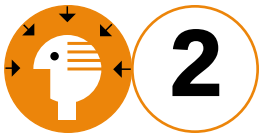

2 Energy access, energy demand, and the information deficit

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

Box 1 **Government policies can block demand from low-income households**

Several types of government policies can inadvertently limit access to energy services for the poor.

- *Long-term exclusive franchise arrangements.* Exclusive franchise agreements are motivated in part by the belief that the energy sector as a whole is a natural monopoly and, where private participation is introduced into the sector, in part by a perceived need to reduce investment risk by guaranteeing exclusivity in generation, transmission, distribution, and retailing. For those not yet connected, however, such agreements can block the development of alternative energy supply arrangements, especially if the franchise holder has a legal monopoly on distribution and retail in the entire country.

  When combined with a uniform tariff policy, exclusivity arrangements are doubly damaging. In India, for example, the chronically poor financial situation of the state electricity boards is attributable mainly to the extremely low tariffs in rural areas. The low revenues undermine the utilities' ability to expand access not only in rural areas but also in urban areas. Their weak financial condition eventually leads to deterioration in maintenance of generating and network assets and declining quality of service for all customers.

- *Tariff, tax, and subsidy policies.* A government might adopt a uniform national tariff policy (differentiated across broad categories of users such as industrial, agricultural, and residential) expressly to protect rural customers. But such a policy can inhibit the extension of networks into rural areas. Rural customers often are willing to pay more than the uniform tariff for a reliable supply of electricity, but utilities may never offer them the choice because they have no incentive to do so. And in some countries—such as Pakistan—industrial and commercial customers are so overcharged that they evade payment and bypass the grid by installing their own generating equipment, which would be uneconomic if tariffs reflected costs. This shrinks the utility's revenue base and further erodes its financial position.

  Import restrictions or taxes on energy products, often motivated by a desire to reduce dependence on particular fuels or on fuel imports, tend to raise the cost and reduce the availability of products. They may also have indirect effects. For example, taxing a high-quality fuel may increase the demand for lower-quality fuels, which will have price effects for the poor if supply is restricted. Thus a policy intended to raise revenue from the well-off can end up excluding the poor from consumption of a fuel.

- *Overspecification of technical and quality standards.* For historical reasons, developing countries often set technical standards in the electricity sector—covering everything from transmission and distribution grids to house wiring—at rich-country levels. That leads to high costs for electrification and increases the disincentive to expand network services. These high costs can be reduced appreciably by using design standards suitable for areas with low loads (World Bank 1996). Simplifying wiring codes and using load limiters (circuit breakers) rather than consumption-based meters for low levels of consumption can significantly reduce the costs not just of installation but also of billing and collection. Using cheaper poles and involving local labor in works and maintenance can also reduce connection and service costs.

Source: Powell and Starks 2000.

time gathering and preparing them), they are more likely to consider other commercial energy options.

Third, modern fuels have become cheaper in real terms. Despite a recent uptick in price, oil and gas are cheaper, in real terms, than they were before the first oil shock in 1973. Electricity prices have also fallen in real terms, because real price declines for fuel (including coal) have been accompanied by increased efficiency—so that more units of electricity are generated per unit of fuel—and because capital costs of many of the most important technologies have also fallen.[4]

These underlying cost drivers might be news to many consumers who have not yet felt their benefits. The problem is that poor government decisions—on pricing, taxation, competition, and other issues—have prevented many of the poor (as well as the better-off) from seeing the full benefits of the new commercial energy trends. Instead, mispricing has meant that consumers choose between no service and poor service—or pay higher prices in black markets or for do-it-yourself solutions (box 1).

End-use patterns are changing dramatically too (table 1). More households are investing in comfort (such as fans) and entertainment (especially television). Changes in consumption are driven by changes in preferences (for modern entertainment, for example), by big declines in prices for consumer electronic goods, and by the increasing energy efficiency of these goods.

Table 1 **Appliance ownership by households with electricity connections in four Indian states, 1980 and 1996** (percentage of households)

Appliance	1980	1996
Lights	100	100
Table fan	32	41
Ceiling fan	24	48
Transistor radio	47	31
Television	1	40
Tape recorder or record player	3	26
Refrigerator	1	9

Source: ESMAP 1999a.

While transistor radios—powered by expensive dry cell batteries—are less common than they were, televisions, tape recorders, and refrigerators have exploded in popularity and become increasingly affordable. Interestingly, consumers often embrace modern fuels for new uses—powering televisions, for example—while retaining traditional fuels for cooking and heating (see chapter 11). Modern fuels are also embraced for their business potential—from home sewing machines to video kiosks.

Spending levels

Not surprisingly, available cross-country data show that rich households spend more per month on electricity than do poorer ones (annex table A.8). But poor households often spend a higher share of their income, as in Bulgaria, Jamaica, Kazakhstan, Nepal, Pakistan, Panama, and South Africa.

Subsidy policy can skew these outcomes. Lifeline tariffs are commonly used in industrial countries to ensure that consumption at a basic level—for example, of the energy needed for good lighting in the evening—is available at low cost, while higher rates are charged for consumption above that level. Even these limited subsidies may have adverse incentive effects for making new connections to low-income households. Lifeline tariffs are still relatively rare in developing countries. More common in these countries is to subsidize entire classes of consumers, which typically benefits mostly middle- and upper-income households (because they tend to be connected more often and to use more power than poorer households). Even correcting for the effect of poor subsidy design and targeting, it would not be surprising to see poor households devoting a greater share of income to electricity, reflecting the high value they place on the service.

Evidence of willingness and ability to pay

Low-income households consume a relatively small amount of energy, and that energy is of low quality. Per capita energy consumption in South Asia is only 2.6 percent—and that in Sub-Saharan Africa only 1.3 percent—of per capita consumption in the United States (World Bank 1996). For these supplies, survey and anecdotal evidence suggests, South Asians and Sub-Saharan Africans pay among the world's highest unit costs—and get some of the world's worst-quality energy.

Ugandans spend an estimated US$100 million a year—an incredible 1.5 percent of GDP—on dry cell batteries to power radios, flashlights, and other small items. The average Ugandan household spends an estimated US$72 a year on dry cell batteries, used in 94 percent of Ugandan households. The cost per unit of energy consumed works out to US$400 a kilowatt-hour. Ugandans may spend almost as much per year on kerosene for their lamps.

Car batteries, which cost about US$120 a year to operate, produce better-quality power at about US$3 a kilowatt-hour. More Ugandan households are powered by car batteries (around 5 percent) than by the integrated electricity network (around 4 percent; ESMAP 1999d). Not surprisingly, businesses and wealthier households in Uganda are enthusiastic buyers of diesel generators, which produce energy at about 19 cents a kilowatt-hour, or about three times the average (inad-

equate) tariff charged by the Uganda Electricity Board (UEB). Household tariffs normally range from 6 to 12 cents a kilowatt-hour. One result of chronic power shortages on the integrated network is that disadvantaged industries often have surplus captive capacity—perhaps equal to 20 percent of UEB's installed base—that cannot be sold to UEB or anyone else (Reinekka and Svensson 1999).

Uganda may be an extreme case, even for Africa. But evidence abounds that consumers in developing countries are willing to pay often extraordinarily high prices for reliable and predictable (if not always high-quality) energy. In the Lao People's Democratic Republic, one of the poorest countries in the world, surveys show that people will pay up to 10 percent of their income for energy services (ESMAP 1999c). Other survey data for developing countries indicate that for households with connections, electricity accounts for 1–8 percent of total consumption (see Afrane-Okese 1999 and the annex to this chapter). Among low-income households, median spending on electricity ranges from US$1 to US$12 a month. At the lower end of that range, mispricing and nonpayment are probably at least partially responsible for the low share of consumption spending devoted to electricity (as exemplified in almost every country in South Asia, Sub-Saharan Africa, and the former Soviet Union). Surveys also suggest that long-suffering customers of poorly performing utilities would be willing to pay more if the quality and reliability of power increased, but resent price increases when quality remains so poor.[5]

The flip side of this story: In too many cases the poor simply do not have the choice of consuming commercial energy. Governments must take the primary blame here—too many fail to follow policies that encourage rational pricing and competition in the energy services sector.

Better ways to measure demand

Most donor projects targeted at the poor now include some attempt to assess demand and willingness to pay at the design stage. However, there are serious problems in ensuring that such analysis elicits relevant information—or is linked effectively to project design. Difficulties in measuring demand for energy services, particularly among low-income households in developing countries, are well known. Survey questions may suffer from unrecognized biases. The answers too may suffer from biases, and they may not reflect actual demand responses. Selecting a representative sample is always difficult. And the analysis of the survey results is inevitably simplified to a point where conclusions may be less than useful (if not obvious).

Nowhere is the problem greater than in estimating the willingness of people to pay for commercial energy services. In many countries years of chronic undersupply, miserable quality, rampant theft of power or nonpayment, gross mispricing, and poor performance by state-owned monopoly suppliers have made willingness to pay even more difficult to assess. Moreover, baseline information on access and payments is generally in short supply in developing countries. State monopoly energy providers, facing only limited incentives to improve services, seldom gather reliable data on customer coverage, payments, and preferences. The only way to systematically reveal willingness to pay is to liberalize markets so that consumers can choose from a wider range of options with fewer distortions. But few developing country policymakers have fully embraced this solution. Most continue to view energy as a social good—and consumers as incapable of independent decisions about the mix of energy they will use.

We need to change the people who do the demand-side analysis.

Anecdotal evidence suggests that the biggest single hurdle for most households is up-front connection costs, which can range from as low as US$50 to well over US$1,000. This is true whether or not utility-provided electricity or gas is available. If it is not, most households theoretically could buy generators or photovoltaic installations, but may lack the credit or cash to do so. Potential customers have indicated in surveys (in many countries) and shown in practice (in a few) a willingness to take medium-term loans to fund up-front costs, repaying them as part of their bill over the first five years or so of service.

Variable costs—operations, maintenance, fuel—are less of a hurdle, although for a utility there are clearly some challenges here in building up both critical mass and the right mix in the customer base. Average monthly billing for some rural cooperatives in Bangladesh is in the range of US$2–3 per customer a month. Even where there is high density of demand, that level of average billing leaves little room for growth.

While the unmet demand of low-income households for commercial energy services is unquestionably large, it has limits. Even with perfect policies, some households will be unable or unwilling to pay for advanced energy solutions. Despite progress in reducing costs for both on-grid and off-grid technology, initial connection and monthly consumption charges can still present steep hurdles for low-income households. And government resources are unlikely to

suffice to electrify low-income households at the same pace as higher-income consumers. Inevitably, tradeoffs will have to be made. But with a mix of good policy and effective communication, a government can sell a program that does not lead immediately to 100 percent electrification.

Conclusion

An understanding of current energy consumption by low-income households and communities, and of their preferences and willingness to pay for improved services, is an essential starting point for any energy project aimed at effectively and sustainably improving welfare. The monopolistic state suppliers that dominated energy sectors in the past were notoriously bad at gathering this kind of information. More recently, sector projects have come to place more emphasis on understanding demand, but available data remain spotty and survey methods are fraught with difficulties. Nevertheless, available survey and anecdotal evidence suggests that the poor represent a strong potential market for improved energy services.

How to make progress? We may know enough about demand on a global scale to be confident about one initial step: change the people who do the demand-side analysis. Fuel suppliers, equipment manufacturers, energy service companies, consumer groups (including user-owned energy suppliers), trade groups, and others need to be more involved in developing the energy services market for low-income households. But this can happen only if policymakers create an appropriate environment—and if state-owned enterprises either stop being part of the problem or disappear (through privatization or liquidation). Policymakers need to allow competition in the market for new customers and to provide mechanisms, including subsidies, to help potential customers pay for initial connections. And they can do much to lower transactions costs for communities, individuals, and private entities wishing to invest in infrastructure.

Policymakers need to make fewer decisions about who gets to buy what from whom. This implies a less controlled market—with its share of failures—in which a variety of institutions deliver a range of services. The result will reflect demand for energy services by the poor today—a market in which the solutions come from households, people make their own choices about fuels and their use, innovative energy service suppliers can prosper, and innovative consumers can increase the quality of their life and, potentially, their income.

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Notes

1. The standard definition of individual poverty is living on less than US$1 a day, adjusted for purchasing power parity. No distinction is made between rural and urban areas (or between monetized and only partially monetized settings).

2. Even this figure may understate the number without access, because some countries (India, for example) count all households in a village as being electrified if the village has one streetlight and one electric water pump.

3. In some countries, particularly in Africa, the growth in the number of households combined with the weak financial condition of local power companies has meant that the share of the population with access to electricity is actually decreasing. In Uganda a load forecast by Electricité de France indicated that doubling the number of household connections would increase the share of the population with access to electricity by less than 50 percent as a result of population growth and new household formation.

4. Capital costs for combined-cycle gas turbine power plants have been cut in half, to around US$400 per installed kilowatt, in less than ten years; efficiencies have gone up more than 10 percent; and delivered gas prices in most regional markets have fallen (see Electric Power Research Institute 1999).

5. Survey results from India and other countries are mixed on this issue and many others, indicating a need for basic education and communication about energy services and why they cannot simply be delivered for free (or at massively subsidized prices).

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Annex
Energy use around the world—evidence from household surveys

Kristin Komives, Dale Whittington, and Xun Wu

This annex presents findings from a study of data sets from Living Standards Measurement Study (LSMS) surveys in fifteen developing countries around the world (box A.1). It reports results on electricity coverage, choice of cooking fuel, expenditures on electricity, and total energy expenditures. These results show:

Box A.1 **Data notes**

- The survey data allow study of household use of electricity for lighting and cooking. The study assumes that households that use electricity for neither lighting nor cooking do not have electricity.
- To identify the richest and poorest households, the study divided the households in each national sample into quintiles by per capita consumption. Consumption data are generally more accurate than household income data.
- The study adopted the urban-rural distinction made by the LSMS survey teams. The methodology used for distinguishing between urban and rural areas varies from country to country, but the cross-national findings nevertheless give a general sense of differences in energy use between urban and rural areas.
- To look at cross-national expenditure patterns, the study converted all expenditures to 1998 U.S. dollars using official exchange rates in the survey year. (Sector-specific purchasing power parity rates would have been preferable but were not available for the countries in the sample.)
- Because most LSMS surveys are not self-weighting, weights are needed in data analysis to correct for the effect of sample design and rates of nonresponse. For the preliminary results reported here, no weights have been used. The results are valid only for the survey population and cannot be extrapolated to the national level.

- Cross-national differences. The countries in the sample are in Asia, Europe and Central Asia, Latin America and the Caribbean, and Sub-Saharan Africa, with surveys ranging from as recent as 1997 to as far back as 1988 (box A.2). The choice of countries in the study sample was based on data availability.
- Differences in household energy use and spending between rich and poor and by consumption levels.

Box A.2 **Countries in the study and the year of their survey**

Asia	
Nepal	1996
Pakistan	1991
Vietnam	1993
Europe and Central Asia	
Albania[a]	1997
Bulgaria	1995
Kazakhstan	1996
Kyrgyz Republic	1993
Ukraine	1996
Latin America and the Caribbean	
Ecuador	1995
Jamaica	1997
Nicaragua	1993
Panama	1997
Sub-Saharan Africa	
Côte d'Ivoire	1988
Ghana	1989
South Africa	1993

a. The survey sample does not include Tirana.

Table A.1 **Electricity coverage varies widely across countries**

Country	Percentage of households with electricity
Côte d'Ivoire	40.8
Ghana	23.8
South Africa	51.2
Ecuador	88.3
Jamaica	77.7
Nicaragua	66.5
Panama	73.2
Nepal	25.8
Pakistan	76.5
Vietnam	48.6
Albania	100.0
Bulgaria	100.0
Kazakhstan	99.7
Kyrgyz Republic	99.5
Ukraine	99.7

Source: LSMS surveys.

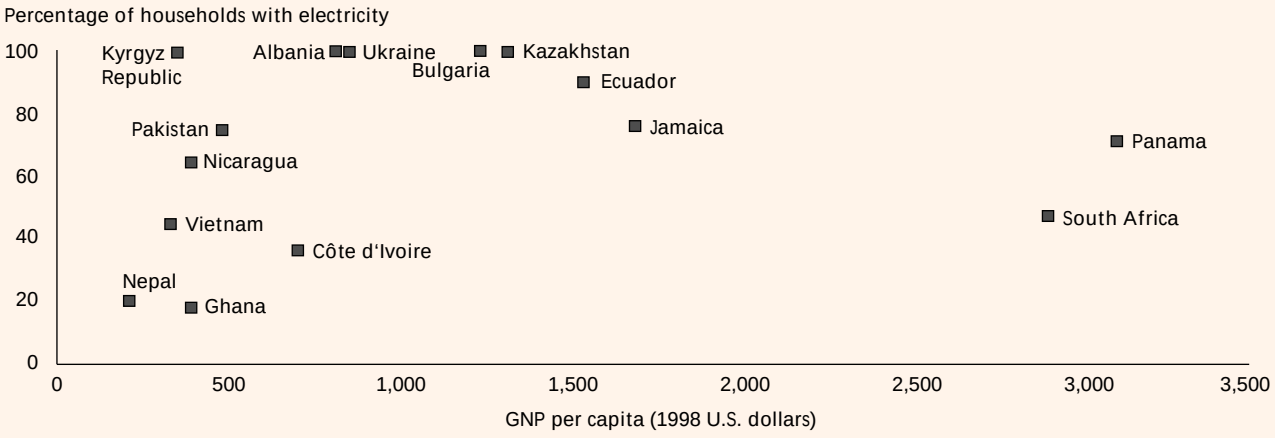
- Differences between urban and rural areas.
- Differences in coverage between electricity and other infrastructure services.

The surveys

Many countries undertake household surveys using some form of the LSMS survey. Developed by the World Bank in 1980, LSMS surveys have been adopted (with minor variations) in more than twenty developing countries. They are one of the most popular tools used by policymakers for measuring living standards and poverty and for designing government policies and evaluating social programs (see Deaton 1997 for an in-depth analysis of the potential uses of the LSMS data sets). LSMS surveys include questions on such utility services as water, electricity, and telecommunications, making them the only source of data for reliable cross-national comparisons combining information on energy use and broader socioeconomic characteristics of households.

LSMS surveys offer a unique opportunity for comparing infrastructure across countries using roughly similar data and for studying household well-being in detail. But they also have some gaps. The surveys are not done each year, so some results are outdated. Surveys rarely collect information on the infrastructure services available to households or on the quality of the service they receive. They gather information on household expenditures on such services, but not on use levels or unit prices. The surveys ask similar questions on infrastructure across countries, but the categories of answers usually differ. Thus some detail is lost in cross-country comparisons.

Figure A.1 **Weak relationship between GNP per capita and electricity use**



Note: GNP per capita data are from the World Bank's World Development Indicators database and are calculated using the World Bank Atlas method.
Source: LSMS surveys.

Moreover, it is difficult to make causal inferences (for example, why households use certain services) using cross-sectional data. For some countries panel data sets are available with survey information from several years. But these are exceptions, and cross-national comparisons using panel data generally are not possible.

Household electricity coverage

This section shows electricity coverage by country, by per capita GNP, for rural and urban areas, and by consumption quintile.

- *Coverage by country.* Households in Europe and Central Asia are by far the most likely to use electricity—more than 99 percent of sample households in Albania, Bulgaria, Kazakhstan, the Kyrgyz Republic, and Ukraine reported having electricity (table A.1). Fewer than half of households in Nepal and Vietnam used electricity at the time of the surveys. Households in Latin America and the Caribbean fall in between: 66–88 percent of households in Nicaragua, Panama, Jamaica, and Ecuador reported having electricity.
- *Coverage by GNP per capita.* The surveys show some tendency for electricity use to rise with per capita GNP, but this relationship is weak (figure A.1). Panama and South Africa are outliers, with lower electricity coverage than might be expected at their income levels. Countries in Europe and Central Asia have more extensive coverage than countries with similar per capita GNP in other regions.
- *Coverage in urban and rural areas.* Electricity use is generally much higher in urban than in rural areas (table A.2). In all countries except those in Africa the urban areas have electricity coverage of more than 85 percent. But electricity use in rural areas varies dramatically among countries. In Europe and Central Asia virtually all rural households report using electricity. By contrast, Ghana has only 4.3 percent coverage in rural areas.
- *Coverage for the richest and poorest quintiles.* The countries of Europe and Central Asia boast the smallest difference in electricity coverage between the richest and the poorest households in the sample population (table A.3). Virtually

Table A.2 **Electricity use in rural areas differs dramatically across countries**

Country	Percentage of households with electricity	
	Rural	Urban
Côte d'Ivoire	12.7	73.1
Ghana	4.3	61.7
South Africa	27.2	74.6
Ecuador	74.8	97.4
Jamaica	69.3	86.1
Nicaragua	33.1	92.3
Panama	48.7	98.1
Nepal	8.9	88.6
Pakistan	58.3	94.6
Vietnam	38.8	87.9
Albania	99.9	100.0
Bulgaria	100.0	99.9
Kazakhstan	99.5	99.9
Kyrgyz Republic	99.5	99.5
Ukraine	99.8	99.7

Source: LSMS surveys.

Table A.3 **Disparities between rich and poor in electricity use are often great**

Country	1998 GNP per capita (1998 U.S. dollars)	Percentage of households with electricity	
		Poorest quintile	Richest quintile
Côte d'Ivoire	700	11.0	71.0
Ghana	390	7.2	43.1
South Africa	2,880	13.0	94.6
Ecuador	1,530	77.9	97.5
Jamaica	1,680	55.4	94.0
Nicaragua	390	28.4	93.1
Panama	3,080	23.0	97.1
Nepal	210	3.7	75.0
Pakistan	480	59.8	89.6
Vietnam	330	27.4	76.3
Albania	810	100.0	100.0
Bulgaria	1,230	100.0	100.0
Kazakhstan	1,310	99.7	100.0
Kyrgyz Republic	350	99.0	100.0
Ukraine	850	99.7	99.7

Note: GNP per capita data are from the World Bank's World Development Indicators database and are calculated using the World Bank Atlas method.
Source: LSMS surveys.

everyone—rich and poor—has electricity. In most other countries in the sample the richest households are much more likely to use electricity than are the poorest.

- *Coverage for all quintiles.* Are the differences related to household consumption levels? The survey data show that electricity use rises with consumption within countries, but not necessarily across countries (figure A.2). Quintiles with roughly similar levels of consumption (but from different countries) can have very different levels of electricity coverage. In Latin America and the Caribbean, for example, coverage for the quintile with a median consumption of about US$200 is roughly 55 percent in Jamaica and 75 percent in Nicaragua. Similarly, in Sub-Saharan Africa the quintile with consumption of US$150 has coverage of more than 40 percent in Ghana, but less than 15 percent in Côte d'Ivoire and South Africa. In both regions it appears that whether a household falls in the richest or poorest fifth of households in its country is more important than its absolute consumption level in determining whether it uses electricity.

Cooking fuels—basic or modern?

Households use energy for many different purposes and often choose different energy sources for each. Most households with electricity connections, for example, do not use electricity for cooking.

Cooking fuels can be grouped into three categories: *advanced* (electricity and bottled or natural gas), *intermediate* (kerosene and charcoal), and *basic* (wood, dung, thatch, and straw). Information on the use of advanced and basic cooking solutions was available for eight countries in the sample.

These eight countries fall naturally into two groups: those in which most of the population uses wood, dung, thatch, or straw as cooking fuel, and those in which this is not the case. Unlike electricity use, the choice of cooking fuel appears to be correlated with GNP per capita. The

Figure A.2 **Relative consumption is more important than absolute consumption in determining electricity use**

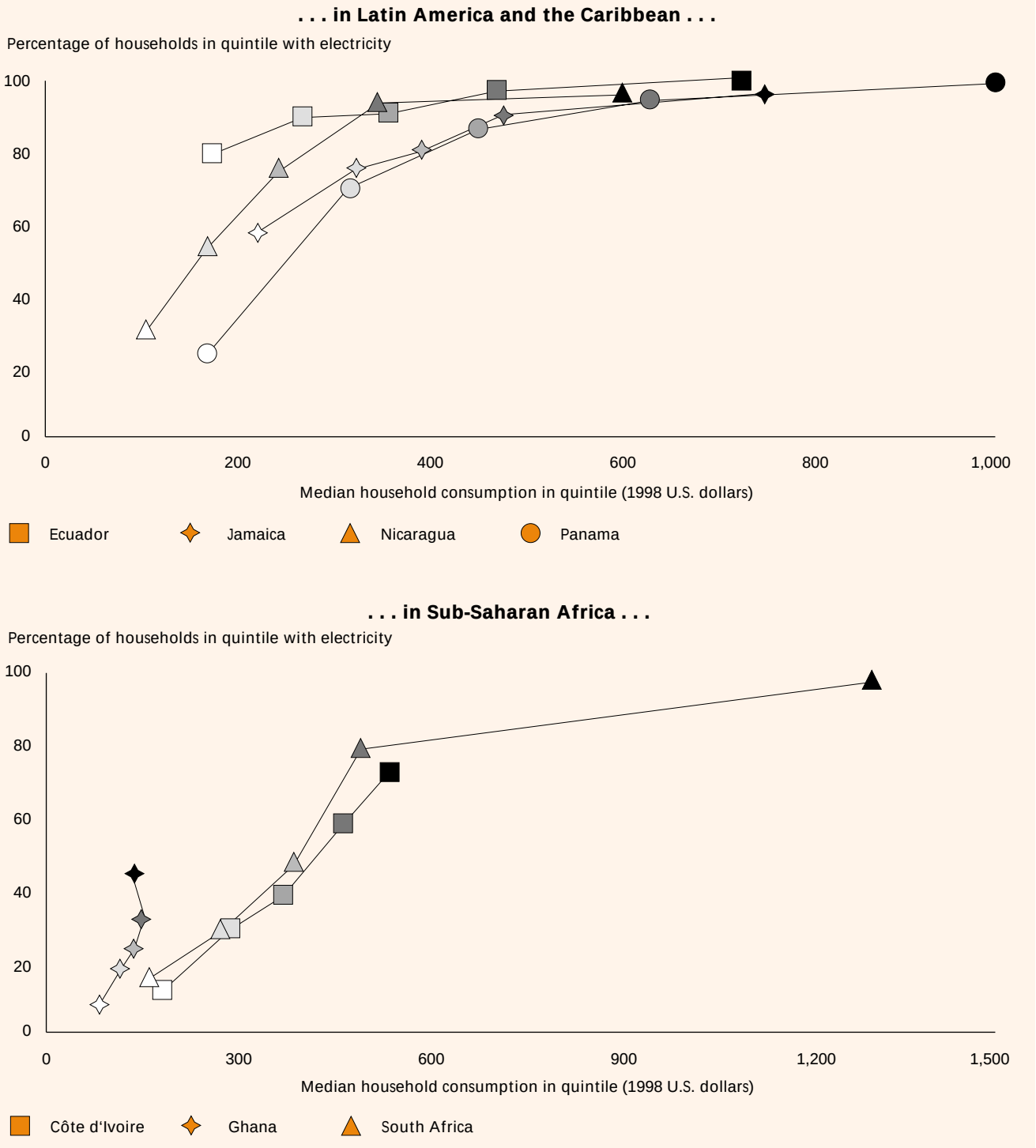
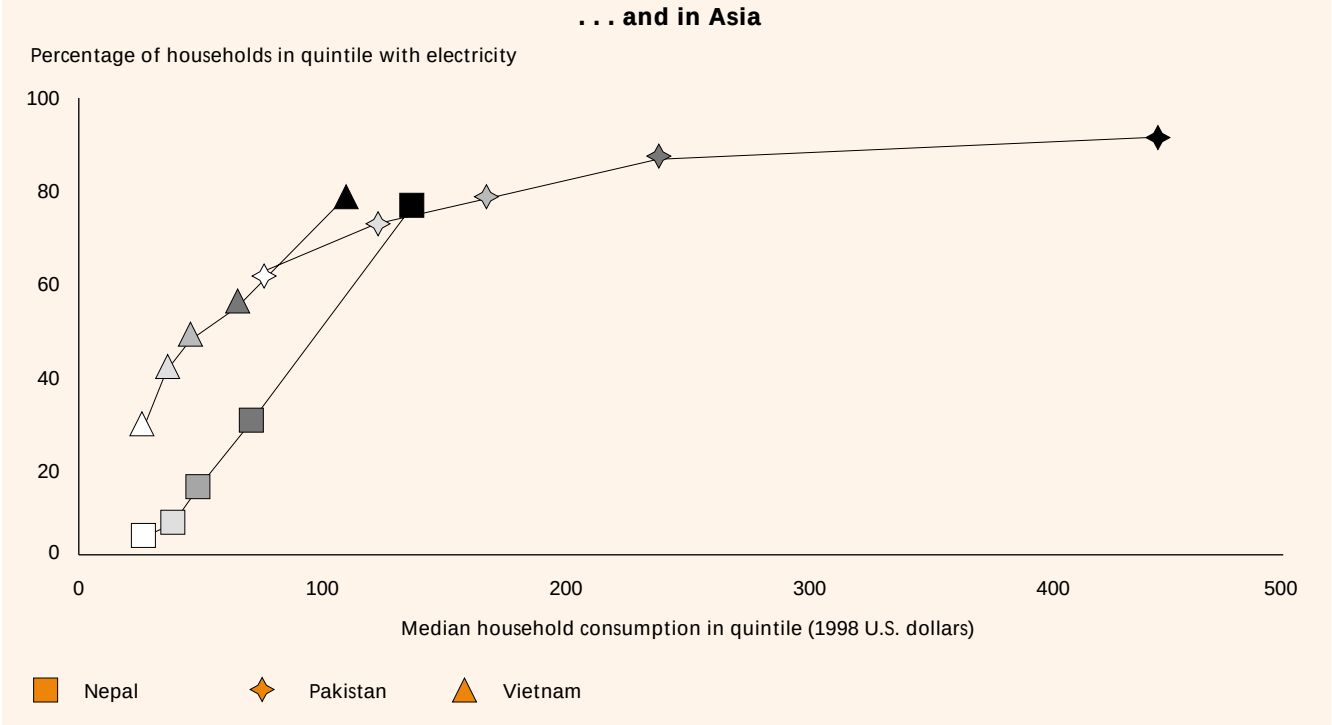


Figure A.2 **Relative consumption is more important than absolute consumption in determining electricity use (continued)**



Note: The progression in the shapes from light to dark shades indicates the progression from the poorest to richest quintile. The richest quintile in Ghana has higher per capita consumption but lower median household consumption than the second quintile because the richest households are on average much smaller.
Source: LSMS surveys.

countries in the first group—Côte d'Ivoire, Nepal, Nicaragua, and Vietnam—are all low-income economies, as classified by per capita GNP. The second group consists of lower-middle-income and upper-middle-income economies: Bulgaria, Ecuador, Panama, and South Africa.

In only two countries in this second group—Bulgaria and South Africa—do large numbers of households use electricity for cooking (table A.4). In Ecuador and Panama most households use gas or kerosene for cooking.

In the four low-income economies almost no households in rural areas and in the poorest quintile use advanced cooking fuels (tables A.5 and A.6). Virtually all these households use wood, dung, thatch, or straw for cooking. Even urban households and those in the richest quintile are unlikely to use advanced fuels. Most use an intermediate fuel, and many use basic fuels. Only in Nicaragua do more than half the households in the richest quintile use an advanced fuel for cooking.

In the four wealthier countries, by contrast, very few urban or rich households use basic fuels for cooking. Fuel use by rural and poor households varies more among these countries.

Spending on electricity services

The LSMS data sets do not include information on electricity rates, but they do have information on monthly electricity spending. This information reveals what share of household consumption goes to electricity services.

- *Monthly consumption devoted to electricity.* Among households paying an electricity bill, the median share of consumption devoted to electricity services is less than 4 percent for all countries (table A.7). The median monthly electricity bill for most countries falls within the range US$1.10–6.00 (in 1998 dollars). The exceptions are Côte d'Ivoire, Jamaica, Panama, and South Africa, all with median bills of more than US$15.00 a month.
- *Electricity spending by the poorest and richest.* As might be expected, the poorest households have lower electricity bills on average than do the richest (table A.8). In some countries the difference is quite small, but in most cases the richest households spend on average three to six times as much on electricity each month.

Although rich households have higher bills, in nine of thirteen countries the households in the poorest quintile

Table A.4 Households' choice of cooking fuel is correlated with per capita GNP (percent)

Country	1998 GNP per capita (1998 U.S. dollars)	Advanced fuels		Basic fuels
		Electricity	Bottled or natural gas	
Low income				
Côte d'Ivoire	700	0.0	7.4	68.1
Nepal	210	0.2	3.7	83.7
Nicaragua	390	2.1	18.8	74.8
Vietnam	330	0.7	0.0	88.7
Middle income				
Bulgaria	1,230	75.6	6.8	.. [a]
Ecuador	1,530	0.9	.. [b]	14.7
Panama	3,080	0.5	.. [b]	26.5
South Africa	2,880	42.5	2.8	27.9

.. Not available.
Note: Basic fuels are wood, dung, thatch, and straw.
a. Wood, dung, thatch, and straw are not included as a separate category in the Bulgarian LSMS survey. Nonetheless, the share of households using these fuels is clearly small: only 17.65 percent reported using a fuel other than electricity or natural or bottled gas.
b. The survey does not distinguish between kerosene (an intermediate fuel) and bottled or natural gas.
Source: LSMS surveys.

Table A.5 Most households use basic fuels for cooking except in the urban areas of wealthier countries (percent)

Country	Rural households		Urban households	
	Advanced fuels	Basic fuels	Advanced fuels	Basic fuels
Low income				
Côte d'Ivoire	0.6	98.3	15.8	35.3
Nepal	0.2	97.5	17.2	32.4
Nicaragua	2.1	96.9	35.2	58.0
Vietnam	0.1	96.5	3.4	57.3
Middle income				
Bulgaria	55.8	..	95.5	..
Ecuador	..	31.6	..	3.0
Panama	..	50.6	..	1.8
South Africa	19.7	54.4	70.8	2.0

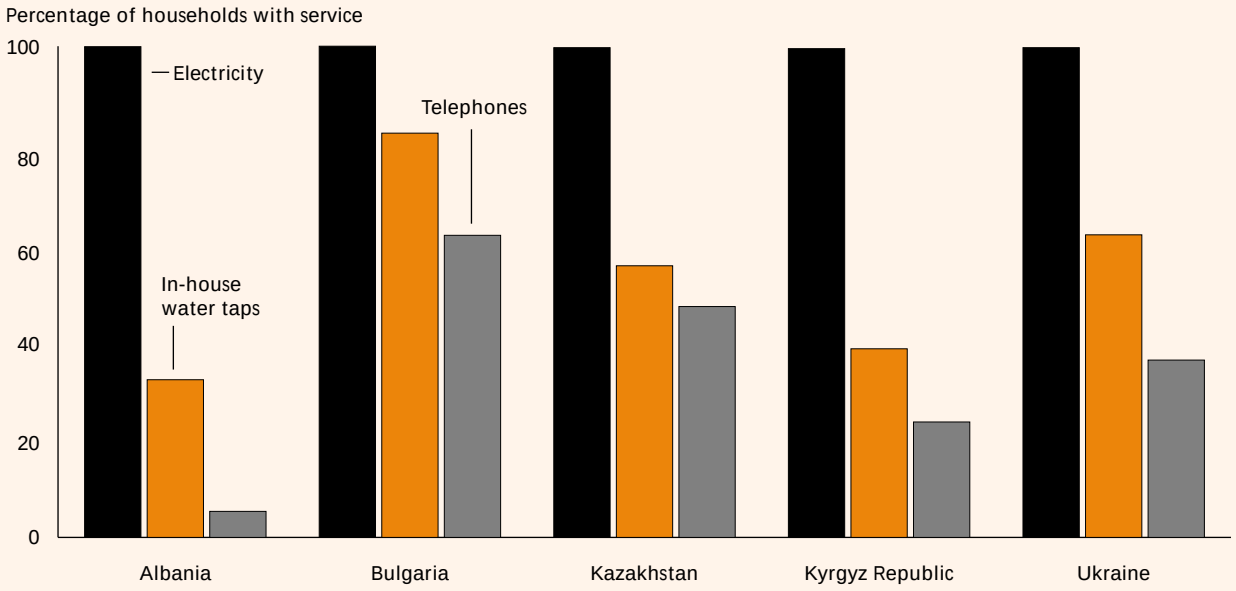
.. Not available.
Note: Advanced fuels are electricity and natural gas. Basic fuels are wood, dung, thatch, and straw.
Source: LSMS surveys.

Table A.6 **Virtually none of the poor in countries with low per capita GNP use advanced fuels for cooking** (percentage of households)

Country	Poorest quintile		Richest quintile	
	Advanced fuels	Basic fuels	Advanced fuels	Basic fuels
Low income				
Côte d'Ivoire	0.0	99.4	27.2	27.2
Nepal	0.0	98.5	18.7	38.9
Nicaragua	0.6	98.6	54.4	40.4
Vietnam	0.0	99.0	3.4	64.4
Middle income				
Bulgaria	69.3	..	90.2	..
Ecuador	..	32.9	..	3.4
Panama	..	77.1	..	2.3
South Africa	5.2	68.5	93.2	0.4

.. Not available.
Note: Advanced fuels are electricity and natural gas. Basic fuels are wood, dung, thatch, and straw.
Source: LSMS surveys.

Figure A.3 **In Europe and Central Asia more households use electricity than have in-house water taps and telephones**



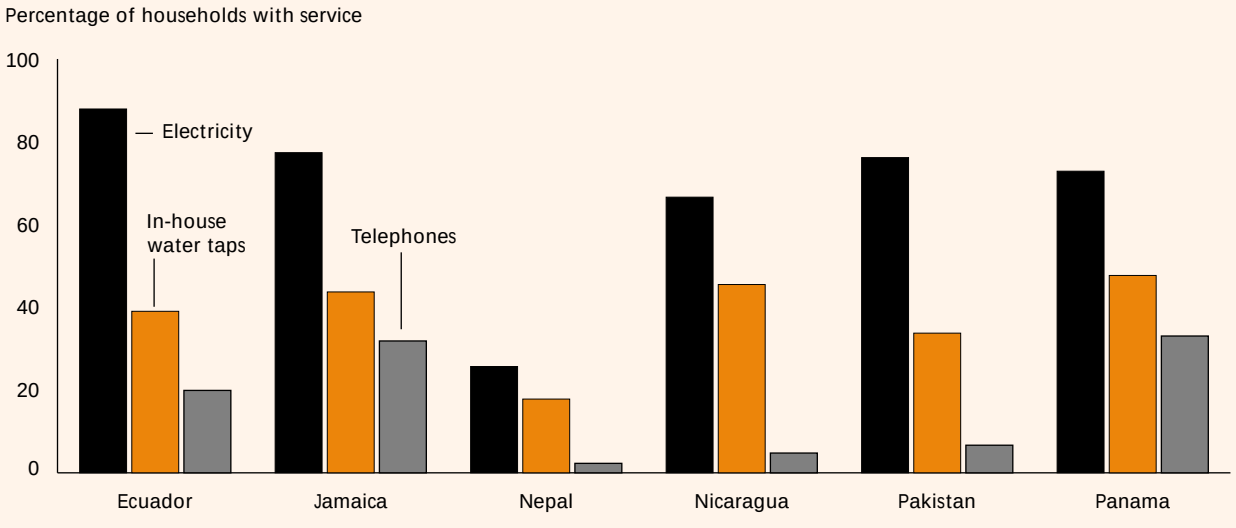
Source: LSMS surveys.

Table A.7 **Median spending on electricity is less than 4 percent of household consumption in all countries**

Country	Median monthly electricity bill (1998 U.S. dollars)	Electricity bill as percentage of consumption
Côte d'Ivoire	15.00	2.8
Ghana	1.40	0.9
South Africa	25.90	3.8
Ecuador	2.90	0.8
Jamaica	17.20	3.7
Nicaragua	6.00	2.0
Panama	16.20	2.7
Nepal	1.80	1.7
Pakistan	2.50	1.7
Vietnam	1.10	2.0
Albania	4.00	2.3
Bulgaria	4.00	2.5
Kazakhstan	3.90	1.8

Source: LSMS surveys.

Figure A.4 **Electricity use is also more widespread than in-house water taps and telephones in Latin America and Asia**



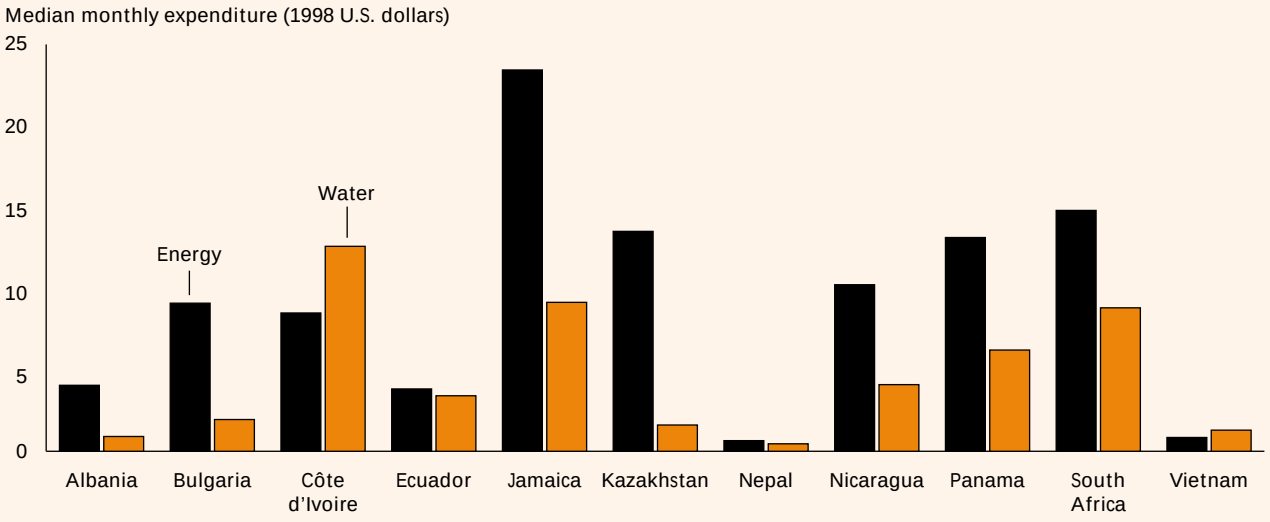
Source: LSMS surveys.

Table A.8 The poorest households devote a greater share of consumption to electricity than the richest do

Country	Median monthly electricity bill (1998 U.S. dollars)		Electricity bill as percentage of consumption	
	Poorest quintile	Richest quintile	Poorest quintile	Richest quintile
Côte d'Ivoire	7.78	23.71	2.3	3 0
Ghana	1.07	1.46	1.2	0.9
South Africa	6.90	44.50	3.9	3.6
Ecuador	1.67	7.09	1.0	0.8
Jamaica	11.47	19.40	5.0	2.6
Nicaragua	2.41	14.44	2.2	2.4
Panama	5.42	24.24	2.9	2.4
Nepal	0.91	2.93	2.9	1.7
Pakistan	1.75	5.28	2.5	1.2
Vietnam	0.53	2.57	1.9	2.2
Albania	2.48	8.94	2.0	3.0
Bulgaria	3.18	5.09	3.4	1.9
Kazakhstan	3.51	3.86	3.1	1.0

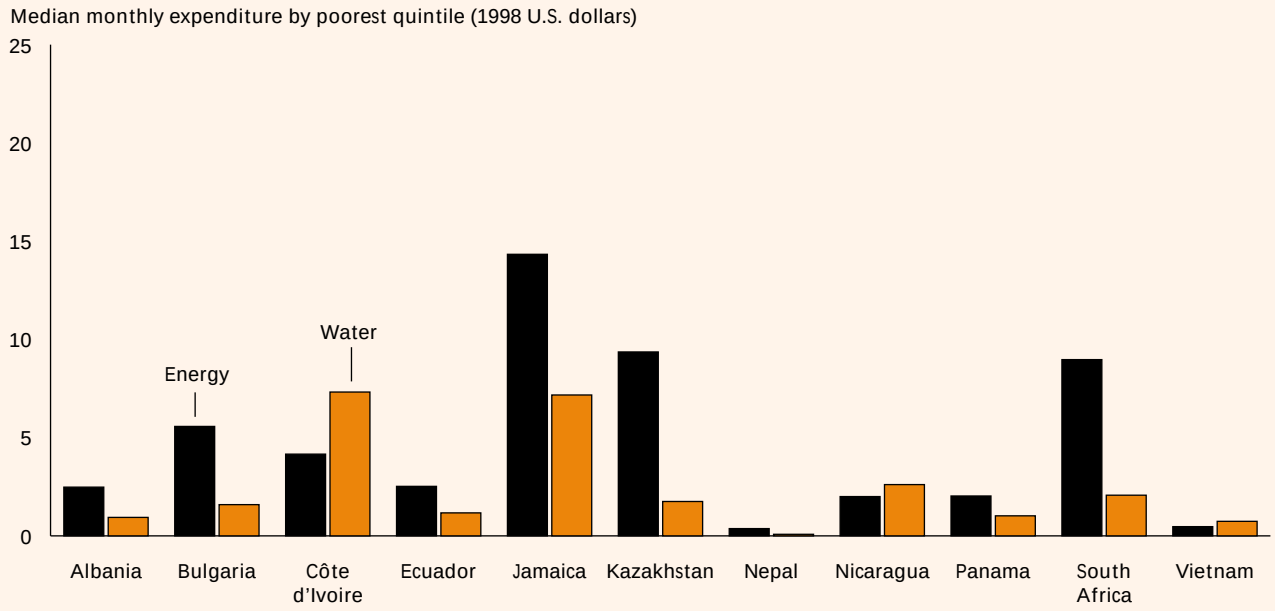
Source: LSMS surveys.

Figure A.5 In most countries households at all consumption levels spend more on energy than on water



Note: Energy spending is the sum of spending on electricity and other fuels for household use. Automobile fuel is not included.
Source: LSMS surveys.

Figure A.6 The poorest quintile also generally spends more on energy than on water



Note: Energy spending is the sum of spending on electricity and other fuels for household use. Automobile fuel is not included.
Source: LSMS surveys.

devote on average a larger share of household consumption to electricity. This share ranges from 1 to 5 percent for households in the poorest quintile, and from 0.8 to 3.6 percent for those in the richest.

Comparing energy with other infrastructure services

More households use electricity than have in-house water taps or telephones in countries in Europe and Central Asia and in other countries in the sample for which data on all three sectors are available (figures A.3 and A.4).

Because each national survey asks about spending on a slightly different group of fuels, comparisons of total energy expenditures within a country (for example, between richest and poorest) are more reliable than cross-national comparisons. In general, households spend more on energy than on water, if they pay for water at all (figure A.5). Although those in the poorest quintile spend less on average than the population as a whole, the patterns of expenditure for these two groups are generally similar (figure A.6).

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Note

The authors would like to thank the many national statistical institutes for providing the World Bank with access to the LSMS survey data. They are also grateful to Diane Steele for introducing them to the LSMS data sets early on and for her assistance in obtaining the data. And they appreciate the comments and suggestions received at various stages of their larger research project from Penelope J. Brook, Omar Razzaz, Neil Roger, Yonas Biru, Jonathan Halpern, and Karl Jechoutek.

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