ELECTRICITY PRICES IN INDIA

Pierre Audinet, Desk Officer for South Asia and Korea, Office of Non-Member Countries

Introduction

India’s electricity-supply industry is mainly owned and operated by the public sector. It is currently running a growing risk of bankruptcy. This has created a serious impediment to investments in the sector at a time when India desperately needs them. This is reflected in the sharp decrease of the ratio of electricity consumption growth to GDP growth in the 1990s. In other words, in the past decade, electricity consumption growth did not follow economic growth. For 1991-1999, the elasticity of electricity consumption with regard to GDP was 0.97 when it was 2.1 for Korea and 0.99 for the OECD on an average. High structural needs of the Indian economy would justify that such a figure exceeds 1.0, unless drastic improvements in energy efficiency took place. Actually, the low 0.97 figure is a reflection of an increasing gap between supply and demand, the continuously deteriorating quality of power, and a low level of access to electricity. It is also the result of large investments made by the manufacturing sector in stand-by and stand-alone facilities to compensate these deficiencies. Unless strong measures are taken immediately to correct this trend, India’s overall economic development will be slowed.

The central issue now is how to enable power utilities to earn a return on investment. Price levels are too low for the system to be financially viable. In the Indian states, vested political interests impede utilities from collecting revenue. They maintain a price structure with large and unjustifiable subsidies. Politicians often interfere in the management of power utilities, hindering their efforts to curb power theft. As a result, transmission and distribution losses in India have increased, further eroding the financial situation of the state electricity utilities. These are not new trends, but the situation has reached a critical stage, where the government can no longer cover the losses of the state power utilities. For decades, the costs incurred for the development and operation of the electrical system increased faster than general economic growth, outstripping public finances’ ability to make up for uncollected rates. The central government has long given priority to developing access to electricity. At the state level this meant low prices for domestic and agriculture consumers and relatively higher prices for electricity supplied to the industry and commercial sectors. Even this system did not compensate for the subsidy burden. The government was obliged to compensate the difference. Growth of the electricity sector has outstripped the growth of the public money available to bear the cost of the increasing subsidies; the mechanism is not sustainable. Nonetheless, consumers who are used to low prices, and populist politicians resist change.

To face increasing investment needs, the central government began in 1991 to focus on attracting private investment. The aim was to sustain power-sector development while keeping public expenditure under control. Competition was gradually introduced in bidding for generation projects. Since the mid-1990s, in response to the growing financial difficulties of state electricity boards (SEBs), the World Bank recommended introducing private capital into the power distribution sector and a new regulatory framework, which would allow independent tariff-setting to correct large price distortions. The central government established the legal framework for this new arrangement in 1998. More recently, it has focussed on distribution, trying to increase revenue collection and additional capital.

Unfortunately, the results of this decade of reform have fallen well below expectations and the central government now seems short of solutions. It is probably too early to judge the final outcome of the change, from a command-and-control public-dominated model to a more market-determined sector. However, the present indicators point to the need for
urgent. In 1995-1996, nine of the 19 SEBs incurred losses. In 2000-2001, all of them were in the red. SEBs are increasingly unable to pay for the electricity they purchase from the central public-sector power companies, or from independent power producers (IPPs). The official – and probably underestimated – figure for transmission and distribution (T&D) losses is higher than ever, reaching 25% in 1997-98. In such conditions, the much-expected private investment has been well below expectations, and even public investments were relatively lower in recent years than before. The difficulties experienced by several private investors have discouraged potential additional investors. Unless radical measures are taken in the very short term, there is a real risk of stagnation in investment in the whole system. The demand-supply gap will continue to grow. With negligible new private investment in generation or distribution, and the central and state governments’ shrinking ability to develop and maintain the power system, an increasing number of consumers will be driven to invest in stand-by or stand-alone generation sets at the expense of the public interest, challenging the very roots of social and regional equity.

Under the Constitution, electricity is on the “concurrent list”, which means that the states, rather than the central government, are primarily responsible for setting electricity tariffs. The states have the largest share of generation and transmission assets and almost all distribution in their control. The states have a key role to play in effecting institutional and result-oriented changes. However, the IEA believes the role of the central government is vital in guiding the developments to come and especially in providing the necessary legal and financial incentives for the states to implement reforms.

In the following section, we bring forward some broad policy recommendations to improve electricity price formation in India. In the two remaining sections, we focus successively on two pricing issues related respectively, to the large price subsidies, and to the nexus between electricity prices and access to electricity.

**Retail pricing policy and demand**

**Issues**

Most of the problems of the Indian power sector arise from the present retail pricing system and from the fact that too little of it is actually paid for. Out of total electricity generated, only 55% is billed and 41% is regularly paid for (GOI, 2001). Electricity is either stolen, not billed, or electricity bills are not paid. All this amounts to a mass of implicit subsidy. The financial burden thus created undermines the economic efficiency and viability of the electricity supply chain and is not in the long-term interests of consumers.

Retail tariffs in India (as well as bulk tariffs) are based on a cost-plus mechanism established at the time of India’s independence in 1948. Electricity prices are subsidised for domestic consumers and for farmers.

Current retail prices of electricity represent less than 75% of real average costs. There is also a large amount of cross-subsidisation between consumer categories. The agriculture and household sectors are cross-subsidised by above-cost tariffs for commercial and industrial customers and railways. The situation worsened in the 1990s. Official data demonstrate that subsidies to households trebled to 80.8 billion rupees over the period 1992-1993 to 1999-2000. Subsidies to agriculture more than tripled to 227 billion rupees over the same period. The government sought to justify these subsidies on social grounds but it clearly failed to achieve its social goal, as higher-income groups in fact appropriate most of the benefits since the subsidy is applied to the price of electricity within a given consumer-category, indifferently to the individual level of income.

Policies to achieve market pricing have been introduced in India. Central and state electricity regulatory commissions are slowly being established. They will issue tariff orders, and should eventually implement them. Policies to implement a minimum price have been pursued since 1996. The goal is a minimum price of 50 paisa/kWh (1.1 US cents/kWh) for agriculture. But, delays in implementing such reforms have prevented even this simple goal from being met. Inflation (8% in 2000) has outpaced the growth in price per kilowatt hour. Policies in place also call for all end-use sectors ultimately to be charged at least 50% of the average cost of supply. This target was intended to be met in three years, but it has not yet been achieved in any of the states.

The poor cost-recovery rate, the very low price and the widespread non-payment of electricity are all deterrents to private investors. Investors cannot be assured that their applications for tariff increases to recover costs will be met, even by theoretically independent regulatory commissions.

---

4 In theory, cost-reflective tariff structures do not differentiate between final uses of electricity. The lowest tariffs apply to customers with the highest consumption and load factors (industrial customers). Households, on the contrary, pay the highest rate due to their low load factor, limited consumption and the relatively higher cost of distribution.
The side effects of this way of subsidising energy consumption are significant. Overpricing of industrial electricity hampers competitiveness. In other sectors, underpricing of electricity is a direct incentive to waste power. Underpricing of electricity for agricultural use puts a heavy financial burden on the electricity sector and incidentally threatens water resources in the long-term. Low cost recovery translates into degradation of service, which in turn requires costly investments in stand-by capacity in the industrial and commercial sectors and by large domestic consumers. Confronted by high prices and unreliable supply from the network, big industrial consumers increasingly turn to “captive-power”, which now represents more than one-third of their consumption. Every industrial consumer lost by the SEBs further worsens their financial situation since it reduces their sales base to low-paying customers. Subsidies artificially sustain demand from the consumers already connected to the grid, but a large unmet demand exists because of grid deficiencies and the inability of insolvent utilities to invest in additional connections.

**Recommendations**

- State governments should promote and foster payment for electricity by all customers.
- Legal action must be taken at the state level to prevent theft so that electricity suppliers have increased assurance that all customers will pay.
- Tariff should be designed to recover costs on the basis of the electricity which is sold and paid for only, separating the cost of stolen electricity from the tariff structure. Otherwise, paying customers end up being burdened with the costs of non-paying customers. To avoid such a difficulty, the unit price should perhaps be capped temporarily.
- Subsidy reform will undoubtedly result in tariff increases. To gain acceptance from consumers, the increases should be accompanied by significant improvements in the reliability, quality and accessibility of electricity supply. Restoring the investment capability of SEBs – or their unbundled sub-divisions – should be a priority. An active communications programme to explain the rationale behind subsidy reform and market pricing must accompany the reform.
- Cost-based electricity pricing needs to be implemented for all users. This requires an accurate data collection system and information on costs. If policy-makers find it appropriate to maintain partial subsidies for a particular category of consumers, the mechanism should be transparent and carefully monitored. The subsidy should also be allocated directly from the state budget to avoid burdening the utilities. It should expire within a set time frame. Access to electricity for low-income households should be carried out through direct support, or by mechanisms such as lifeline rates.5
- Demand-side management and load management should be more actively pursued at the state levels for all sectors, particularly industry and agriculture, to reduce peak-supply shortages and increase the cost-efficiency of the system. For such measures to be successful, metering and pricing policies based on daily demand profiles should be implemented.

**Electricity prices and subsidies**

More than any other factor, the way electricity prices are determined has inhibited India’s power market development. Underpricing and political interference in price determination have worsened the financial situation of the main electricity producers, wholesale buyers and suppliers: the SEBs. This increases the risk for private players who wish to enter the electricity market.

The SEBs’ end-use electricity tariffs vary widely according to customer category. The major categories are households, agriculture, commercial activities, industry and railways. There are large cross-subsidies between customer categories in India: tariffs for households and agriculture are generally well below actual supply costs, while tariffs to other customer categories are usually above the utilities’ reported average cost of supply. In 1999-2000, the average price of electricity sold amounted to 208 paise/kWh – 26% below the average cost of supply (see Figure 1). According to official data (GOI, 2001a), the total under-recovery of costs – the difference between total costs and total revenues – amounted to 272 billion rupees in 1999-2000, an increase of 190% since 1992-93. Most of this subsidy is reported to be for the agricultural sector. Cost recovery rates vary markedly across the country. Rates are lowest in Jammu and Kashmir, Assam, and Bihar, while the highest rates (over 90% of cost recovery) are in Himachal Pradesh, Maharashtra and Tamil Nadu.

---

5 This policy recommendation applies to schemes such as Kutir Jyothi, facilitating access to electricity to low income groups.
Figure 1. Average Tariffs, 1999-2000, paise/kWh

Figure 1 clearly demonstrates that subsidies are largest in the farm and household sectors, which are cross-subsidised by above-cost tariffs for commercial and industrial customers and railways. A cost-reflective tariff structure would normally result in the lowest tariffs being charged to industrial customers, which have the highest consumption and load factor. The highest tariffs would be paid by household customers. Official data show that the nominal value of total subsidies to household customers quadrupled to 80.8 billion rupees from 1992-1993 to 1999-2000. Subsidies to agriculture more than tripled to 227 billion rupees over the same period.

The problem of underpricing worsened progressively through the early 1990s, to the degree that average revenues covered less than 76% of average costs by 1995-96. The recovery rate improved slightly up to 1997-98, but dropped sharply in the next two years to under 74%. This has mainly been due to a decline in average tariffs to agriculture, to under 25 paise/kWh. This has happened in spite of the introduction in Haryana, Himachal Pradesh, Orissa, Uttar Pradesh and Meghalaya of a minimum rate of 50 paise/kWh, as called for in the 1996 Common Minimum National Action Plan for Power. That plan also called for all end-use sectors ultimately to be charged no less than 50% of the average cost of supply, and within three years for agriculture. In no state has this goal been achieved.

Underpricing stimulates over-consumption by the beneficiary of the subsidies. In India, this is reflected in the excessive amount of electricity consumed by agriculture. Given the size of the population engaged in agriculture and its electoral importance, this largesse by policy-makers is difficult to eliminate. Vested interests hamper power-market development.

A review of historical data shows that consumption of electricity by agriculture multiplied by 19 from 1971 to 1998, whereas overall consumption multiplied only by seven. As of 1998, the sectoral structure of Indian electricity sales has differed dramatically from that of other Asian countries. In Asia, the domestic and commercial sectors generally account for almost half of electricity consumption and agriculture represents only 2%. Industry accounts for 43% of overall consumption. The Indian figure is 45%, but more than one-third is auto-generated.

The amounts disbursed in subsidies are partly covered by cross-subsidies, which in turn burden less-favoured consumers, like industry. In 1999-2000, the prices paid by domestic customers, 149 paise/kWh (3.3 U.S. cents/kWh), and by customers registered as being from the agriculture sector, 25 paise/kWh (0.6 U.S. cents/kWh), were far below the overall average price (208 paise/kWh). This occurred at the expense of commercial consumers (354 paise/kWh), industry (350 paise/kWh, 7.8 U.S. cents/kWh) and railway hauling (411 paise/kWh).

The distortions go further. Since the average price per kilowatt-hour is calculated dividing the revenue collected by the quantity sold to a given category of consumer, official statistics probably underestimate the average price paid by agriculture, maybe by half. Indeed, by hiding non-metered or/and non-billed consumption from other sectors into the electricity sold to the farm sector, the average price is artificially deflated, and the actual amount of subsidies to the farm sector could be over-estimated. This is likely to blur the official appraisal of the amount of subsidies and their actual impact on consumption.

The large cross-subsidies from industrial, commercial, and railway hauling to the domestic and agriculture sectors tend to atrophy the paid consumption of the industrial and commercial sectors. Industry is subject to planned load-shedding, power cuts, voltage collapse and frequency variations, i.e. the high price paid by these customers is not compensated by good-quality supply. On the contrary, the poor quality of electricity service contributed to substantial industrial output losses.

6 Excluding China, Korea and Japan.
7 This is at least ten times lower than the OECD average for the same category of customers.
8 For instance, in Uttar Pradesh, sales to agriculture for 1999-2000 were restated by the SEB as 5 122 GWh, versus 9 982 GWh resulting in an average price of 94 paise/kWh compared to the reported 48 paise/kWh (see World Bank, 2000).
9 The process of deliberately disconnecting pre-selected loads from the power system in response to a loss of power input to the system, in order to maintain the nominal value of the frequency.
The primary effect of underpricing is to distort the overall energy market in favor of electricity. Households, farmers and others who benefit from underpriced electricity consume as much cheap electric power from the grid as possible, and account for the bulk of demand. When the cheap central supply fails, private sources have to make up for the supply gap. Customers who need electricity supply invest in resources such as batteries and diesel generators. In so doing, they cannot benefit from the economies of scale arising from the grid and use systems that are not necessary very efficient in producing electricity. The double effect of underpricing, that has resulted in growing wastage of electricity over the past decades, and the development of auto-production largely explains why India has a higher electricity intensity of its GDP than the rest of Asia (excluding China; see Figure 2).

Central government and state budgets are burdened by subsidies, which account for a large share of current expenditures, at the expense of investments in the electricity sector or other sectors such as education and health.

The subsidy problem may be larger than or different from what is suggested by the data presented here. As mentioned above, if most of these non-technical losses are allocated to sales to agriculture, the agriculture tariff issue could be less important than statistics make it appear. Conversely, the issue of non-payment could be more important than officially stated. Many customers, from agriculture but also households in urban areas, do not pay but continue to receive service. These customers effectively enjoy a 100% subsidy. This non-payment problem could far outweigh the official subsidies issue.

Since SEBs are managed like government, it is difficult to operate the power sector on the basis of economic criteria. Metering, billing and collecting revenues have been neglected. Decision-making remains highly
centralised. Lower level employees have little decision-making authority.

An IEA study in 1999 attempted to quantify the size of electricity subsidies in India based on a price-gap analysis, the economic and (notional) financial cost of subsidies, and the potential impact subsidy removal would have on electricity consumption and related CO₂ emissions. That analysis has been updated with more recent price data (for 1999) and has been extended to cover agriculture. Table 1 summarises the results.

Table 1. Electricity Subsidies: Summary of Results

<table>
<thead>
<tr>
<th></th>
<th>Average price (rupees/kWh)</th>
<th>Reference price (rupees/kWh)</th>
<th>Rate of subsidy (%)*</th>
<th>Potential primary energy saving from subsidy removal (%)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households</td>
<td>1.50</td>
<td>3.56</td>
<td>57.9</td>
<td>48</td>
</tr>
<tr>
<td>Industry</td>
<td>3.50</td>
<td>3.42</td>
<td>n.a</td>
<td>0</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.25</td>
<td>3.56</td>
<td>93.0</td>
<td>86</td>
</tr>
<tr>
<td>Average</td>
<td>-</td>
<td>-</td>
<td>38.0</td>
<td>34</td>
</tr>
</tbody>
</table>

*Difference between actual price and reference price as percentage of reference price.

** TPES saved/TPES for the sectors covered by the IEA calculations.

Source: IEA calculation.

On the basis of 1999-2000 data, the rate of subsidy expressed as a proportion of the full cost-of-supply reference price amounted to 93% for agriculture and 58% for households. Electricity sales to industry are no longer subsidised. Using a –0.75 direct price elasticity of demand for the household, industry, and agriculture sectors, our analysis suggests that removing electricity subsidy would lead to significant reductions in electricity consumption, particularly in the agricultural sector. Total electricity use would be 40% lower in the absence of all subsidies. Assuming that the removal of subsidies on electricity sales reduces the demand for fuel inputs to power generation in equal proportion and that average thermal efficiency is constant at lower production levels, the use of coal and oil in thermal power plants would drop by 40%. This would lead to a 99-million-tonne reduction in power-sector CO₂ emissions, mostly due to lower coal use. The removal of specific coal subsidies would reduce emissions by an additional six million tonnes.

It is important to bear in mind the limitations of the price-gap approach, which identifies only static effects. It compares the actual situation with a hypothetical situation where there are no subsidies, keeping all other factors constant. In reality, this would never be the case. The dynamic effects of removing subsidies are likely to be significant. It could bring benefits in the form of greater price and cost transparency, gains in economic efficiency through increased competition and accountability and, consequently, accelerated technology deployment. These changes would offset, at least to some degree, the long-run static effects of subsidy removal on energy demand and related CO₂ emissions. This would be especially true for the electricity industry.

Subsidy reform, to the extent that it increases the SEBs’ financial viability, would boost their capacity to invest and, therefore, increase sales to customers who currently lack access to electricity. In the long run, a reduction in subsidies could lead to an increase in electricity consumption by end-users not currently served or whose supply is severely curtailed, by blackouts, brownouts or time-limited service. Indeed, this is the implicit goal of electricity sector reforms, including subsidy reduction.

Whether this dynamic effect would be large enough to offset completely the static effect of higher prices is unclear. The size of the static effect is also unclear. As Figure 4 indicates, past experience shows a positive relationship between electricity prices and electricity consumed. The speed with which subsidy removal would lead to increased investment is also uncertain.

Figure 4. Electricity Prices and Consumption in India (1978-1996), Prices in Rs 1990 per kWh and Consumption in GWh

Source: IEA.

Any attempt to quantify the impact of electricity subsidy reform on investment in power generation would also need to take into account the economics of
auto-production. One effect of the current structure of cross-subsidies is that investment has partially shifted from the SEBs to industry itself. The 1996 Common Minimum National Action Plan for Power sought to promote auto-generation by calling on SEBs to provide access to their grid to transmit power that is surplus to a company’s own needs to other end-users.

**Electricity pricing and market access**

Implementing more cost-reflective electricity prices when a large part of the population lacks access to electricity is a difficult task. Reforms need to benefit a large majority of the population in order to be accepted. The fact that about one-third of India’s population lives below the poverty line raises the question of the initial cost of providing access to energy markets. Hence, as in many other developing countries “subsidies are likely to remain a key part of pro-poor energy policies for some time. Traditional ways to deliver subsidies often fail to help the poor. The challenge for governments is to find better ways of delivering subsidies” (ESMAP, 2000).

Healthy competition in the energy sector will eventually bring down costs and assist capital formation. In the short run, however, the consumer price will increase to reflect the costs of providing energy service without subsidies. In a country like India, there would be two negative effects of pricing energy at cost. Some consumers who are not able to pay the price may lose access to commercial energy. In the longer run, additional investments would concentrate on profitable market segments, limiting access for the part of the population unable to pay.

The benefits of society from the access to energy are easy to identify: improvements in health and hygiene through refrigeration and water heating, the immeasurable advantages of electric lighting and increase in workers’ productivity, to name just a few. Another external benefit from widespread access to energy is the narrowing of social gaps. But these external benefits are difficult to quantify and cannot be expected to be accounted for by energy markets. In a completely free-market system, energy is likely to be under-provided. In this respect, initial access to energy services qualifies as a social good.

Energy pricing should aim at cost recovery. But in a situation where energy is likely to be under-provided by the market, the need for some form of support to promote access to the energy service for poor households is acknowledged (ESMAP, 2000; WEC, 2000). However, the budgetary costs of subsidies are high (IEA, 1999). Financial support needs to be targeted and limited by time or income to avoid the regressive effects of subsidising energy users who are able to pay. The cost may be paid through a system of cross-subsidisation, or directly by the state, if public finances permit. The latter is preferable. The cost of a subsidy ought to be clearly identifiable; the costs of cross-subsidies might be hard to identify.

A subsidy scheme should have minimal implementation costs. In this respect, a system providing the subsidy at the supply level, such as in India has one advantage: its administrative costs will probably be lower than a system providing financial support directly to the demand-side through vouchers or income-support schemes. Direct support for demand, with the subsidy going to the consumer to cover the costs of his connection, and/or consumption, would be more efficient and cost-effective, but more expensive to administer. It would require clear rules to identify and transfer the financial support to the beneficiaries. Various options exist for excluding unwanted beneficiaries. Each of them has different budget implications.

Apart from a general under-pricing of electricity as practised in India, ad hoc subsidy schemes have been established by private investors and public utilities in developing countries at the request of local administrations or in response to populist political pressures. For example, progressive electricity tariffs (also called social tariffs) are applied to the household sector in India, and in several other developing countries: Cambodia, Vietnam, Ivory Coast, South Africa, Costa Rica, Gabon. The principle is to charge larger consumers more than smaller ones. In most cases, a system of cross-subsidies between consuming categories allows the utility to recover the cost of delivering the electricity service. Very often, however, electricity prices are too low to recover costs and an additional system of cross-subsidies is necessary. This burdens industrial or commercial consumers with subsidies for the household sector. In 1998, the Indian central government launched the Kutir Jyothi Yojna programme (literally “light for small houses”). Under this programme, SEBs must connect households under the poverty line. The government and the SEBs provide grants up to a maximum of 1 000 rupees per connection with the installation of a meter or 800 rupees per
connection without a meter. Implementation of the programme has been hindered by difficulties in identifying eligible households and by the SEBs’ severe financial problems.

Such schemes need to be rationalised to reach their social target without hampering the efficiency of the whole system. The mechanism should not impose a financial burden on the utility providing the support. The threshold should not be so high as to encourage consumers to remain in the lower-consumption category, nor should the progressive tariff beyond the threshold be too steep.

The main challenge is to anticipate properly the overall cost of the subsidy mechanism. An attempt is made below to estimate the direct cost of demand-side support to electricity access.

As much as possible, access of the poor to electricity must be addressed by instruments of social policy, not by electricity pricing. If the poor cannot pay the full costs, then the difference to full costs has to be paid out of the state budget.
Box 1. The Cost of Subsidising Low-income Consumers’ Access to Electricity

Let us assume that the government decides to facilitate the access of poor households to electricity by providing them with a minimum requirement, that is lifeline system, where a financial support covers the consumption of a fixed monthly quantity of power, as well as the expenditure for their connection to the grid. Let us also assume that low-income households in Indian urban areas consume roughly 50 kWh per year*. What would be the total cost of such a system?

The expenditure required to give the targeted population access to minimum electricity service has two components:

- the connection cost either through the central grid, or through local grids based on decentralised electricity production [C];
- the cost of poor households’ daily consumption of power [E].

Note that the category “poor households” here refers to the part of the population that will benefit from easier access to power and does not necessarily refer to households with income below the poverty line.

The first component is a non-recurrent expenditure. The second is recurrent. The first component is significant in a developing country where the need to connect domestic customers is great and where the connection expenditure may be significant compared to the economic value of the electric supplied.

The financial transfers involved in the subsidies can take various forms. The mechanism with minimal administrative costs might be preferred. For example, money could be provided directly to the service provider, or to the final consumer, through a fixed amount deducted from the electricity bill.

The total cost of the subsidy will be [C] + [E] where:

\[ [C] = \frac{(C \ast p)}{H} \quad \text{and} \quad [E] = \frac{(S \ast P)}{[H \ast (K*(1-E))]} \]

with:

- \( C \) = average connection cost (per household)
- \( p \) = number of poor urban population to be connected
- \( H \) = number of persons per household
- \( S \) = marginal supply cost of power for residential consumption (production + T&D)
- \( P \) = estimated poor population
- \( K \) = chosen lifeline consumption level
- \( E \) = fixed chosen percentage of electricity billed and paid for

In the present case, the calculation of [E] is based on a simplified lifeline rate system. All consumers are assumed to be billed for their electricity at marginal cost except consumers with consumption below the chosen lifeline level. The latter are charged a fixed proportion of the actual marginal production cost of the electricity service. This provision facilitates management of the financial transfer to households as it can be handled directly by the electricity provider. At the same time, it avoids supplying a totally free service which could give the wrong signal to consumers.

The supply cost of power for household consumption is estimated at 3.4 rupees per kWh**. Moreover, we assume that one third of the existing customers and half of the additional households to be connected each year will benefit from this lifeline rate. We also assume that the price charged to this category of the population will be one rupee per kWh, and that four million households will be connected each year***.
On these assumptions, the maximum annual direct expenditure to be borne by the economy would be 44.7 billion rupees (roughly USD 1.1 billion): 11 billion rupees for connection charges for new customers and 28 billion rupees for the consumption of poor households. This is likely a maximum as the subsidy volume is calculated on the assumption that subsidised households consume their entire 50 kWh per month. Actual average consumption would probably be much lower. Special attention would have to be paid to the regular increase over time of the total direct expenditure as a result of additional consumers coming in (assuming the share of poor customers remains constant), if the support mechanism is maintained.

As an indication, the direct expenditure or cost of this support mechanism would be at least four to five times less than the current cost of subsidies for electricity consumption which amounts to 187 billion rupees, or USD 4.5 billion****.

Figures used in the calculation (1997 data)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian population (millions)</td>
<td>980</td>
</tr>
<tr>
<td>Number of households (millions)</td>
<td>163</td>
</tr>
<tr>
<td>Households living in electrified zone (%)</td>
<td>90</td>
</tr>
<tr>
<td>Number of households living in electrified zones (millions)</td>
<td>147</td>
</tr>
<tr>
<td>Domestic customers (millions)</td>
<td>70</td>
</tr>
<tr>
<td>Domestic customers in the total number of households (%)</td>
<td>43</td>
</tr>
<tr>
<td>Overall domestic consumption (TWh)</td>
<td>59</td>
</tr>
<tr>
<td>Average annual observed consumption (kWh)</td>
<td>846</td>
</tr>
<tr>
<td>Distribution lines 500 kV and under (km)</td>
<td>3,108,830</td>
</tr>
<tr>
<td>Meter cost: (purchase + installation for 1 Phase Electromagnetic kWh in rupees)</td>
<td>583</td>
</tr>
<tr>
<td>Connection cost per customer (rupees)</td>
<td>2,783</td>
</tr>
</tbody>
</table>

Assumptions:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of persons per household</td>
<td>6</td>
</tr>
<tr>
<td>Length of line to be installed per new customer (m)</td>
<td>20</td>
</tr>
</tbody>
</table>

Sources:


Notes:

* Poor households consume small quantities of electricity. A field survey made in a large city of south India in 1994 (Alam & al., 1998) showed that electricity represents one-fourth of the total energy consumed in the household sector (the rest is fuelwood, kerosene and LPG). In that survey, the lowest income groups consumed an average of 7 kWh per capita and per month (57 kWh per household). The figure for the richest income group was 41 kWh per capita (180 kWh per household) and the average was 15 kWh (90 kWh per household). The choice of 50 kWh as a threshold is debatable and probably on the high side. Similar progressive tariffs in other developing countries have sometimes supported lower consumption levels (e.g. up to 20 kWh per household per month).

** IEA, 1999.

*** The current rate of connection is slightly above three million.

**** As estimated in IEA, 1999. This is a conservative figure as it only accounts for subsidy transfers to households and industry.
References


CEA, 1998, Average Electric Rates and Duties in India, Central Electricity Authority, New Delhi.


GOI, 2001a, Annual report on the working of State Electricity Boards & Electric Departments, Planning Commission, New Delhi.


RSEB, 1999, Revised Rates, Rajasthan State Electricity Board, Jaipur.
