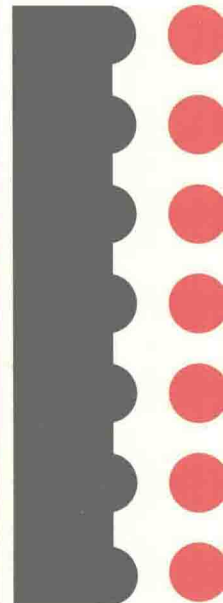
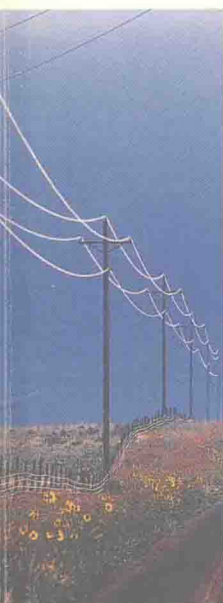


Energy Services for the World's Poor



Energy Sector Management
Assistance Programme

Energy and Development Report **2000**

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Energy Services for the World's Poor



The World Bank



ESMAP

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Assistance Programme

Energy and Development Report **2000**



Energy Services for the World's Poor

Acknowledgments

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Foreword

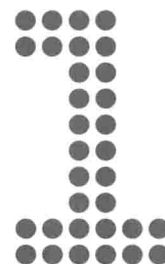
How should a developing country government, concerned with tackling poverty among its citizens, think about its role in the energy sector? Do energy policies and projects have a positive role to play in alleviating poverty? If they do, what kinds of policies and projects are likely to have the most beneficial—and sustainable—impact? And where should energy sector policy advisers, similarly concerned with promoting development and improving the lot of the poor, focus their efforts?

These are the critical—and contentious—questions motivating this year's *Energy and Development Report*. They lie at the heart of the debate about how much emphasis development policies should place on growth and on attempts to directly improve the lot of the poorest. And they are central to debates about the potential of different sectoral interventions to improve both general economic well-being and the welfare of the poor. The chapters that follow offer no definitive answers, no magic bullets. But they do seek to cast light—and provoke debate—on the questions that must be answered to develop energy sector policies that play a positive and sustainable role in the battle against poverty.

James Bond

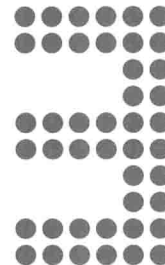
Chairman, Energy and Mining Sector Board

April 2000



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Part 1

Energy services for the world's poor



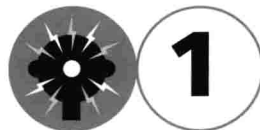
Customer first



New tools



New rules



Reaching the poor in the age of energy reform

Penelope J. Brook and John Besant-Jones

Throughout the industrial era investments to expand and improve energy services have been a mainstay of economic and social development policy in emerging and industrial countries alike. By expanding access to reliable sources of energy—gas, electricity, petroleum products—for agriculture, industry, commerce, and households, governments have primed growth in productivity and output. But in recent years the focus of their interventions has shifted from investing public funds in large-scale energy projects to mobilizing private investment and adopting commercial standards through structural, regulatory, and ownership reforms. Whatever the approach, the link between energy and economic development remains indisputable (World Bank 1994).

The link between energy programs and poverty alleviation is less well understood—and more likely to provoke debate and soul-searching among energy specialists. That access to better and cheaper energy services improves the welfare of the poor seems obvious. But how can we identify the less direct effects of changes in the sector on the poor—particularly the effects of recent sectoral reforms? And how can we weigh the effects on the poor of pro-growth, pro-efficiency reforms against those of direct interventions aimed at improving the poor's access to modern energy for consumption and productive uses?

Hard data to answer these questions remain in remarkably short supply. And the time for preparing this report was too short to commission empirical work to address this deficit. (Several authors note useful directions for such research, however.) Instead, the report focuses on clarifying the following issues:

- What role access to efficient and sustainable energy services can play in strategies for reducing poverty, and what role liberalizing energy markets can play in improving this access.
- How programs for liberalizing energy markets can improve options for expanding access to energy services for the poor (supported by case studies).
- What the key challenges—and key energy policy instruments—are in strengthening support to the poor.

It is arguable that the poorest of the poor, who probably make up the majority of the estimated 2 billion people who lack access to modern energy, do not stand to benefit much from reforms targeted primarily at existing electricity and gas networks. Should governments maintain these growth-oriented sector policies, but focus more attention on social spending aimed at sharing their benefits more effectively with the poor? Are more thorough reforms needed instead, aimed at developing markets in a variety of energy services for households and communities beyond the reach of existing networks—and often at the margins of the cash economy? Or should more emphasis go to programs combining a variety of infrastructure services and community interventions, so as to reap synergies from both bundling infrastructure services and involving communities in service delivery? These questions will continue to stoke a healthy debate among energy and poverty specialists for some time. This report aims to provoke, and to cast light on, that debate.

Access to energy—and poverty alleviation

Poor households and communities typically rely on diverse sources of energy, using one fuel for heating, another for cooking or lighting, another for agricultural or other productive activities. Often the real (per unit) costs of these alternative energy sources are high relative to those of electricity or gas delivered through networks to wealthier households. Moreover, these energy sources often have high nonmonetary costs. When women and children spend many hours collecting firewood or dung for heating and cooking, for example, they have less time for education or for developing other productive activities. And the use of traditional energy sources can have serious health and environmental consequences.

In essence, meeting the needs of the poor for sustainable energy means finding technological and institutional innovations that lower the costs of obtaining and using energy services, and tailoring these services to the requirements of low-income households and communities. That requires some knowledge of how they currently obtain

services—and of the nature of their demand for improved services (see chapter 2).

Energy services such as lighting, cooking, refrigeration, and power for electronics and motive force are provided most cheaply and conveniently, and with the least local pollution, when they are derived from electricity or gas delivered through networks. That is because the unit costs of energy from non-network sources are high relative to those of energy delivered through networks (see chapter 6). Moving from traditional to modern fuels can thus dramatically raise the effective incomes of low-income households.

But substantial barriers may prevent low-income households and communities from gaining access to modern energy services:

- Low-income households may be unable to fund the high costs of connecting to the networks (which run from US\$50 for the simplest single-phase connection to hundreds of dollars for more conventional connections).
- The effective cost of access to electricity is increased by the additional cost of purchasing electric appliances and fittings (see chapter 2).
- Electricity and gas networks are costly to build and thus require high densities of energy demand to be viable. Since low-income areas have relatively low densities of energy demand, especially in rural areas, expanding networks to these areas is generally not viable without substantial subsidies (see chapter 5).
- Where no network exists, installing alternatives (such as a household photovoltaic cell) is costly (see chapter 11).
- Investments in nongrid technology are often quite lumpy, reducing options for incremental increases in the use of gas and electricity. Where photovoltaic systems are used, for example, the initial decision on the size of cell to be installed sets an upper limit on energy availability (see chapters 10 and 11).
- Sustainable improvement in energy services requires not just investing in technology, but also developing commercial mechanisms for handling the relationship between suppliers and customers—from billing and payments to responding to customer complaints. Traditional mechanisms for handling the interface with customers are often ill suited to poor households in informal settlements (which may, for example, lack a formal address) or small and dispersed rural communities (see chapter 6).
- Households' ability to commit to new connections and pay for service depends not only on the affordability of the service but also on access to credit. Financing can be a major barrier for households that operate at least in part outside the cash economy or lack traditional forms of collateral.
- In the transition economies of Europe and Central Asia low-income households that historically received highly

subsidized energy services struggle to pay tariffs set closer to cost recovery levels (see chapters 3 and 8).

For policymakers wanting to improve services for the poor, the critical question is what kinds of policies and projects will be most successful—and most cost-effective—in knocking down these barriers. The more successful policies are in this, the less need there will be for subsidies to bridge the gap between service cost and households' ability to pay (see chapter 7).

The task for policymakers is not to pick winning technological and commercial innovations.

Has energy market reform helped the poor?

Intentionally or not, developing country energy policies often have elements likely to block or distort efforts to help the poor. Many traditional policies have been built on the implicit assumption that the demand characteristics of low-income energy users are similar to those of higher-income consumers. For example, it is presumed that all consumers will be best served by connections to conventional electricity grids providing twenty-four-hour access at standards approximating those in developed countries. So policies for expanding access have often centered on universal service obligations for incumbent or new utilities, accompanied by cross-subsidies ostensibly aimed at improving affordability for the poor but regressively favoring higher-income users, and exclusivity provisions protecting these otherwise unsustainable cross-subsidies. In addition, policies have emphasized network expansion, probably at the cost of non-network alternatives—if only because of monopolies granted to network owners unfamiliar with these alternatives.

The past decade has seen a revolution in energy policy in developed and developing countries. In a growing number of countries traditional public investment projects to reinforce and expand electricity and gas networks are being supplemented or replaced by sector reforms aimed at enhancing competition, reforming regulation, and securing a greater role for the private sector in financing and managing power generation and gas and, increasingly, distribution. The maps on the front and back inside covers show reform “scorecards”

for the power and oil and gas sectors, based on a 1998 survey of 115 developing countries. This survey focused on six key reform steps in each sector—from commercialization and market restructuring to regulatory reform and privatization. The results show that the power sector in these countries is still dominated by state-owned monopolies. In the oil and gas sectors the maps show very low levels of reform in downstream oil and gas, which is often accompanied by heavily subsidized prices and untapped potential for markets in such petroleum fuels as liquefied petroleum gas (Bacon 1999).

But private sector involvement in energy has been increasing. Between 1990 and 1999 seventy-six developing countries introduced private participation in their electricity and gas sectors by awarding more than 700 projects and divestitures of shareholdings in electricity and gas enterprises. These transactions involved private investments totaling almost US\$187 billion.¹ While middle-income developing countries have led this revolution, low-income countries also have been active participants (figures 1 and 2).

Despite the experience gained in energy reform, advances in generation technologies (conventional and non-conventional), and institutional and financial innovations in providing energy to low-income areas, the reforms have made little impact in improving energy services to the poor. They have focused on networks serving better-off users, gen-

erally neglecting institutional and market constraints to serving the poor.

Policymakers reforming energy markets need to focus more on protecting and promoting the interests of the poor. In particular, they need to find ways of providing market and regulatory incentives that motivate private energy suppliers to extend access, improve service reliability, and help with payment difficulties. The record on this score from the privatization of electricity distribution in developing countries—predominantly in Latin America, for urban and periurban areas—is mixed. But the Latin American experience also shows that there is scope for helping the poor when electricity distribution is passed to the private sector (see chapters 9 and 10).

Energy policies for alleviating poverty

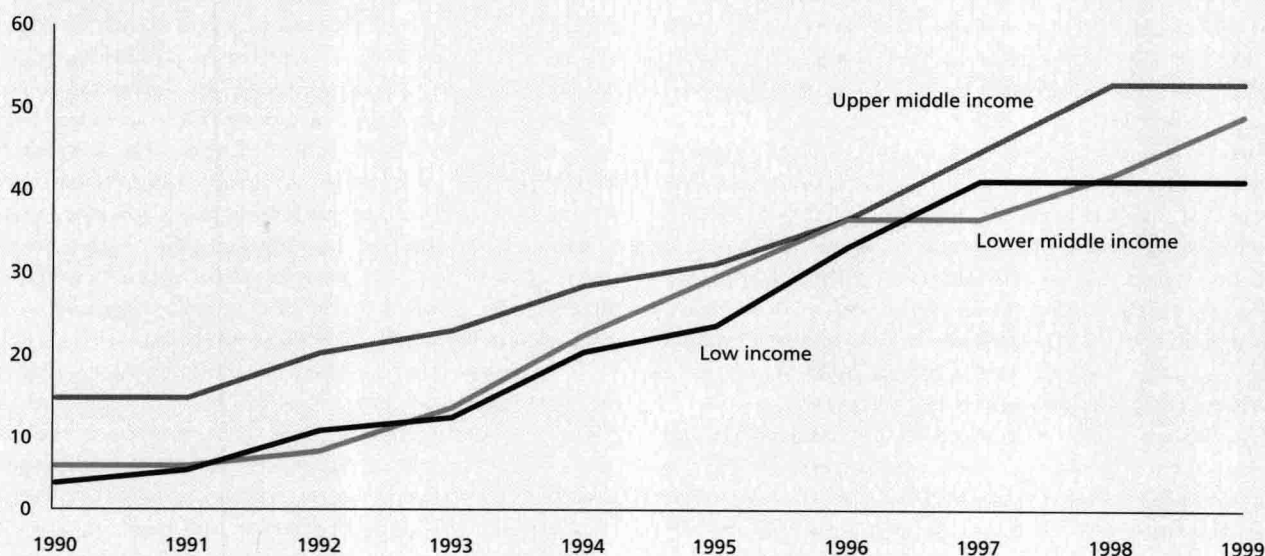
Across the energy sector, critical challenges remain: How to ensure that projects and policies intended to improve national welfare, particularly the welfare of the poor, achieve their aims? And how, in a sector characterized by both great diversity in services and complex links between service and poverty, to identify the kinds of interventions most likely to yield large and lasting benefits for the poor?

The task confronting policymakers is not to pick winning technological and commercial innovations (seldom an

Figure 1

Developing countries with electricity projects involving private participation, 1990–99

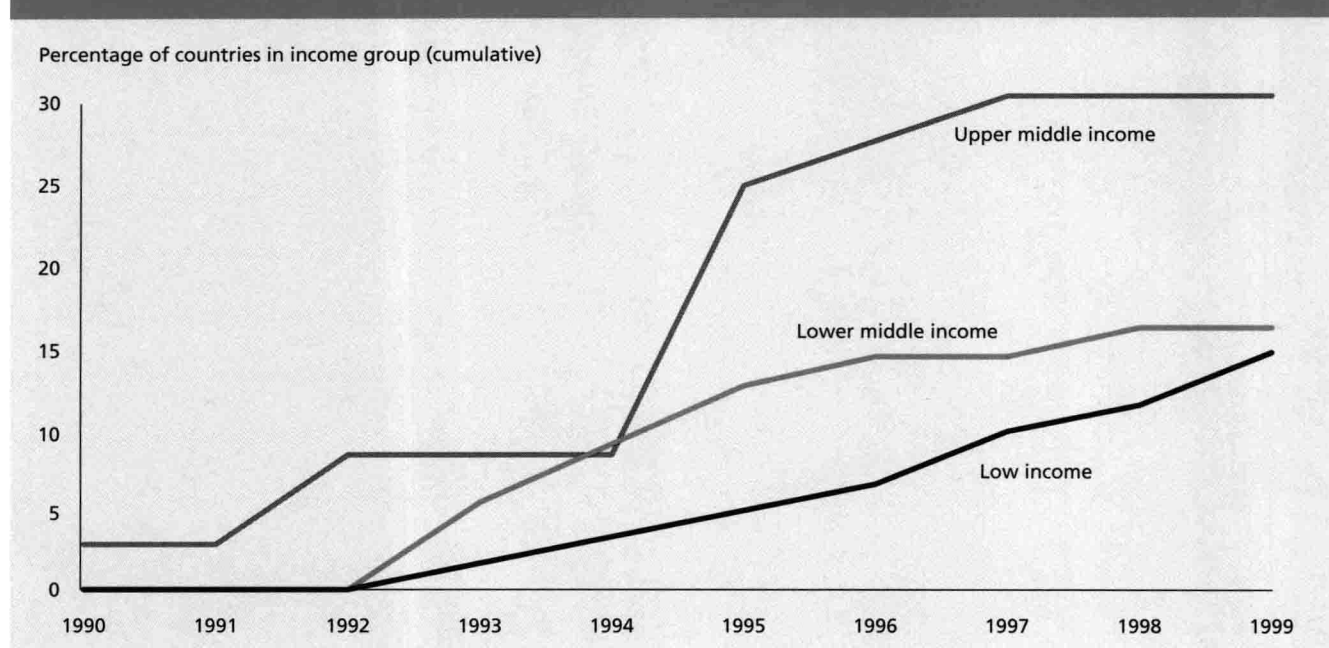
Percentage of countries in income group (cumulative)



Note: Country groupings are based on the income categories defined in World Bank 1999.
Source: World Bank, PPI Project Database.

Figure 2

Developing countries with gas projects involving private participation, 1990–99



Note: Country groupings are based on the income categories defined in World Bank 1999. Gas projects include only transmission and distribution.
Source: World Bank, PPI Project Database.

area in which they have much comparative advantage), but to establish an environment with strong incentives for innovation in delivering energy services that meet the demands of users. New generation and distribution technologies and easily replicable models for community mobilization are essential to improving services for the poor, but will not develop in a hostile institutional environment.

The key tools at the disposal of governments as they try to open opportunities for “pro-poor” innovations are institutional ones (see chapter 12). They include choices about market structure and ownership (where and how competition and entry will be allowed and supported), regulation (what the prerequisites for, and mode of, regulatory intervention will be), and pricing (interventions in tariff structures, and fuel taxation). In efforts to help the poor enter the market for better energy services, tools are likely to include not only subsidy policy but also liberalization of financial markets to ease access to credit.

The chapters that follow focus both on policies for liberalizing energy markets and on policies and projects aimed directly at improving energy services for the poor—through subsidies and through investments in pilot or demonstration projects that increase market penetration for promising new technologies.

The report also provides resources for practitioners in energy and poverty: a review of developments in private financing of energy infrastructure in developing countries during the 1990s, a list of selected readings, and a list of World Bank Group contacts in the energy sector.

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Note

1. These data are from the World Bank’s Private Participation in Infrastructure (PPI) Project Database. For more details on developments in the gas and electricity sectors, and on the database, see part 2.

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Customer first

2

Energy access, energy demand,
and the information deficit

A

Energy use around the world—
evidence from household surveys

3

Better energy services, better
energy sectors—and links with the poor

4

Measuring the impact of energy
reform—practical options



Energy access, energy demand, and the information deficit

Alan Townsend

Message from the editors

Projects and policies that improve the poor's access to reliable, modern energy services can make an important difference to their welfare. But what is the starting point for improving access? And what kinds of improvements will poor households and communities value? To answer these questions requires some understanding of how they obtain and use energy services today, both for consumption and for productive activities. Also essential is an understanding of poor households' demand for better energy services—and their willingness to pay for them. Traditionally, data collection on these issues was weak—state monopoly providers had limited incentives and capacity to learn about their current and potential customers. More recently, policy advisers and donor agencies have worked to understand the poor's demand for services and to tailor projects to their preferences. But the data gap remains wide. A commonly cited figure for those lacking access to electricity is 2 billion people. As this chapter and its annex show, these people rely on highly varied energy sources—often incurring real costs far higher than those for equivalent energy from electricity networks. Improving energy services is not, of course, simply a matter of reaching 100 percent electrification. It means providing better options for moving to cleaner, safer, cheaper energy sources—and making energy markets more responsive to the needs and demands of households and communities. Evidence suggests that the poor are indeed often willing to pay for better energy services. Thus a major challenge is to open markets to identify and meet this demand.

A key theme of this report is that commercial energy markets, with proper design, can offer a broad range of sustainable and profitable energy services to low-income households. As described in the following chapter, sector specialists generally assume that the poor would be better off if they consumed more and better-quality energy services. In addition, there is a general expectation that, all things equal, they would choose to do so if given the chance, despite limited resources.

In practice, energy policymakers and those who advise them have access to relatively little consistent, reliable data on the poor's current energy consumption or demand for improved services. This does not, of course, imply that, at the household or community level, the poor are necessarily ill informed about the benefits of improved energy access or vague about their preferences and willingness to pay for improved services. What it does imply is that those shaping broad policy or developing government-sponsored projects

in the sector are often poorly informed about the markets in which people actually access and use energy services—and risk making interventions that are inconsistent with local needs and preferences or, worse, actively thwart them.

Improving energy services for the poor will require greater attention on two fronts. First, policymakers and their advisers need to use such demand data as are available—within their own countries and abroad—to design projects that, at the least, do not close off energy options valued by the poor or distort incentives to supply and use better services. Second, they need to design policies and projects that elicit access and demand information more effectively. Here, the greatest gains are likely to come from policies that open up markets in energy services—and rely less on decisions by policymakers about who gets to buy what from whom. This chapter surveys the limited cross-country data available on demand for energy services by low-income households and discusses the implications for policymakers and energy sup-

pliers. The accompanying annex draws on one of the more consistent cross-country data sets—based on the Living Standards Measurement Study (LSMS) surveys—to provide illustrative data on service coverage, choice of cooking fuel, and energy expenditures.

Policies and markets need to be designed to elicit information on access and demand.

A huge and diverse market

Poverty is generally measured on an individual basis,¹ but the key unit for energy infrastructure is the household. Low-income households represent a huge potential market for energy services. While poor households are disproportionately rural, huge numbers remain inadequately supplied with modern energy services even in cities and in the periurban areas surrounding major centers of the developing world. This problem is likely to increase as urbanization intensifies—current projections are that the majority of people in developing countries will be living in urban or periurban areas by 2020.

Worldwide, hundreds of millions of low-income households lack access to modern energy (electricity and petroleum products), but estimating the figure even within a few hundred million people is difficult. A common (though perhaps outdated) estimate is about 2 billion people, a third of the world's population.² Only by carefully compiling data from representative household surveys covering a large cross-section of the world's developing countries can we obtain a more accurate estimate. But for most countries such survey data do not yet exist.

Available cross-country survey data show that low-income households consume a mix of energy products for domestic and productive purposes (see annex to this chapter). As a whole they:

- Exhibit substantial variation in energy consumption patterns, depending on climate, local fuel resources, the economic history of their country, whether they are urban, rural, or periurban, and other factors. Households in many African countries consume little commercial energy compared with households in the countries of the former Soviet Union, for example, where the electricity infrastructure built in Soviet times still connects almost 100

percent of the population (though inadequate tariffs and chronic nonpayment of energy bills are eroding these systems' reliability).

- Consume a mix of energy that is suboptimal from economic, financial, health, and environmental perspectives.
- Consume less modern energy than they would be willing and able to use if supplies were commercially available at prices that are fair while still recovering costs.

Emerging trends at the household level have implications—not yet fully understood—for the way we might measure demand for and access to energy. Households in most developing countries are getting smaller and may have fewer wage earners, reflecting such factors as higher per capita incomes, smaller family sizes, greater access to education, and increasing urbanization. The people living in these smaller households are less likely to be poor and thus more likely to have disposable income to spend on modern energy. But the smaller households also mean that each new electricity connection may benefit fewer people than in the past. This has implications for the design of programs to increase access and may also make state enterprise-led connection strategies more unrealistic.³

Trends in energy mix and use

Low-income households use a diverse mix of fuels to meet their needs. While higher-income households tend toward commercial, high-value fuels such as electricity, diesel, and liquefied petroleum gas (LPG) for both domestic and productive uses, the poor tend to use more human and animal motive power for productive purposes and more biofuels (wood, dung, thatch, and straw residues) and candles for domestic purposes—consuming very little of efficient, commercial fuels (World Bank 1996). About a third of total energy use in developing countries comes from biofuels, most consumed by poor households (Afrene-Okese 1999). As incomes grow, households generally switch to electricity for lighting and fossil fuels for cooking—while in agriculture and industry, electricity and diesel engines replace human and animal motive power. In urban areas the transition to modern fuels is generally complete by the time per capita incomes reach around \$1,000–1,500 (Barnes 2000).

Still, even for poor households, commercial energy is becoming a more important part of the mix for both consumption and productive purposes. Several factors lie behind this emerging pattern. First, the quality of energy from biofuels is low, and applications are limited. People who want to use good lights, radios, or appliances need commercial energy (including such sources as photovoltaic panels and batteries). Second, in heavily deforested areas and urban and periurban areas biofuels have become so scarce that they too have become commercialized. Once consumers pay cash for traditional fuels (or spend too much