Africa	Development of an Electrical Market	May 96	130,000
Uganda	Rural Electrification Study	May 96	150,000
Vietnam	Power Sector Regulation and Electricity Law	May 96	329,700

Table A2.3 Activities Ongoing in Calendar 1996

<i>Region/country</i>	<i>Description</i>	<i>Initiation</i>	<i>Funds received (US\$)</i>
Africa	Africa Gas Initiative Phase I	March 94	754,000
Africa	Improving Efficiency of Petroleum Procurement	March 94	180,000
Africa	Review of Efficiency of Petroleum Pricing	March 94	50,000
Africa	West Africa Solar Project	April 95	360,000
Bolivia	Energy Efficiency and Environment	March 94	388,200
Bolivia	Energy Strategy for Rural Sector	September 94	330,000
Brazil	Gas to Power	March 95	149,800
Cambodia	Commercialization of a Power Company	December 95	362,400
Central and Eastern Europe	District Heating I	March 95	505,000
Central and Eastern Europe	District Heating II	December 95	90,000
Central Asia	Natural Gas Investment Strategy	November 95	563,800
Central Asia Republics	Renewable Strategy Study	December 95	96,000
China	Institutional Strengthening and TA in Rural Power Sector	March 92	317,900
China	Natural Gas Development Strategy	February 95	200,000
Comoros	Solar Market Development	August 95	150,000
Egypt	Renewable Energy Strategy and Institutional Strengthening Study	December 95	113,000
Global	Clean Coal Initiative Roundtable	December 95	75,000
Global	Environment Manual for Power Development	June 95	270,000
Global	Increasing Efficiency of Gas Distribution Networks	December 95	300,000
Global	Solar Initiative Regional Strategy	March 95	75,000
Guinea	Decentralized Rural Electrification	December 95	250,000
India	Environmental Issues in the Power Sector	March 95	942,300
India	Rural Energy Study	July 89	325,700
India	Urban Energy Study	March 93	198,300
Kenya	Photovoltaics-Financing Mechanisms for Solar Electric Equipment	September 95	135,000
Latin America	Energy Management Services	June 95	70,800
Morocco	Gas Development Plan, Phase 2	March 93	510,400
Morocco	Gas Pricing Study	March 93	200,000

(continues on next page)

Note: Does not include the projects listed in Table A2.1, "Activities Completed During Calendar 1996," or Table A2.2, "Activities Launched During Calendar 1996."

(Table A2.3 continued)

<i>Region/country</i>	<i>Description</i>	<i>Initiation</i>	<i>Funds received (US\$)</i>
Mozambique	Energy Pricing and Household Energy	December 93	142,000
Pakistan	Energy Efficiency Technical Assistance to ENERCON	March 95	290,100
Peru	Environmental Impact of Hydrocarbons Production	September 95	115,000
Peru	Rural Energy Electrification	September 95	172,000
Peru	Training: Energy Management Services	October 95	215,000
Poland	Energy Sector Restructuring Program	February 93	1,049,900
Slovak Republic	Energy Efficiency Technical Assistance	August 94	312,500
Southern Africa	Renewable Energy for Rural Electrification	December 95	85,700
Swaziland	Household Energy Strategy Study	November 95	75,000
Tanzania	Power Loss Reduction and Distribution Expansion	August 89	765,300
Tanzania	TA to DOE and TANESCO	January 93	757,300
Vietnam	Domestic Fuels Efficiency TA	June 94	199,300
Zambia	Energy Sector Restructuring	June 93	563,100

Note: Does not include the projects listed in Table A2.1, "Activities Completed During Calendar 1996," or Table A2.2, "Activities Launched During Calendar 1996."

Annex 3: List of Reports on Completed Activities

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
SUB-SAHARAN AFRICA (AFR)			
Africa Regional	Anglophone Africa Household Energy Workshop (English)	07/88	085/88
	Regional Power Seminar on Reducing Electric Power System Losses in Africa (English)	08/88	087/88
	Institutional Evaluation of EGL (English)	02/89	098/89
	Biomass Mapping Regional Workshops (English)	05/89	—
	Francophone Household Energy Workshop (French)	08/89	103/89
	Inter-African Electrical Engineering College: Proposals for Short- and Long-Term Development (English)	03/90	112/90
	Biomass Assessment and Mapping (English)	03/90	—
	Symposium on Power Sector Reform and Efficiency Improvement in Sub-Saharan Africa (English)	06/96	182/96
Angola	Energy Assessment (English and Portuguese)	05/89	4708-ANG
	Power Rehabilitation and Technical Assistance (English)	10/91	142/91
Benin	Energy Assessment (English and French)	06/85	5222-BEN
Botswana	Energy Assessment (English)	09/84	4998-BT
	Pump Electrification Prefeasibility Study (English)	01/86	047/86
	Review of Electricity Service Connection Policy (English)	07/87	071/87
	Tuli Block Farms Electrification Study (English)	07/87	072/87
	Household Energy Issues Study (English)	02/88	—
	Urban Household Energy Strategy Study (English)	05/91	132/91
Burkina Faso	Energy Assessment (English and French)	01/86	5730-BUR
	Technical Assistance Program (English)	03/86	052/86
	Urban Household Energy Strategy Study (English and French)	06/91	134/91
Burundi	Energy Assessment (English)	06/82	3778-BU
	Petroleum Supply Management (English)	01/84	012/84
	Status Report (English and French)	02/84	011/84
	Presentation of Energy Projects for the Fourth Five-Year Plan (1983–1987) (English and French)	05/85	036/85
	Improved Charcoal Cookstove Strategy (English and French)	09/85	042/85
	Peat Utilization Project (English)	11/85	046/85
	Energy Assessment (English and French)	01/92	9215-BU
Cape Verde	Energy Assessment (English and Portuguese)	08/84	5073-CV
	Household Energy Strategy Study (English)	02/90	110/90

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Central African Republic	Energy Assessment (French)	08/92	9898-CAR
Chad	Elements of Strategy for Urban Household Energy: The Case of N'Djamena (French)	12/93	160/94
Comoros	Energy Assessment (English and French)	01/88	7104-COM
Congo	Energy Assessment (English)	01/88	6420-COB
	Power Development Plan (English and French)	03/90	106/90
Côte d'Ivoire	Energy Assessment (English and French)	04/85	5250-IVC
	Improved Biomass Utilization (English and French)	04/87	069/87
	Power System Efficiency Study (English)	12/87	—
	Power Sector Efficiency Study (French)	02/92	140/91
	Project of Energy Efficiency in Buildings (English)	09/95	175/95
Ethiopia	Energy Assessment (English)	07/84	4741-ET
	Power System Efficiency Study (English)	10/85	045/85
	Agricultural Residue Briquetting Pilot Project (English)	12/86	062/86
	Bagasse Study (English)	12/86	063/86
	Cooking Efficiency Project (English)	12/87	—
	Energy Assessment (English)	02/96	179/96
Gabon	Energy Assessment (English)	07/88	6915-GA
The Gambia	Energy Assessment (English)	11/83	4743-GM
	Solar Water Heating Retrofit Project (English)	02/85	030/85
	Solar Photovoltaic Applications (English)	03/85	032/85
	Petroleum Supply Management Assistance (English)	04/85	035/85
Ghana	Energy Assessment (English)	11/86	6234-GH
	Energy Rationalization in the Industrial Sector (English)	06/88	084/88
	Sawmill Residues Utilization Study (English)	11/88	074/87
	Industrial Energy Efficiency (English)	11/92	148/92
Guinea	Energy Assessment (English)	11/86	6137-GUI
	Household Energy Strategy (English and French)	01/94	163/94
Guinea-Bissau	Energy Assessment (English and Portuguese)	08/84	5083-GUB
	Recommended Technical Assistance Projects (English and Portuguese)	04/85	033/85
	Management Options for the Electric Power and Water Supply Subsectors (English)	02/90	100/90
	Power and Water Institutional Restructuring (French)	04/91	118/91

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Kenya	Energy Assessment (English)	05/82	3800-KE
	Power System Efficiency Study (English)	03/84	014/84
	Status Report (English)	05/84	016/84
	Coal Conversion Action Plan (English)	02/87	—
	Solar Water Heating Study (English)	02/87	066/87
	Peri-Urban Woodfuel Development (English)	10/87	076/87
	Power Master Plan (English)	11/87	—
	Power Loss Reduction Study (English)	09/96	186/96
Lesotho	Energy Assessment (English)	01/84	4676-LSO
Liberia	Energy Assessment (English)	12/84	5279-LBR
	Recommended Technical Assistance Projects (English)	06/85	038/85
	Power System Efficiency Study (English)	12/87	081/87
Madagascar	Energy Assessment (English)	01/87	5700-MAG
	Power System Efficiency Study (English and French)	12/87	075/87
	Environmental Impact of Woodfuels (French)	10/95	176/95
Malawi	Energy Assessment (English)	08/82	3903-MAL
	Technical Assistance to Improve the Efficiency of Fuelwood Use in the Tobacco Industry (English)	11/83	009/83
	Status Report (English)	01/84	013/84
Mali	Energy Assessment (English and French)	11/91	8423-MLI
	Household Energy Strategy (English and French)	03/92	147/92
Mauritania, Islamic Republic of	Energy Assessment (English and French)	04/85	5224-MAU
	Household Energy Strategy Study (English and French)	07/90	123/90
Mauritius	Energy Assessment (English)	12/81	3510-MAS
	Status Report (English)	10/83	008/83
	Power System Efficiency Audit (English)	05/87	070/87
	Bagasse Power Potential (English)	10/87	077/87
	Energy Sector Review (English)	12/94	3643-MAS
Morocco	Energy Sector Institutional Development Study (English and French)	07/95	173/95
Mozambique	Energy Assessment (English)	01/87	6128-MOZ
	Household Electricity Utilization Study (English)	03/90	113/90
	Electricity Tariffs Study (English)	06/96	181/96
Namibia	Energy Assessment (English)	03/93	11320-NAM

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Niger	Energy Assessment (French)	05/84	4642-NIR
	Status Report (English and French)	02/86	051/86
	Improved Stoves Project (English and French)	12/87	080/87
	Household Energy Conservation and Substitution (English and French)	01/88	082/88
Nigeria	Energy Assessment (English)	08/83	4440-UNI
	Energy Assessment (English)	07/93	11672-UNI
Rwanda	Energy Assessment (English)	06/82	3779-RW
	Energy Assessment (English and French)	07/91	8017-RW
	Status Report (English and French)	05/84	017/84
	Improved Charcoal Cookstove Strategy (English and French)	08/86	059/86
	Improved Charcoal Production Techniques (English and French)	02/87	065/87
	Commercialization of Improved Charcoal Stoves and Carbonization Techniques Mid-Term Progress Report (English and French)	12/91	141/91
SADC	SADC Regional Power Interconnection Study, Volumes I-IV (English)	12/93	—
SADCC	SADCC Regional Sector: Regional Capacity-Building Program for Energy Surveys and Policy Analysis (English)	11/91	—
São Tome and Príncipe	Energy Assessment (English)	10/85	5803-STP
Senegal	Energy Assessment (English)	07/83	4182-SE
	Status Report (English and French)	10/84	025/84
	Industrial Energy Conservation Study (English)	05/85	037/85
	Preparatory Assistance for Donor Meeting (English and French)	04/86	056/86
	Urban Household Energy Strategy (English)	02/89	096/89
	Industrial Energy Conservation Program (English)	05/94	165/94
Seychelles	Energy Assessment (English)	01/84	4693-SEY
	Electric Power System Efficiency Study (English)	08/84	021/84
Sierra Leone	Energy Assessment (English)	10/87	6597-SL
Somalia	Energy Assessment (English)	12/85	5796-SO
South Africa, Republic of	Options for the Structure and Regulation of Natural Gas Industry (English)	05/95	172/95
Sudan	Management Assistance to the Ministry of Energy and Mining (English)	05/83	003/83
	Energy Assessment (English)	07/83	4511-SU

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
	Power System Efficiency Study (English)	06/84	018/84
	Status Report (English)	11/84	026/84
	Wood Energy/Forestry Feasibility (English)	07/87	073/87
Swaziland	Energy Assessment (English)	02/87	6262-SW
Tanzania	Energy Assessment (English)	11/84	4969-TA
	Peri-Urban Woodfuels Feasibility Study (English)	08/88	086/88
	Tobacco Curing Efficiency Study (English)	05/89	102/89
	Remote Sensing and Mapping of Woodlands (English)	06/90	—
	Industrial Energy Efficiency Technical Assistance (English)	08/90	122/90
Togo	Energy Assessment (English)	06/85	5221-TO
	Wood Recovery in the Nangbeto Lake (English and French)	04/86	055/86
	Power Efficiency Improvement (English and French)	12/87	078/87
Uganda	Energy Assessment (English)	07/83	4453-UG
	Status Report (English)	08/84	020/84
	Institutional Review of the Energy Sector (English)	01/85	029/85
	Energy Efficiency in Tobacco Curing Industry (English)	02/86	049/86
	Fuelwood/Forestry Feasibility Study (English)	03/86	053/86
	Power System Efficiency Study (English)	12/88	092/88
	Energy Efficiency Improvement in the Brick and Tile Industry (English)	02/89	097/89
	Tobacco Curing Pilot Project (English)	03/89	UNDP Terminal Report
	Energy Assessment (English)	12/96	193/96
Zaire	Energy Assessment (English)	05/86	5837-ZR
Zambia	Energy Assessment (English)	01/83	4110-ZA
	Status Report (English)	08/85	039/85
	Energy Sector Institutional Review (English)	11/86	060/86
	Power Subsector Efficiency Study (English)	02/89	093/88
	Energy Strategy Study (English)	02/89	094/88
	Urban Household Energy Strategy Study (English)	08/90	121/90
Zimbabwe	Energy Assessment (English)	06/82	3765-ZIM
	Power System Efficiency Study (English)	06/83	005/83
	Status Report (English)	08/84	019/84
	Power Sector Management Assistance Project (English)	04/85	034/85
	Petroleum Management Assistance (English)	12/89	109/89
	Power Sector Management Institution Building (English)	09/89	—
	Charcoal Utilization Prefeasibility Study (English)	06/90	119/90

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Zimbabwe (<i>continued</i>)	Integrated Energy Strategy Evaluation (English)	01/92	8768-ZIM
	Energy Efficiency Technical Assistance Project: Strategic Framework for a National Energy Efficiency Improvement Program (English)	04/94	—
	Capacity Building for the National Energy Efficiency Improvement Programme (NEEIP) (English)	12/94	—
EAST ASIA AND PACIFIC (EAP)			
Asia Regional	Pacific Household and Rural Energy Seminar (English)	11/90	—
China	County-Level Rural Energy Assessments (English)	05/89	101/89
	Fuelwood Forestry Preinvestment Study (English)	12/89	105/89
	Strategic Options for Power Sector Reform in China (English)	07/93	156/93
	Energy Efficiency and Pollution Control in Township and Village Enterprises (TVE) Industry (English)	11/94	168/94
	Energy for Rural Development in China: An Assessment Based on a Joint Chinese/ESMAP Study in Six Counties (English)	06/96	183/96
Fiji	Energy Assessment (English)	06/83	4462-FIJ
Indonesia	Energy Assessment (English)	11/81	3543-IND
	Status Report (English)	09/84	022/84
	Power Generation Efficiency Study (English)	02/86	050/86
	Energy Efficiency in the Brick, Tile and Lime Industries (English)	04/87	067/87
	Diesel Generating Plant Efficiency Study (English)	12/88	095/88
	Urban Household Energy Strategy Study (English)	02/90	107/90
	Biomass Gasifier Preinvestment Study, Volumes I and II (English)	12/90	124/90
	Prospects for Biomass Power Generation with Emphasis on Palm Oil, Sugar, Rubberwood and Plywood Residues (English)	11/94	167/94
Lao PDR	Urban Electricity Demand Assessment Study (English)	03/93	154/93
Malaysia	Sabah Power System Efficiency Study (English)	03/87	068/87
	Gas Utilization Study (English)	09/91	9645-MA
Myanmar	Energy Assessment (English)	06/85	5416-BA
Papua New Guinea	Energy Assessment (English)	06/82	3882-PNG
	Status Report (English)	07/83	006/83
	Energy Strategy Paper (English)	—	—
	Institutional Review in the Energy Sector (English)	10/84	023/84
	Power Tariff Study (English)	10/84	024/84
Philippines	Commercial Potential for Power Production from Agricultural Residues (English)	12/93	157/93
	Energy Conservation Study (English)	08/94	—

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Solomon Islands	Energy Assessment (English)	06/83	4404-SOL
	Energy Assessment (English)	01/92	979/SOL
South Pacific	Petroleum Transport in the South Pacific (English)	05/86	—
Thailand	Energy Assessment (English)	09/85	5793-TH
	Rural Energy Issues and Options (English)	09/85	044/85
	Accelerated Dissemination of Improved Stoves and Charcoal Kilns (English)	09/87	079/87
	Northeast Region Village Forestry and Woodfuels Preinvestment Study (English)	02/88	083/88
	Impact of Lower Oil Prices (English)	08/88	—
	Coal Development and Utilization Study (English)	10/89	—
Tonga	Energy Assessment (English)	06/85	5498-TON
Vanuatu	Energy Assessment (English)	06/85	5577-VA
Vietnam	Rural and Household Energy: Issues and Options (English)	01/94	161/94
	Power Sector Reform and Restructuring in Vietnam: Final Report to the Steering Committee (English and Vietnamese)	09/95	174/95
	Household Energy Technical Assistance: Improved Coal Briquetting and Commercialized Dissemination of Higher Efficiency Biomass and Coal Stoves (English)	01/96	178/96
Western Samoa	Energy Assessment (English)	06/85	5497-WSO
SOUTH ASIA (SAS)			
Bangladesh	Energy Assessment (English)	10/82	3873-BD
	Priority Investment Program (English)	05/83	002/83
	Status Report (English)	04/84	015/84
	Power System Efficiency Study (English)	02/85	031/85
	Small Scale Uses of Gas Prefeasibility Study (English)	12/88	
India	Opportunities for Commercialization of Nonconventional Energy Systems (English)	11/88	091/88
	Maharashtra Bagasse Energy Efficiency Project (English)	07/90	120/90
	Mini-Hydro Development on Irrigation Dams and Canal Drops, Volumes I, II, and III (English)	07/91	139/91
	Wind Farm Pre-Investment Study (English)	12/92	150/92
	Power Sector Reform Seminar (English)	04/94	166/94
Nepal	Energy Assessment (English)	08/83	4474-NEP
	Status Report (English)	01/85	028/84
	Energy Efficiency and Fuel Substitution in Industries (English)	06/93	158/93

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Pakistan	Household Energy Assessment (English)	05/88	—
	Assessment of Photovoltaic Programs, Applications, and Markets (English)	10/89	103/89
	National Household Energy Survey and Strategy Formulation Study: Project Terminal Report (English)	03/94	—
	Managing the Energy Transition (English)	10/94	—
	Lighting Efficiency Improvement Program Phase I: Commercial Buildings Five Year Plan (English)	10/94	—
Sri Lanka	Energy Assessment (English)	05/82	3792-CE
	Power System Loss Reduction Study (English)	07/83	007/83
	Status Report (English)	01/84	010/84
	Industrial Energy Conservation Study (English)	03/86	054/86

EUROPE AND CENTRAL ASIA (ECA)

Bulgaria	Natural Gas Policies and Issues (English)	10/96	188/96
Eastern Europe	The Future of Natural Gas in Eastern Europe (English)	08/92	149/92
Poland	Energy Sector Restructuring Program, Volumes I–V (English)	01/93	153/93
Portugal	Energy Assessment (English)	04/84	4824-PO
Romania	Natural Gas Development Strategy (English)	12/96	192/96
Turkey	Energy Assessment (English)	03/83	3877-TU

MIDDLE EAST AND NORTH AFRICA (MNA)

Egypt, Arab Republic of	Energy Assessment (English)	10/96	189/96
Morocco	Energy Assessment (English and French)	03/84	4157-MOR
	Status Report (English and French)	01/86	048/86
	Energy Sector Institutional Development Study (English and French)	05/95	173/95
Syria	Energy Assessment (English)	05/86	5822-SYR
	Electric Power Efficiency Study (English)	09/88	089/88
	Energy Efficiency Improvement in the Cement Sector (English)	04/89	099/89
	Energy Efficiency Improvement in the Fertilizer Sector(English)	06/90	115/90
Tunisia	Fuel Substitution (English and French)	03/90	—
	Power Efficiency Study (English and French)	02/92	136/91

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
	Energy Management Strategy in the Residential and Tertiary Sectors (English)	04/92	146/92
	Renewable Energy Strategy Study, Volume I (French)	11/96	190A/96
	Renewable Energy Strategy Study, Volume II (French)	11/96	190B/96
Yemen	Energy Assessment (English)	12/84	4892-YAR
	Energy Investment Priorities (English)	02/87	6376-YAR
	Household Energy Strategy Study Phase I (English)	03/91	126/91
LATIN AMERICA AND THE CARIBBEAN (LAC)			
LAC Regional	Regional Seminar on Electric Power System Loss Reduction in the Caribbean (English)	07/89	—
Bolivia	Energy Assessment (English)	04/83	4213-BO
	National Energy Plan (English)	12/87	—
	National Energy Plan (Spanish)	08/91	131/91
	La Paz Private Power Technical Assistance (English)	11/90	111/90
	Natural Gas Distribution: Economics and Regulation (English)	03/92	125/92
	Prefeasibility Evaluation Rural Electrification and Demand Assessment (English and Spanish)	04/91	129/91
	Private Power Generation and Transmission (English)	01/92	137/91
	Household Rural Energy Strategy (English and Spanish)	01/94	162/94
	Natural Gas Sector Policies and Issues (English and Spanish)	12/93	164/93
	Preparation of Capitalization of the Hydrocarbon Sector (English)	12/96	191/96
Brazil	Energy Efficiency and Conservation: Strategic Partnership for Energy Efficiency in Brazil (English)	01/95	170/95
Chile	Energy Sector Review (English)	08/88	7129-CH
Colombia	Energy Strategy Paper (English)	12/86	—
	Power Sector Restructuring (English)	11/94	169/94
	Energy Efficiency Report for the Commercial and Public Sector (English)	06/96	184/96
Costa Rica	Energy Assessment (English and Spanish)	01/84	4655-CR
	Recommended Technical Assistance Projects (English)	11/84	027/84
	Forest Residues Utilization Study (English and Spanish)	02/90	108/90
Dominican Republic	Energy Assessment (English)	05/91	8234-DO
Ecuador	Energy Assessment (Spanish)	12/85	5865-EC
	Energy Strategy Phase I (Spanish)	07/88	—
	Energy Strategy (English)	04/91	—

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
Ecuador (<i>continued</i>)	Private Mini-Hydropower Development Study (English)	11/92	—
	Energy Pricing Subsidies and Interfuel Substitution (English)	08/94	11798-EC
	Energy Pricing, Poverty and Social Mitigation (English)	08/94	12831-EC
Guatemala	Issues and Options in the Energy Sector (English)	09/93	12160-GU
Haiti	Energy Assessment (English and French)	06/82	3672-HA
	Status Report (English and French)	08/85	041/85
	Household Energy Strategy (English and French)	12/91	143/91
Honduras	Energy Assessment (English)	08/87	6476-HO
	Petroleum Supply Management (English)	03/91	128/91
Jamaica	Energy Assessment (English)	04/85	5466-JM
	Petroleum Procurement, Refining, and Distribution Study (English)	11/86	061/86
	Energy Efficiency Building Code Phase I (English)	03/88	—
	Energy Efficiency Standards and Labels Phase I (English)	03/88	—
	Management Information System Phase I (English)	03/88	—
	Charcoal Production Project (English)	09/88	090/88
	FIDCO Sawmill Residues Utilization Study (English)	09/88	088/88
Energy Sector Strategy and Investment Planning Study (English)	07/92	135/92	
Mexico	Improved Charcoal Production Within Forest Management for the State of Veracruz (English and Spanish)	08/91	138/91
	Energy Efficiency Management Technical Assistance to the Comision Nacional para el Ahorro de Energia (CONAE) (English)	04/96	180/96
Panama	Power System Efficiency Study (English)	06/83	004/83
Paraguay	Energy Assessment (English)	10/84	5145-PA
	Recommended Technical Assistance Projects (English)	09/85	—
	Status Report (English and Spanish)	09/85	043/85
Peru	Energy Assessment (English)	01/84	4677-PE
	Status Report (English)	08/85	040/85
	Proposal for a Stove Dissemination Program in the Sierra (English and Spanish)	02/87	064/87
	Energy Strategy (English and Spanish)	12/90	—
	Study of Energy Taxation and Liberalization of the Hydrocarbons Sector (English and Spanish)	120/93	159/93
Saint Lucia	Energy Assessment (English)	09/84	5111-SLU

<i>Region/Country</i>	<i>Activity/Report Title</i>	<i>Date</i>	<i>Number</i>
St. Vincent and the Grenadines	Energy Assessment (English)	09/84	5103-STV
Trinidad and Tobago	Energy Assessment (English)	12/85	5930-TR
GLOBAL			
	Energy End Use Efficiency: Research and Strategy (English)	11/89	—
	Guidelines for Utility Customer Management and Metering (English and Spanish)	07/91	—
	Women and Energy—A Resource Guide: The International Network—Policies and Experience (English)	04/90	—
	Assessment of Personal Computer Models for Energy Planning in Developing Countries (English)	10/91	—
	Long-Term Gas Contracts Principles and Applications (English)	02/93	152/93
	Comparative Behavior of Firms Under Public and Private Ownership (English)	05/93	155/93
	Development of Regional Electric Power Networks (English)	10/94	—
	Roundtable on Energy Efficiency (English)	02/95	171/95
	Assessing Pollution Abatement Policies with a Case Study of Ankara (English)	11/95	177/95
	A Synopsis of the Third Annual Roundtable on Independent Power Projects: Rhetoric and Reality (English)	08/96	187/96

Annex 4: Efficiency, the Environment, and ESMAP

Introduction and Summary

This Annex is a special background paper developed for the donors' roundtable on energy efficiency and the environment to be held in conjunction with the 1997 ESMAP Annual Consultative Group (CG) Meeting.

The paper discusses strategies for both achieving energy efficiencies and mitigating the adverse environmental impacts of energy production and use. In large part, these strategies are coincident. Ultimately, market forces, released by sector reform, can go a long way toward meeting objectives in both areas, although the existence of externalities argues in favor of a continued role for government in extending energy-efficiency programs in order to contain and reduce adverse environmental impacts of energy. Currently, ESMAP and the World Bank have major roles to play in supporting the consolidation of energy sector reforms in developing countries and economies in transition, and in dismantling those obstacles to the implementation of energy saving and environmentally friendly technologies and practices that derive from a lack of information and inadequate financing mechanisms.

Energy Efficiency

Energy use in developing countries is expected to grow dramatically over the next 20 years, from 80 percent of consumption levels in OECD countries to in excess of twice those levels. Achieving efficiency in both energy production and consumption will be critical to meeting the challenge of increased non-OECD energy requirements. Efficiency gains in turn will depend on the successful introduction and implementation of sector reforms.

Price Reform and Market Restructuring

Energy price reform and market restructuring, so-called top-down reforms, set the stage for more efficient energy sector performance.

By adopting policies that move energy prices to market levels, governments not only stimulate supply but also encourage efficiency and conservation in the delivery of energy supplies and in their consumption.

Privatization of energy sector activities and policies to promote competition in energy and other sectors, on both domestic and international levels, will have similar favorable impacts. Energy suppliers, focused on profits, will increasingly set prices so as to recover costs, eliminate subsidies, and, at the same time, invest in improved billing and collection procedures. Energy consumers, similarly attentive to the bottom line and to retaining or expanding market share, will seek to cut costs by reducing energy use. It is interesting to note that they may often be helped in this regard by energy suppliers. For example, where power sector restructuring has resulted in unbundling of the power chain and distribution companies are billed by power generators on the basis of peak demand (capacity or MW) as well as energy delivered (MWh), they will have a strong incentive to work with their customers to promote peak load reduction. With increased supply options available to power consumers as a result of retail power wheeling and cogeneration, distributors will also have an incentive to advise customers on how to reduce their energy use and monthly bills in order to avoid losing their business.

Top-down sector reform is a difficult process: energy price increases, whether for petroleum products, natural gas or power, typically attract intense public debate, and restructuring to promote competition often runs into opposition from entrenched monopoly interests. That said, the reform process is well under way in many countries, particularly in Latin America and Asia. It is far from complete, however, and some regions (e.g., Africa) are still lagging in the implementation of reform.

Information Barriers and Financing Issues

Energy efficiency will not be achieved solely on the basis of top-down sector reform. It will also depend on an ability at the grass-roots level to respond effectively to market signals. Enhancing this ability is the objective of a variety of “bottom-up” reform activities.

Barriers to the adoption of energy efficient measures even in the context of price and restructuring reforms are many and include the following:

- Inadequate information among enterprises and financial institutions concerning the level and value of energy-efficiency improvements
- Limited technology transfer mechanisms in the early stages of market development
- Perceived (and possibly real) high levels of project, market, and implementation risks for enterprises
- The small size of many high-return efficiency projects relative to other business opportunities
- high transaction costs for designing, packaging, and implementing efficiency projects
- Weak institutions for preparing and implementing energy-efficiency projects
- Difficulties in monitoring and verifying the level of energy savings over the lifetime of the energy-efficiency measures
- Difficulties in arranging financing.

Bottom-up reforms are designed to overcome these barriers, which largely relate to a lack of information and other transactions costs with respect to opportunities to introduce new energy efficient technologies or management practices, and to the limited availability of financing mechanisms to implement them. A variety of forms of intervention are possible: publicly funded information campaigns and efficiency audits; efficiency standards and codes; public financing and guarantees; or private sector initiatives. The particular programs adopted by any one country will depend in part on the stage of sector reform in which it finds itself.

Stages of Reform

Efficiency programs normally start with top-down reforms, introduced by government. These were the focus of reform, especially through the early 1990s. Grass-roots efficiency measures at that time were largely dependent on government agencies and public sector monopolies. More often than not these proved to be weak supporters of grass-roots programs. As top-down reforms took hold, bottom-up reform shifted increasingly from the public to the private sector, the key players being either energy suppliers or consumers themselves, or private firms motivated to advise on or invest in efficiency projects by the potential value of energy savings. Energy service companies (ESCOs) hold a great deal of promise for efficiency gains, but currently they are experiencing start-up funding problems in many countries. Once these are overcome, the market and the private sector, supported by framework policies of government, can be expected to assume the dominant roles in promoting and putting in place energy-efficiency programs.

A Role for ESCOs

Market incentives to achieve energy efficiency are clearly present for ESCOs. ESCOs are companies that provide energy services or energy management under performance contracts, with their remuneration based on a share of the achieved savings. In brief, ESCOs perform the following activities:

- Identify and prepare energy management or efficiency projects.
- Assist in arranging investment financing, often through leasing or off balance sheet arrangements.
- Implement, operate and maintain the energy-efficiency measures over the life of the service contract.
- Recover the costs of the efficiency measures and make a profit from the shared savings.
- Provide a performance guarantee depending on the contract with the host.

ESCOs have clear advantages over alternative delivery mechanisms for improving energy efficiency. First they are focused entirely on energy efficiency. Rather than energy costs amounting to 5 to 15 percent of total costs, as in most manufacturing industries, energy-related costs are 100 percent of the business of an ESCO. With contracts based on performance, ESCOs have a clear incentive to make the project work. In liberalized markets, competitive pressure on the host firm to lower production and operating costs, in combination with the ESCO's own profit motive, provide additional incentives beyond solely the prospect of energy savings for the host company. Although energy-efficiency projects are always likely to be labor intensive, the concentration of expertise within an ESCO permits the firm to become highly skilled in carrying out its core business, thereby reducing the transaction costs for all parties.

Because of their expertise in carrying out energy-efficiency projects, ESCOs can develop the confidence of financing institutions to provide leasing or loan funds for projects. The availability of monitoring and verification protocols, now being used in a number of OECD countries, is reducing the uncertainty concerning the level and sustainability of energy savings. As a consequence, lending institutions are more inclined to look to the energy savings themselves and the contracts for shared savings as the security for the loan rather than the enterprise itself. Financial obligations associated with the energy savings measures can then be considered off balance sheet, thereby increasing the borrowing capacity of the enterprise involved.

In circumstances where ESCOs become involved in efficiency projects, capitalization and financing are likely to be crucial issues. ESCOs that hope to become players in the energy-efficiency market will have to be capitalized to cover the costs of project preparation and the risks of project operation. Risks can be spread over a large number of smaller projects, but the ESCO itself must have an adequate balance sheet to cover the residual risk and carry the financing obligations for projects. These requirements suggest that ESCOs must be of a minimum size to be able to operate effectively. Consequently, to support such firms, the energy-efficiency market also needs to be of a minimum size.

Even when financing for the efficiency project itself is available, a large gap may develop between the conception and the accomplishment of an energy-efficiency project. The problem arises because ESCOs must carry the costs of project preparation from the time of identification through to financial closure and implementation of the project. Undercapitalized ESCOs will encounter their greatest difficulties in this area. Managers of ESCOs working in Central and Eastern Europe in district heating report that preparing, say, a \$50 million project to be financed through a syndicate of commercial banks can take a year and require \$1 million of expenditures for audits, engineering, legal expenses, arranging project financing, and carrying the risk that the project might not come to fruition. Preparation of smaller

projects can cost 10 to 20 percent of the investment amount, since a large portion of the transaction requirements are fixed costs. It is thus clear that only firms with access to substantial working capital will be able to carry this kind of project preparation. Mechanisms and instruments are needed to establish funding facilities not only for the investments to be undertaken by the ESCOs but also for their preparation.

In past energy-efficiency projects, financing from bilateral and multilateral financial institutions (MFIs) in accordance with general procurement rules has seldom provided the support needed to finance the project preparation by ESCOs. The MFIs' procurement rules typically require the borrower to take responsibility for project preparation, possibly with the support of a project preparation facility or engineering loan in the case of a large project. Engineering firms involved in preparing a project, however, are normally excluded from participating in the implementation of the loan because of a conflict of interest. Unfortunately, this situation is the antithesis of what is needed to encourage the start-up of ESCOs. The opportunity for profit sharing from energy-efficiency opportunities is the underlying market incentive in the ESCO concept. ESCOs hence need to be able to seek out these opportunities and carry the risks of preparing projects with the expectation that they will ultimately profit from a share of the savings. To maximize this incentive, the entity initiating the process must have a stake and vested interest in the outcome.

Government funding to set up an ESCO may be justified if there is little prospect for setting up private sector firms in the short term. This approach was successfully followed in Canada, where the Federal Government set up ESCOs to increase energy efficiency in its own installations and to demonstrate the concept. These ESCOs were eventually privatized and continue to grow.

Analysis is being done in the course of work to prepare an Energy and Environment Strategy for the World Bank to find ways to overcome the limitations of existing financing mechanisms. This strategy is scheduled for discussion with the Bank's Board of Directors in June 1997.

Energy Efficiency and the Role of ESMAP

The process for achieving success in developing successful energy-efficiency activities can be summarized as follows:

- *Reform.* Energy-efficiency activities cannot succeed in a country unless steps are taken to begin the reform process notably with regard to pricing. Commercialization and corporatization are necessary for power companies to mount meaningful loss reduction and efficiency improvement programs.
- *Inform.* All partners and stakeholders need to be aware of the costs and benefits of undertaking energy-efficiency programs. Vastly increased information flows are needed to achieve the degree of market transformation needed to develop sustainable energy-efficiency programs.
- *Perform.* ESMAP, counterpart institutions, and ESCOs need to have the means to carry their activities through to successful completion. Activities must be designed so that there is a clear progression from identification through to implementation of efficiency projects. Project designs need to ensure that performance can be maintained through market-based incentives.

ESMAP will continue to be involved in all phases of this process. With top-down reform programs well advanced in many countries, however, ESMAP's focus has begun to shift toward grass-roots

implementation issues. In particular, ESMAP will work with in-country counterpart institutions to identify and quantify the market for energy services and the potential for the creation of eventually self-sustaining ESCOs. A premium will be assigned to projects with possibilities for early follow-up investments in energy efficiency.

Energy Efficiency, the Environment, and ESMAP

ESMAP's agenda concerning energy and the environment was set out in a paper, "Energy and the Environment: ESMAP Beyond UNCED," presented at the CG meeting in 1992 as a follow-up to the United Nations Conference on Environment and Development, held that year in Rio de Janeiro. In brief, ESMAP's goal is to help reduce the negative environmental effects of energy production, conversion, and end-use by reducing the energy intensity of economic activity and development.

The key elements of the agenda are as follows:

- Designing and implementing energy conservation and efficiency programs on both the supply and demand sides that are economically justified in terms of resource costs and benefits, including environmental externalities
- Increasing the technical efficiency of energy conversion and end-use equipment
- Improving the institutional capability of countries to plan, operate, and maintain energy systems and to formulate policies that lead to a rational use of energy with minimal environmental impact
- Encouraging technological development and innovation, such as switching to natural gas, where economic.

Clearly, the strategies for achieving energy efficiency and safeguarding the environment are to a large extent coincident. The potential for market-induced energy-efficiency gains that simultaneously benefit the environment has been estimated at 20 to 30 percent of total primary energy use.

The existence of adverse environmental externalities, however, argues for extending energy-efficiency investments and activities beyond levels justified on the basis of market considerations alone. Externalities at the local and regional level primarily relate to emissions of particulates, NO_x, and SO₂ associated with energy use. Energy savings that would be justified once local and regional externalities are taken into account have been estimated at an additional 10 to 20 percent of energy use.

At the global level, the current level of understanding of the global warming phenomenon is highly uncertain. Hence, the level of investment in energy-efficiency improvements that would be merited on the basis of global externalities is uncertain. The range of energy savings justified by global externalities can be considered to be a further 10 to 20 percent of total energy use, although some will argue that the range is much higher.

ESMAP can play an important role in increasing understanding in both developing countries and OECD countries of the linkages between energy and the environment and in supporting the design of policies (standards, codes, taxes, or even in some cases subsidies) to ensure that the environmental externalities associated with energy production, transmission, and consumption are properly taken into account.

Joint UNDP/World Bank

Energy Sector Management Assistance Programme (ESMAP)

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The United Nations Development Programme