7 The role of energy subsidies

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Message from the editors

A first priority of energy policies aimed at alleviating poverty must be to bring down the costs of safe, clean, reliable energy services. Chapters 5 and 6 discuss some promising trends in that direction, but low-income households must clear another high hurdle before they become energy consumers—the initial cost. They must pay to have gas or electricity connected, or buy a photovoltaic cell or LPG cylinder, and then buy the appliances that will run on the energy. Subsidies are thus likely to remain a key part of pro-poor energy policies in developing countries for some time. Traditional ways of delivering subsidies, particularly cross-subsidization of consumption, often fail to help the poor. They are also less sustainable—and make little sense—once governments begin liberalizing energy markets. The challenge for governments is to find better ways of delivering subsidies—going back to basics on the questions of whom to subsidize, which aspects of cost to subsidize and by how much, and how to deliver these subsidies. A "good" subsidy scheme is one that enhances access for the poor while sustaining incentives for efficient delivery and consumption. But that is not sufficient: the subsidy scheme must also be practicable within the financial and human resource constraints of the government.

A remarkable number of people in developing countries have gained access to electricity during the past twenty-five years—more than 1 billion. Still, about 2 billion people do not have access to electricity. An equal number rely on biomass energy for cooking. It remains the case that high-income households have electricity, and the world's poorest, mostly rural households do not. For petroleum products and other "modern" fuels, the scenario is similar. The rich have access and the poor do not. The poor also often spend a significant amount of their time collecting fuel for their household needs or spend a large percentage of their income on energy.

Limited access, a high percentage of income spent on energy, and significant amounts of time spent collecting biomass fuel for cooking all have been cited as reasons for providing energy subsidies to encourage the poorest households to use high-quality fuels. The problem is that while such subsidies can be beneficial, they can also be harmful, inefficient, and in some cases detrimental to the poor.

The modern fuels being used by households in developing countries include electricity, liquefied petroleum gas (LPG), and kerosene.[1] The supplies of these fuels are often irregular, and policies on their use in various countries range from taxation to subsidies. Many development assistance programs have been directed toward making the supplies of these fuels more regular, reliable, and efficient. Unfortunately, their efforts often do not take into consideration those who do not have access to such services. Attempts to subsidize energy have led to problems as well. Many energy subsidies intended for the poor are appropriated by middle- and high-income groups.

This chapter explores the case for subsidies to promote the use of energy that enhances the quality of life of the poor or reduces their expenditures on energy and to encourage businesses to serve poor and rural populations.

Why subsidize energy?

At the sectoral level energy is a commodity that is bought and sold through markets. There are often many private energy companies competing intensely in such markets. Why subsidize energy? If the goal is to improve the living standards of the poor, there may be other ways to do so. Energy is

but one component of a household's basic basket of consumption, which includes food, water, shelter, clothing, and education. There may be better ways to increase the welfare of poor people than through energy subsidies. For example, the poor could be provided with income transfers so that they can choose the best solutions for themselves.

A simple answer to this question is that energy should not be subsidized. In an ideal world the poor could adopt whatever form of energy suits their needs and ability to pay. But reality is more complicated. The poor often have difficulty in gaining access to quality energy services, and businesses have a hard time justifying the initial high costs of serving them. Moreover, most developing countries lack the social service infrastructure required to effectively manage income-based transfer programs.

Many studies show that the poor are often willing to pay for higher-quality energy services, but are deterred from obtaining service by high access costs or nonavailability of service.

If modern energy is available to the poor, which may be the case in urban areas, the high costs of initiating energy services or taxes on fuels may pose a constraint on their ability to adopt higher-quality fuels. Energy service businesses may have weak incentives to provide access to quality energy services to the poor, mainly because of the low population densities, which make it costly to serve remote locations, and the low incomes of the poor, who often use little energy compared with wealthier households. Thus the main barriers to service may be access costs, the ability to pay for access, and related government policies, such as import restrictions and tax policies.

Access barriers are common for both electricity and LPG. In some countries close to the full thirty-year life-cycle cost of electricity service must be paid up front by consumers, amounting to more than US$600 as a connection fee. This is obviously beyond the means of poor households. Similarly, for LPG in most countries people must apply and pay fees for service, pay a deposit for LPG bottles, and pay in advance for their contents. This limits the ability of the poor to obtain such energy services, even though they may be able to afford the monthly energy service expenses. The poor do not have cash reserves for such fees or lump-sum purchases.

The use of modern energy sources such as electricity, kerosene, and LPG is clearly desired by many rural and poor people. They want electricity for lighting, as this allows them to extend the day and read in the evening (Barnes 1988). And children can study longer, which will raise education levels (Bose 1993; Domdom, Abiad, and Pasimio 1999; Khandker 1996). Electricity service makes this possible because of the high quality of light; typically an electric lightbulb gives off about 200 times as much light as a kerosene lamp (van der Plas and de Graff 1988; Nieuwenhout, van der Rijt, and Wiggelinkhuizen 1998). In urban Java (Indonesia) families using electricity have lower lighting expenditures and receive on average six times as much light as households using kerosene (ESMAP 1990; Fitzgerald, Barnes, and McGranahan 1990).

For cooking, the urban poor often pay more for wood or charcoal than they would for LPG, once the end-use efficiencies of the fuels are taken into account (Alam, Sathaye, and Barnes 1998; ESMAP 1999; Barnes, Krutilla, and Hyde 1999). Thus subsidizing access may assist them in lowering their expenditures on energy for cooking—and in avoiding all the problems of indoor air pollution. Recent evidence from India indicates that indoor air pollution may be responsible for more than 400,000 premature deaths a year (Smith 1999, 1987).

Subsidies to private firms should encourage access, not cover operating costs.

In sum, the benefits of access justify some form of energy subsidy. The welfare gain will often be much higher than the long-term costs involved in providing electricity service. But the up-front investments by private or even public businesses to reach low-income customers cannot justify the resulting small revenue flows, especially for energy businesses with short-term profit goals. Moreover, the poor cannot afford to pay these long-term costs at the initiation of service or over a short period. As a consequence these businesses have little incentive to market energy services to poor segments of the population. A subsidy can be used to assist poor households in obtaining higher-quality energy services—either some form of direct subsidy to the poor or, where service networks are nonexistent, incentives to businesses to develop such service networks. However, energy subsidies should be directed at encouraging access to services rather than helping to cover the operating costs of providing the services.

Some typical subsidy problems

The goal of most subsidy programs is to promote some "social good," such as improving the quality of life of a group of people or redistributing income to less fortunate groups. Subsidies should be directly targeted to the intended

beneficiaries and no others. They should minimize market distortions. Subsidies also can be justifiably used to promote the development of the market for new products or services.

In practice, it is difficult to efficiently achieve these multiple objectives. Moreover, subsidies are the grist of politics. Subsidies have often been:

- Implicit, such as nonpayment of electricity bills.
- Untargeted, such as a subsidy for energy used by all.

In Yemen the lifeline rate was set at a consumption level that includes more than 75 percent of the population.

- Indiscriminate, such as a subsidy for a quantity well above that needed by poor or rural populations.
- Complex or difficult to administer to the targeted group.
- Overly restrictive with respect to the end use or technology, depriving users of choice.

Mistargeting of subsidies grows as different interest groups attempt to capture them. For example, Indonesia has had a policy of subsidizing kerosene to encourage its use by the poor for cooking. Although the policy has accomplished its goal, as many low-income households are cooking with kerosene, there are also many free riders—middle- and high-income people who take advantage of the subsidy (ESMAP 1990). In Ecuador subsidized kerosene was diverted to the transport sector and much of it never reached the poor, especially in rural areas (ESMAP 1994). In the first case the subsidy, while reaching the poor, was not well targeted (errors of inclusion). In the second case the design of the subsidy introduced distortions in the energy market, and many of the intended beneficiaries never benefited from the subsidy (errors of exclusion).

In some cases subsidies appropriate for the poor are not properly dimensioned. One such case is the misuse of lifeline rates in the electricity sector. A lifeline rate is a cross-subsidy that enables the poor who use minimal services to pay a lower price than wealthier households using higher levels of service. Lifeline rates can be a well-targeted subsidy for the poor, particularly where they are already connected to the grid, because the poor generally can afford to use very little electricity, mainly for lighting and televisions. But the welfare benefit of the uses can be quite high, justifying the cross-subsidy. In many countries, however, the lifeline is set very high. In Yemen the lifeline was set at 200 kilowatt-hours a month, a consumption level that includes most of the population. Thus even conceptually sound subsidies can be misapplied, with the result that those who are ready and willing to pay higher prices for electricity receive more benefits than the poorer households.

Subsidies meant to encourage the development of an activity often outlive their usefulness and eventually begin to cause problems for society. Take an example from India. In the early stages of the green revolution the government decided that it was a good idea to encourage irrigation. The new seed varieties to increase crop yields required a reliable source of water. As a consequence, when electricity was introduced in rural areas, the agricultural electricity price was set very low. After a time this practice was not really necessary, as the productivity gains from the new varieties far exceeded the cost of electricity for agricultural pumping along with other inputs needed to increase crop production. But the subsidies were not phased out over time after the rural market for electricity developed.

The farmers lobby has not only been successful in keeping the existing subsidies in place, but in some states has persuaded politicians to provide farmers free electricity. The farmers with electricity service not only get free or nearly free electricity, but also keep the profits from increasing agricultural production. As a consequence the state electricity boards have been severely decapitalized and cannot finance the necessary investments to maintain reliability and extend service.

The subsidy decision: who, what, how, and how much

Subsidies should be assessed by their relative *efficacy*, *sector efficiency*, and *cost-effectiveness*. Efficacy means that the subsidy reaches those for whom it is intended, the poor (minimizing errors of inclusion and exclusion). Sector efficiency means that the subsidy is structured in such a way that it encourages provision of service at least cost. This is one aspect that needs to be addressed more thoroughly in energy sector restructuring work, which often does not consider access issues, particularly in remote rural areas. Cost-effectiveness means that the subsidy achieves social goals at the lowest program cost while providing incentives to businesses to serve poor and rural populations. To achieve these three goals, decisions must be made on the subsidy's target group, on its form and its level, on the eligibility criteria for the subsidy, and on how to finance it.

Whom to subsidize

Those without access to higher-quality energy services generally are rural households and the poor. In the case of electricity the share of the population without service varies significantly among countries, but generally it is the poorest third. Thus in most cases the target group for the subsidy should be those without service. Households that already have service generally are the better-off. In practice, many households that have electricity service have benefited from past subsidies.

In the case of oil-based products many households purchase kerosene in small quantities, but it is almost impossible to purchase subsidized LPG in comparable amounts because the bottles are still relatively large. Therefore, the poor may have access to kerosene at very high prices because of the small quantities that they purchase, and have difficulty getting LPG because of the large purchases and service initiation fees involved.

What to subsidize

For disadvantaged groups without service, it would be reasonable to subsidize service access itself. As noted, the poor, especially those in urban areas, spend a significant amount of their income on low-quality energy services. Subsidizing some of the access barriers that they face can encourage them to climb the energy ladder to better services. For example, the electricity connection fee for poor households can be kept low by providing a partial subsidy for the capital cost of the connection and rolling the rest of the cost into monthly bills. An example of such a subsidy program is Chile's rural electrification program (see chapter 9). This program encourages businesses to serve rural populations by subsidizing the costs of connections for poor consumers.

The Chilean case involves the expansion of service by existing businesses. An even greater challenge is to provide electricity access to remote populations when businesses are weak or nonexistent, as is the case in the renewable energy industry. Various models for promoting renewable energy systems, such as household photovoltaic systems, are being tried through both World Bank lending and Global Environment Facility grants. They involve providing subsidies to retailers, communities, concessionaires, and service providers to encourage them to serve remote populations. Such models are producing varied results (Martinot, Cabraal, and Mathur 2000).

For the case of LPG, the initial service fees could be reduced and smaller bottles developed to lower the initial costs of service.

How to subsidize

The choice of instrument and implementation mechanism is a significant determinant of the efficiency and efficacy of a subsidy in improving the welfare of the poor. In general, fuel, or supply-side, subsidies perform poorly. The reason for this has already been touched on in the discussion of the kerosene subsidies in Indonesia. Although implementing such a program is not difficult, fuel subsidies generally reduce business incentives to expand services and are badly targeted.

India has used a 25 percent fuel subsidy for LPG for cooking for many years (see Alam, Sathaye, and Barnes 1998). Unlike Indonesia, India has had to import LPG to meet consumer demand. To keep the subsidies under control, India has limited imports of LPG and limited retailers to distributing LPG in urban areas. Even today there are long waiting lists of urban households for the subsidized LPG. As a consequence these subsidies go mainly to the well-off and middle class.

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Subsidies for access to different types of energy can be justified if they are well targeted and if they reduce business costs in a rural service territory. For example, it can be quite costly to extend electricity to one household in a village, especially given the low electricity consumption of rural households. But if service initiation costs are low, perhaps 100 households would be encouraged to take a connection and start paying monthly or bimonthly electricity bills. While a business could not make any profit serving one household, it probably could serving 100. As long as all business operating costs are covered, there will be an incentive to serve the rural customers. In Costa Rica the distribution company recognized that people often wait until after the grid comes to their village to obtain a connection. Late adopters of electricity know that the cost of connecting their household will be lower than that for the initial users. The electricity cooperatives therefore developed an initiation fee schedule to promote demand for service. This fee was based on an "average" penetration level in the village, and they charged all customers the same fee regardless of whether they were an early or late adopter. In addition, the government subsidized some of the capital costs of line extensions. Even so,

the distribution company constantly generated losses during the first five years of the cooperative electrification program because of new line expansion (Foley 1997).

How much to subsidize

There is a fine line between subsidies that encourage service provision and those that encourage only the purchase of equipment. This is an especially important problem for renewable energy, since most of the costs of service are the capital costs of the systems themselves. Consider an example from Peru, where a village without electricity was selected to receive household photovoltaic systems. The systems involved 100 percent subsidies. After several years a return visit to the village revealed that many households had sold their systems. The subsidy level should be pitched to provide relief to poor households and to create business incentives to serve the poor over the long term.

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Decisions on the size of subsidies should follow some general principles. Subsidies should provide an incentive to extend service to households that would not otherwise get it. They should stimulate new business without being an end in themselves. They should provide a benefit to the rural and poor populations, but should not create a disincentive to provide energy service after the equipment is installed in the households.

In the Asunto Valley in Bolivia installation of a free micro-hydro system actually caused the local distribution company to lose money because of the increased costs associated with adding the capacity (ESMAP 1991). Many of the photovoltaic programs in India encouraged manufacturers to produce for the government subsidy rather than for the market. The appropriate balance is to provide enough subsidy to enable poor and rural households to afford access to the service while not destroying business incentives to serve them.

Assessing subsidy mechanisms

The design and implementation of subsidies should not be viewed as a static process. As noted, subsidies should be efficacious, efficient, and cost-effective (table 1). They can come in many different sizes and shapes, depending on the country's institutional endowment and on government policies, and they can be financed in different ways. Sources of subsidy may include cross-subsidies between user groups for network companies, subsidized interest rates on loans, equity investment by a government to promote service expansion, low bulk tariff rates for distribution companies expanding service, taxes earmarked for a subsidy fund, and government budgetary contributions.

To be cost-effective, efficient, and useful for rural and poor people, energy subsidies should have two main goals. The first is to assist the poor in gaining access to higher-quality energy services, which points toward having a subsidy that helps lower front-end costs for poor consumers. The second is to provide business incentives to serve rural and poor consumers who would not otherwise be served, without significantly distorting energy markets and without having the government as the major customer for equipment. A key activity that the government can and should be involved in is providing technical assistance in the form of information, research, and advice to communities on energy options.

In general, supply-side subsidies should be avoided because they are not well targeted and because they cause distortions in the energy market. But there have been exceptions where the distortions inherent in such subsidies have not unduly undermined service provision or the financial viability of the businesses involved. One example of an approach that struck a balance between subsidies for service expansion and business incentives to serve rural populations involved the successful rural electrification program in Thailand (Tuntivate and Barnes 1997). In Thailand all electricity companies were required by law to be financially profitable. The company responsible for expanding rural service was the Provincial Electricity Authority. To compensate for its service expansion costs, the company was permitted to purchase electricity from the power company at a lower price than the company serving Bangkok paid. In addition, after studying consumer load patterns, the company established a pricing structure that involved a demand subsidy in the form of a minimum tariff and discrete blocks with higher charges for larger users. The minimum tariff is a kind of lifeline rate. The Provincial Electricity Authority remains financially viable because of the many measures it took to keep costs low. But the subsidy was also important for expanding electricity to more than 90 percent of the population in Thailand.

Little empirical work has been done to identify the effectiveness of efforts to reach rural and poor households with energy services, with or without subsidies. To design

Table 1 **Assessing alternative energy subsidy mechanisms for the poor**

Subsidy mechanism	Sector efficiency	Efficacy	Cost-effectiveness
Subsidy directed to service provider (supply side)			
Subsidy for bulk power supply	☐	☐	☑
Direct operating subsidy	☐	☐	☑
Capital subsidy	☐	☐	☑
Financing subsidy	☐	☐	☑
Subsidy directed to consumer (demand side)			
Direct connection subsidy to non-service provider	☑	☑	☐
Connection subsidy through service provider	☑	☑	☑
Credit for new connection	☑	☑	☐
Direct consumption subsidy to low power users (lifeline rate)	☐	☑	☑
Cross-subsidy to low power users (lifeline rate)	☐	☑	☑
Consumption subsidy for all consumers	☐	☐	☐

effective energy subsidies requires a better understanding of the populations they serve. To clearly identify the impact of assistance for rural and poor households, the service companies or governments should be completing market assessments, consumer surveys, and studies on willingness to pay for services.

Conclusion

There is no justification for subsidies to the large commercial businesses that dominate the energy sector or to industries that provide services mostly to better-off households in developing countries. But under some circumstances it is reasonable to use subsidies to promote access to energy for the poorest households, which now must get by with such fuels as dung and straw for cooking, and candles and kerosene for lighting.

Each subsidy mechanism has strengths and weaknesses. Supply-side subsidies such as the kerosene subsidy in Indonesia have poor targeting characteristics and provide weak incentives for efficient service delivery. But the explicit administrative costs of managing such subsidies are low. Where governments have ample resources to spend on service expansion and efficiency considerations are of low priority, supply-side subsidy schemes may work, but at a very high cost to the country.

Demand-side subsidies have better targeting properties and, in the case of subsidized connection costs, provide better incentives for efficient service delivery. Subsidies for connections financed by budgetary transfers provide better incentives to expand coverage than cross-subsidies or any of the supply-side subsidies, since this mechanism permits the provider to generate more revenue for each new connection extended to the target population. The downside of these sorts of demand-side subsidies is that they generally require an administrative and institutional superstructure to identify and verify target beneficiaries independent of the service provider. Doing this effectively often carries a high cost relative to the total subsidy program costs.

Energy subsidies have become unpopular among policy advisers. But subsidies should not be rejected out of hand. Instead, they should be more carefully designed to maximize their impact on the poor. But even well-designed subsidies are only one among many factors involved in successfully reaching poor populations with quality energy services. Others include setting up effective institutional structures for markets, dealing with the tendency of politicians to steer subsidy programs away from the poor to their constituencies, and developing pricing policies that permit businesses to recover costs for energy services.

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Note

1. For cooking, modern fuels would include LPG, kerosene, and the use of biomass in improved stoves. For lighting, modern energy refers to the use of electricity, which is significantly more efficient than burning kerosene or other petroleum products.

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