Electricity tariffs for farmers in India amount to less than 10 percent of the cost of supply. That means a power subsidy for the agricultural sector of an estimated US$6 billion a year—equivalent to about 25 percent of India’s fiscal deficit, twice the annual public spending on health or rural development, and two and a half times the yearly expenditure on irrigation. At the same time, the quality of supply to farmers has worsened over the years. Operational inefficiencies and high distribution losses due to pilferage have contributed to the financial insolvency of power utilities across India. With little or no investment funding available to rehabilitate the electricity system, power outages and voltage fluctuations have become increasingly frequent. Consumers’ dissatisfaction has grown, and so has their unwillingness to pay even highly subsidized charges. As users delay paying electricity bills and resist tariff increases, cost recovery diminishes for the utilities, perpetuating the problem.

A study covering two states—Andhra Pradesh and Haryana—assessed the impact of cutting subsidies as part of broad reforms of governance and regulation aimed at reducing losses, controlling theft, strengthening metering and collection, and moving to independent tariff setting, competition, and privatization (box 1). As a first step the study assessed the current approach to delivering services—in particular, the costs arising from poor-quality service and poor subsidy design.

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The costs of unreliable quality and supply

Although farmers pay a small fraction of the cost of power, they endure the frustration and economic costs of supply that is both unreliable (not available at predictable times) and of poor quality (with fluctuating voltage). Both problems mean that water often cannot be pumped during critical periods in the plant growth cycle, leading to lower crop yields and incomes for farmers.

Electricity is available to agriculture mostly during off-peak hours—sometimes for as little as three and a half hours a day as a result of supply regulation and poor management of the network by the utilities. At other times unscheduled power cuts occur when transformers fail because of overloading, unbalanced loading, or poor maintenance and protection of equipment. In Haryana 26 percent of transformers failed during 2000, most often during July and August, when irrigation requirements and thus electricity demand are highest. It took more than 10 days on average to repair a transformer and restore power supply to consumers in Haryana. In Andhra Pradesh the incidence of transformer burnout is even higher, at about 29 percent, though repairs take only about four days.

In some parts of Haryana farmers receive power supply at normal voltages plus or minus 6 percent (as required by Indian electricity supply rules) only 20–40 percent of the time. The voltage fluctuations significantly reduce the operating efficiency of electric pumps and lead to pump burnouts. Frequent imbalances in the three-phase supply also strain pump motors and accelerate burnouts.

Repairing a burned-out motor costs about half the yearly electricity tariff that farmers pay for each pump. The costs of repairing motor burnout are regressive, amounting to 10 percent of gross income for marginal farmers but less than 2 percent for large farmers. Moreover, marginal farmers face other disadvantages. Some farmers cope with the poor quality of power supply by purchasing backup diesel pumps, or overinvesting in larger pumps in the hope of pumping more water when electricity is available. But small and marginal farmers can least afford these coping strategies—and about 40 percent of farmers who own electric pumps in Haryana, and 48 percent in Andhra Pradesh, are small and marginal.

Beyond the costs of the repairs and the lower crop yields caused by lack of water while motors are being repaired, the poor quality of power supply has several other important effects on farmers. Using Haryana survey data, the study developed a regression analysis to isolate the effect of different power supply indicators on the net incomes of electric pump users. It found that three factors have a large and statistically significant impact on farmers’ income: the days lost due to transformer burnout, power unavailability, and unscheduled power cuts.

The costs of theft

The electricity subsidies take the form of a flat rate paid by farmers per unit of horsepower per pump; farmers’ actual power use is not metered or recorded. These flat-rate subsidies help to camouflage theft.

To estimate farmers’ actual power use in Haryana, meters were installed on a sample of 584 pumpsets and their readings recorded every other week for a year. The results show that farmers consume 27 percent less than the utilities estimate—and that transmission and distribution losses are therefore correspondingly higher than the utilities claim (47 percent, compared with the official 33 percent).

These incremental losses cost the utilities about US$160 million a year, undermining their ability to provide reliable service to farmers. A large part of the losses is due to pilferage by residential, commercial, and low-voltage industrial customers.
The costs of poor targeting

Large farmers are more vocal in arguing for retaining the subsidized flat rate because it represents a manageable share of their gross income. Moreover, paying a flat tariff for every pump enables them to irrigate a large area at a low per unit cost. But for small farmers who can afford electricity for irrigation, the cost per hectare is significantly higher. These small farmers need pumps of a minimum size, and they must pay the same tariff per pump as large farmers to irrigate a much smaller area. As a result, while electricity tariffs represent 6 percent of the gross farm income of large farmers, they amount to 13 percent of income for marginal farmers.

But electricity subsidies do not even reach most small and marginal farmers. Many lack access to electricity and rely mostly on rainfall to irrigate their fields. In Haryana, for example, farmers owning electric pumps have net incomes a third higher than the average for the state’s farmers and four times those of farmers relying exclusively on rainfed cultivation.

Reality check on reform

To gain a better understanding of the potential impact on farmers of different reform packages, the study simulated several policy reform scenarios:

- **Business as usual**—with tariff increases but deteriorating quality.
- **Gradual reform**—with steeper tariff increases and some improvement in quality.
- **Accelerated reform**—with the same tariff increases but more aggressive improvements in quality.

The accelerated reform scenario envisions more aggressive institutional, regulatory, and technical reforms than the gradual reform scenario. These accelerated reforms would reduce theft, improve billing collection, shorten the wait for service, and improve the utilities’ capacity to manage loads. And they would lead to greater reductions in the duration of power cuts (70 percent, compared with 40 percent for gradual reforms) and in days lost because of transformer burnout (70 percent, compared with 40 percent; table 1).

The study carried out the simulations for a six-year period to allow for the introduction of tariff reforms and for investments to rehabilitate the transmission and distribution network. The results show that tariff increases for agriculture, matched by improvements in quality, would benefit farmers, particularly small and marginal farmers (figure 1). Under the business as usual scenario the incomes of small farmers would drop by 100 percent and those of large farmers by 50 percent. With accelerated reform, the incomes of small farmers would rise by 100 percent and those of large farmers by 40 percent.

### Implications

Small and marginal farmers in Haryana have shown a high willingness to pay for improved reliability of power supply because the poor quality of supply has affected them so severely. By contrast, medium-size and large farmers (about 60 percent of those owning electric pumps) are less willing to pay in the short run because of their expensive backup arrangements, which reduce their vulnerability to

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**Table 1** Percentage change in power supply indicators from base year to year six

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Business as usual</th>
<th>Gradual reform</th>
<th>Accelerated reform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tariffs</td>
<td>210</td>
<td>470</td>
<td>470</td>
</tr>
<tr>
<td>Share of costs recovered at</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>end of year six (percent)</td>
<td>30</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Availability of power supply</td>
<td>No change</td>
<td>9 hours a day</td>
<td>9 hours a day</td>
</tr>
<tr>
<td>Duration of power cuts</td>
<td>100</td>
<td>–40</td>
<td>–70</td>
</tr>
<tr>
<td>Days lost to transformer burnout</td>
<td>100</td>
<td>–40</td>
<td>–70</td>
</tr>
<tr>
<td>Frequency of motor burnout</td>
<td>100</td>
<td>–40</td>
<td>–40</td>
</tr>
</tbody>
</table>

supply fluctuations. So it is the smaller and poorer farmers who end up bearing the cost of wasted resources and unreliable supply. To improve equity as well as efficiency in the use of water resources, it is therefore imperative to shift to electricity metering and per unit tariffs.

Both the gradual and the accelerated reform would involve a transition period during which tariffs would rise but the quality of supply would remain uneven. Small and marginal farmers, who would be most affected by the variations in quality, could reduce their costs during this period by investing in smaller pumpsets with more efficient motors. Farmers’ willingness to invest in new pumpsets would depend, of course, on efforts to improve the quality of supply as quickly as possible, to minimize the risk of pump burnouts.

Given this risk, an incentive package may be needed to encourage farmers to invest in new pumpsets—as well as some kind of insurance against the cost of burnouts—until the quality of supply is more consistent. Over the six-year reform period, during which the quality of power supply is expected to improve, the cost to farmers of a new pumpset—as well as of the (more realistic) per unit tariff—would be completely offset by higher productivity and farm income. In the shorter term states that encourage energy conservation as part of their reform package could offer incentives to rural cooperatives or village electricity committees to help farmers pur-

chase the more efficient pumpsets as the quality of power supply improves.

Many farmers understand that improved electricity service depends on higher tariffs and metering. Fewer understand the need to invest in more efficient pumpsets. To ensure continued and increasing support as power sector reforms are put into action, policymakers must clearly define, communicate, and build consensus for a strategy that balances higher costs of power with improved service performance over a time frame that small and marginal farmers find acceptable. The key will be to offer incentives and support that make the transition as painless as possible.

Note

1. The Note draws on a World Bank study carried out in collaboration with the states of Andhra Pradesh and Haryana (World Bank 2001). The World Bank team for the study included Lucio Monari, senior economist in the South Asia Energy and Infrastructure Group and task leader, Djamal Mostefai, Dina Umali-Deininger, Sunil Khosla, Bhavna Bhatia, and Chandra Govindarajalu. The contribution of several consultants and government officials is also acknowledged. The study is available at http://lnweb18.worldbank.org/sar/sa.nsf/India.

Reference