

Executive Summary

1 About three-quarters of all households in India, comprising more than nine-tenths of rural households and one-third of urban households, used traditional biomass—wood and dung—as a household fuel in 1999–2000. Approximately half a million premature deaths and nearly 500 million cases of illness are estimated to occur annually as a result of exposure to smoke emissions from biomass use by households in India, making indoor air pollution the third leading health risk factor. Young children (under five years of age) and women are affected disproportionately. Traditional biomass use has other adverse social impacts: principal among these is that biomass fuel collection can take long hours and entail significant drudgery, consuming time that could be used for other important activities such as childcare, school study, or leisure.

2 There are a number of options for mitigating the negative effects of traditional biomass use, ranging from behavioral change to better kitchen ventilation, more efficient stoves, or the use of cleaner fuels. One of the most effective measures is to switch to cleaner-burning fuels, liquid or gaseous, for all or most cooking. This study focuses on the two most commonly used commercial fuels in India that can mitigate the social costs of traditional biomass use: kerosene and liquefied petroleum gas (LPG). The objective of the study is to assess the effectiveness of the existing kerosene and LPG price subsidies in facilitating a shift to these fuels; the impact of subsidy phase-down and possible subsidy restructuring on household fuel-use patterns; and alternative policies to promote kerosene and LPG, with a special emphasis on the poor.

Kerosene and LPG Markets in India

3 The Government of India provides large universal price subsidies for kerosene and LPG. The subsidized fuels are handled exclusively by state oil companies. In 1993, the government allowed private marketers to begin selling kerosene and LPG, but at market-based, rather than subsidized, end-user prices. This unequal treatment of the private marketing companies has made it very difficult for them to expand their market share. The allocation of subsidized kerosene by the central government varies from state to state, with an urban bias in a number of states. Because LPG is a relatively expensive cooking fuel, and because most users reside in urban areas where there is more cash income and free biomass is often not readily available, the distribution of subsidized LPG historically has been confined largely to urban areas. It has also been seriously supply-constrained: until recently there was a long waiting list to sign up for subsidized LPG (in April 2000 the list extended to more than 6 million users).

4 The subsidies were scheduled to come down substantially by the time of downstream petroleum sector deregulation in April 2002, but partly on account of the recent

high international prices the subsidy phase-down has fallen behind schedule. In fiscal 2002–03 (April 1, 2002 to March 31, 2003) these subsidies, which previously had been managed through cross-subsidies from other petroleum products using the Oil Pool Account, were made explicit for the first time in the national budget. For LPG and kerosene, the Ministry of Finance allocated Rs 45 billion (approximately US\$1 billion). Because of rising international prices, the actual subsidy was much higher, at more than Rs 100 billion, of which the government outflow was Rs 63 billion (Business Standard 2003a). The shortfall was picked up by the four state oil companies (Business Standard 2003b). The government has increased the explicit subsidy to Rs 81 billion for fiscal 2003–04 (Business Standard 2003c).

Approach

5 This study used the 1993–94 and 1999–2000 data from the National Sample Survey (NSS), the largest household survey in India. The NSS asked questions about the quantities and values of different household energy sources, including firewood, dung, kerosene, LPG, and electricity. To gain a better understanding of the determinants of household fuel use patterns, this study used the 1999–2000 NSS data to create detailed models of household energy consumption. The purpose was to quantify how different parameters influenced household fuel choice and the amounts of fuel consumed; the modeling was used also to estimate the impact of phasing down subsidies and introducing measures to protect the poor. A number of policy scenarios were investigated, including different degrees of subsidy phase-down and cash transfer to compensate for fuel price increases. To strengthen the conclusions drawn here, international experience with kerosene and LPG subsidies additionally was reviewed for comparison with the study findings.

Summary of Findings

6 The price subsidies for kerosene and LPG continue to be fiscally unsustainable and difficult to contain, as illustrated by the need to virtually double the initially planned subsidy amount in fiscal 2002–03 and to increase by 60 percent the subsidy allocation for fiscal 2003–04. These subsidies bear large opportunity costs. The subsidy figure of Rs 63 billion for fiscal 2002–03 was the same order of magnitude as the entire central government’s spending on education—the Central Plan allocation for education was Rs 62 billion, of which Rs 43 billion was set aside for primary education (The Tribune 2003)—and markedly higher than the Rs 4 billion allocated for rural employment programs (The Hindu 2002). Furthermore, an analysis of NSS data suggests that these subsidies are of little help in meeting social policy objectives.

7 The subsidies appear seriously mistargeted. The price subsidy for LPG accrues disproportionately to the rich: three-quarters of the subsidy went to urban households in 1999–2000, four-fifths of whom were in the top half of the population by expenditure. The kerosene subsidy appears to carry a large leakage: as much as half of the subsidized kerosene in 1999–2000 is estimated to have been diverted to the black market or other sectors, most prominently the automotive diesel sector, at a cost to the central government of Rs 40 billion (close to US\$1

billion). The consumption of subsidized kerosene that reaches households is at least distributed more or less uniformly across income groups. However, the ineffectiveness of the subsidy and its delivery mechanism is further illustrated by the finding from NSS that even the poorest households buy some market kerosene for lighting, even though the total amount of kerosene they use can be less than the allocated subsidized quota. Given the high level of diversion of subsidized kerosene and the concentration of LPG use among higher-income households, it must be concluded that subsidies for neither fuel are effective in promoting equitable access.

Household energy use patterns

8 In rural areas, biomass fuel use is prevalent across all income groups and remained virtually unchanged between 1993–94 and 1999–2000, with more than 90 percent of rural households using wood, dung, or both. Mirroring the findings in other countries, wood consumption rises with increasing income among rural households, so that increasing income alone would not necessarily help to reduce wood use for some time. Close to 60 percent of all rural households were using cash-free wood in 1999–2000. In contrast, the use of LPG and kerosene as the primary cooking fuel was essentially nonexistent among rural households in 1999–2000; this applies across all income groups with the exception of the richest 10 percent. In short, supply conditions in rural areas favor the use of biomass for cooking because of its low labor costs and the ready availability of free biomass. This suggests that the effectiveness of fiscal instruments, such as changing relative fuel prices or increasing income relative to fuel prices, in promoting a switch from traditional biomass to petroleum fuels in rural areas would have serious limitations.

9 In urban areas over the same period, biomass use declined markedly and kerosene consumption also fell slightly, largely in favor of LPG. In 1999–2000, one-fifth of all urban households were still using biomass as the primary fuel. The percentage of urban households relying on cash-free wood was a mere 7 percent, considerably less than the corresponding figure in rural areas. About one-fifth of urban households were paying on average Rs 100 per month to purchase wood. One-sixth of households used purchased wood as their primary cooking fuel. They paid on average Rs 137 per month for wood, kerosene, and LPG, compared to Rs 176 per month spent by those who used LPG as the primary cooking fuel. They were also, on average, poorer than those who cooked mainly with LPG. At the same time, there are families in the poorer (lower) expenditure deciles that cook primarily with LPG, and families in the richer (upper) deciles that cook mainly with purchased wood. This illustrates that factors other than price and affordability (most prominently supply constraints, especially given that as many as 13 million households were on the waiting list in December 1999; other factors include customs and education) play an important role in household fuel choice. With continuing urbanization and the increasing scarcity of biomass driving up the market price of fuelwood, more and more urban households purchasing wood for cash are expected to opt for cleaner and more convenient fuels, provided that there is an efficient and well-functioning downstream petroleum market with competitive prices and no supply constraints.

10 Most rural households and many urban households use multiple energy sources for cooking and lighting. According to the NSS data, many households use modest quantities of kerosene for cooking, augmenting this kerosene with some use of biomass fuels. Other studies, in India and elsewhere, support the observation that traditional and modern fuels increasingly coexist in the household energy mix. The social benefits, such as health and time savings for women and children, of partial fuel switching—whereby wood continues to be used and only partially substituted by cleaner fuels—need to be better understood. Specifically, the health benefits of the smoke-free indoor environment that is achieved by full fuel switching from traditional biomass are likely to be compromised by partial fuel switching, but the exact effects of different combinations of fuels and stove technologies are hardly known. The benefit in the terms of time savings, however, is broadly in line with the amount of biomass used, and accrues to women even with partial fuel switching. To the extent that partial fuel switching is the first step toward full fuel switching and may accelerate the switch, efforts to promote the switch may be justifiable even should their immediate social benefits be limited.

Examination of alternative subsidy schemes

11 Analysis of household fuel choice in India, examination of alternative policies to the current subsidy schemes, and a review of international experience suggest that it would be difficult, if not impossible, to design an effective subsidy scheme for LPG and kerosene. Cash transfer to the poor to compensate for the subsidy phase-down or elimination, normally a sensible policy on account of the freedom of choice it gives to the recipients, does not seem suitable for promoting a shift in cooking fuel use toward more expensive clean fuels, particularly in rural areas. Modeling of the NSS data, consistent with international evidence, indicates that rural households conversely may use more wood if a modest amount of cash is given to them. This highlights the facts that switching to cleaner fuels is not a budget priority for many households, and that, in combination with other mitigation measures, raising awareness about the health benefits of modern household energy options could be one of the most effective interventions to facilitate fuel switching.

12 In the case of LPG, an interesting example of a different subsidy is the Deepam scheme in Andhra Pradesh. The scheme waived the cylinder deposit fee for its beneficiaries, targeting women from households that are classified as below the poverty line (BPL) and who are members of women self-help groups. Most beneficiaries live in rural areas. An assessment undertaken in 2000–01 of this scheme showed that urban beneficiaries used much more LPG than rural beneficiaries, LPG was used most extensively when there were opportunities for earning cash income (such as the agricultural season), and that for most beneficiaries wood remained the primary cooking fuel. Most households found it difficult to manage the cash payments for cylinder refills even with the large subsidy prevailing at the time, resulting in incidental use of LPG for making tea or preparing meals for unexpected guests. Overall, and raising questions about its effectiveness, the scheme facilitated the uptake of LPG but failed to encourage the substantial and sustainable use of LPG by its intended primary beneficiaries, the rural poor.

13 Exploring alternative ways of providing the kerosene subsidy to the poor merits special consideration because households without connection to or the reliable supply of electricity have little choice but to continue using kerosene. In the longer term, this issue is expected to be addressed by greater access to and better quality of electricity service, but the situation in the interim is a cause for concern. This concern notwithstanding, it was not possible to identify a viable mechanism to better target and deliver the kerosene subsidy. The subsidy is inherently prone to significant leakage, as has been found consistently in countries with such subsidies, because kerosene is a perfect substitute for automotive diesel. The experience, notably of Nepal, further suggests that a coupon system, which in theory should enable better targeting and which can be effective for certain goods, does little to reduce kerosene leakage.

Impact of subsidy phase-down

14 The impact of subsidy elimination on poor, nonelectrified households using kerosene for lighting is estimated to be about Rs 30 per month (at the price levels observed in February 2003), or about 2 percent of the total household budget. (International oil prices were high in February 2003, and the long-term impact is expected to be smaller.) It is not obvious that this rather modest amount would justify a subsidy, especially since half of subsidized kerosene is diverted from its intended users. Given that many poor households would still likely have to buy some market kerosene, the overall impact would be even more modest.

15 The use by the poor of LPG and kerosene as primary cooking fuels was found in 2000 to be limited, even in urban areas. Phasing down price subsidies would diminish the ability of the urban poor and of low-middle-income households to use cleaner petroleum fuels. This concern does not, however, outweigh the problems associated with the current subsidies, especially given the positive impact on market competition and innovation of removing price subsidies.

16 The elimination of price subsidies would be expected to have a large impact on the structure and nature of the downstream petroleum sector in India, because historically only state oil companies have been permitted to market subsidized fuels. This fact has stifled the growth of private marketers for kerosene and LPG, substantially curtailing new entry and competition. International experience amply demonstrates that creating a market environment in which fair and healthy competition flourishes is the most effective way to expand the supply and availability of competitively priced kerosene and LPG. At a minimum, such a market environment should help to make more LPG and kerosene available to those households that are able and willing to pay to switch to these fuels.

17 A competitive market also would encourage market innovations and experimentation with different schemes to help households take up and use petroleum fuels. Schemes such as installment plans to cover the cylinder deposit fee have been tried in the past by private LPG marketers in India and have been helpful; they have however not lasted long, because private marketers cannot compete with the state oil companies selling heavily subsidized LPG. In Guatemala, where the LPG market is completely liberalized, installment

payment plans to cover the purchase of a suitable stove and to cover the cylinder deposit fee are common and are helping to facilitate LPG uptake among low-middle-income families.

A Way Forward

18 **There is a strong case for phasing out price subsidies for LPG and kerosene.** This study was motivated by the primary objective of facilitating access to clean fuels, given the significant health and social benefits of switching away from traditional biomass. Price subsidies have been found to be ineffective in expanding the uptake of LPG and kerosene as primary household fuels among the poor, and have proven fiscally unsustainable. Even given this social objective, phasing out the price subsidies for LPG and kerosene and fostering a vibrant, open, and competitive market for these fuels would appear to be a better approach. The conclusions of this study lend strong support to the announcement by the Ministry of Finance in June 2003 that the LPG and kerosene subsidies will be phased down in three years and eliminated by April 2006 (Business Standard 2003d).

19 **There are ways to ease the impact of subsidy phase-down on consumers.** Given the subsidy framework in India, subsidy phase-down would be easier for the government when international prices are low, when the subsidy element is small and the impact on households of the phase-down correspondingly small. When international prices are falling, by maintaining end-user prices constant the government may be able to effectively shrink the subsidy component to the point where its removal results in little or no price increase. By phasing down subsidies over three years, the proposal by the Ministry of Finance provides, in principle, sufficient opportunities to implement this approach and eliminate subsidies in a relatively smooth manner, avoiding large price shocks for consumers.

20 **No effective subsidy mechanism for kerosene or LPG seems to exist.** Neither the analysis of consumer energy choice in India nor international experience could point to any viable subsidy scheme for these petroleum fuels. This is because both kerosene and LPG have attractive alternative uses among the nonpoor, such as vehicle owners, and the poor may have other cash expenditure needs that, when traditional biomass is widely available, they consider a higher priority than modern cooking fuels. LPG furthermore is strongly favored by the rich as a cooking fuel. Any subsidy for these fuels, regardless of its design, therefore is subject to significant leakage, mistargeting, or both. In addition, unlike water, electricity, or natural gas networks, for which access is predicated on the larger community choosing to establish the necessary supply infrastructure, the distribution of kerosene and even LPG relies on the individual household's ability and willingness to pay the start-up (stove and cylinder) and operating (fuel) costs. These operating costs furthermore are relatively high compared to the start-up costs (the ratio of the operating to start-up costs is much higher than for water, electricity or natural gas), limiting the effectiveness of subsidizing the start-up costs for the poor, as illustrated by the Deepam scheme. All these factors compound the difficulties of designing a subsidy to facilitate a shift by low-income households to kerosene or LPG.

21 **There is a need to identify other options to promote cleaner household energy, inside and outside the petroleum sector, that are more effective and viable.**

The prospects for fuel switching, supported by government interventions, are distinctly different for urban and rural areas. Access to free or cheap biomass and the availability of income-generating opportunities for those currently spending time on biomass collection and cooking are critical factors in determining consumer choice, and clearly are more supportive of a shift to petroleum fuels in urban than in rural areas. To the extent biomass is traded for cash or has clear opportunity costs (such as during the harvesting and monsoon seasons) in rural areas it also is influencing fuel choice, albeit on a much smaller scale, both in terms of the percentage of households using commercial fuels and the relative share of these fuels in the total household energy mix. The following are some possible solutions and approaches that take account of these urban/rural differences:

- **For LPG and kerosene, the best way to promote access and uptake in the long run is to liberalize the downstream petroleum market.** To this end, a necessary step is to phase out subsidies that cause market distortions, impede new entry and competition, and slow down the development of efficient markets.
- **An important role of the government is to establish and enforce adequate technical and safety standards, and ensure consumer protection,** especially against under-filling of LPG cylinders. This merits special attention in the early days of rapid LPG market development, as international experience suggests that in a market with a large number of operators and little enforcement, accidents and commercial malpractice can become common.
- **There are significant opportunities to facilitate a shift away from traditional biomass to clean fuels in urban and peri-urban areas, including among the poor.**
 - Urban and peri-urban households would be among the primary beneficiaries of a fully liberalized, competitive market for LPG and kerosene which will increase the uptake of these fuels among those able to pay.
 - There is also scope for expanding the market for these fuels by introducing incentives for low-middle-income households. Neither kerosene nor LPG is likely to become the primary cooking fuel of the poor, but households that are higher on the income ladder, not the very poor but who are nevertheless not rich, would consider switching to LPG if they could afford the cylinder connection fee. Market-based schemes to help these households pay the start-up cost of LPG could be quite effective. These schemes are more likely to be successfully implemented in a competitive market.
 - For those poorer urban and peri-urban households that cannot afford LPG or kerosene but purchase wood for cash, improved (cleaner and more efficient) biomass stoves and fuels (such as biomass waste briquette technologies) may be a cheaper attractive option.

- In the long term, promoting the use of natural gas in cities with gas pipelines merits consideration, particularly in view of the recent gas discoveries in eastern India. Establishing a distribution network for household use is expensive. Nevertheless, natural gas is well suited for a targeted subsidy: diversion is difficult and there is the option of cross-subsidizing a small first block (lifeline tariff) by higher blocks. The gas tariff structure should be carefully designed to allow the urban poor to use natural gas to meet most of their household energy needs without unduly subsidizing middle- and upper-income households.
- **Rural households are more difficult to deal with and require a concerted multisectoral approach over a long period of time.**
 - Establishing an open and competitive market for petroleum fuels would also help, even though to a smaller extent than in urban areas.
 - Fostering economic growth, employment opportunities (particularly for women), and rural infrastructure development have the collateral benefits also of facilitating fuel switching.
 - Accelerating the viable expansion of rural electrification is of special importance, because in addition to reducing the need for kerosene for lighting it has in a number of countries been found to be strongly correlated with the uptake of clean fuels for cooking.
 - Given that biomass will for the foreseeable future remain the principal option for rural India, the promotion of cleaner biomass-based household energy technologies (such as biomass briquettes, biogas, improved stoves, and other appliances) needs to be given greater attention. To be sustainable, solutions to rural household energy should be demand-driven and commercially oriented. In particular, it is important to determine what types of biomass-based and other cleaner energy technologies are likely to work for different economic circumstances and household preferences. Any technological alternatives to free or cheap traditional biomass will be widely adopted only if the incremental costs are affordable and outweighed by tangible nonmonetary benefits valued by the user.
 - When seeking to facilitate a long-term shift to clean household fuels and other energy technologies, it is important to identify and target areas where the chances of switching are highest—that is, those with limited access to free biomass where many households must purchase wood for cash; areas where houses are electrified, and areas where there are income opportunities that enable households to purchase commercial energy products and services on a regular basis.

roles of the government is to educate the public about the adverse health impacts of traditional household energy and the benefits of using cleaner fuels, as well as other options including the benefits of increasing stove efficiency. In the early stage of consumer education, the government may consider providing seed money for the development of more efficient, more durable stoves. Public awareness of the adverse impact of indoor air pollution could encourage households to reduce their exposure to smoke emissions and, among those who can afford to switch out of traditional biomass, such as higher-income households in rural areas, to seriously consider switching to kerosene, LPG, or biomass-based clean technologies for cooking.