2

Kerosene and LPG Markets in India

2.1 Kerosene and LPG are the two principal clean household fuels in India that have substituted biomass for cooking. Two other alternatives, natural gas and electricity, are not commonly used because of a lack of general availability for household use, in the case of natural gas, and much higher cost, in the case of electricity. Biomass-based clean fuels, such as biogas, have not yet been commercialized, although there is significant interest in India in exploring the potential of nonhydrocarbon alternatives.

Characteristics of Kerosene and LPG

2.2 Kerosene, a liquid, does not a as a consequence burn as cleanly as gaseous fuels. It nonetheless is considerably cleaner than the biomass used in traditional stoves. One of kerosene's main advantages is that it is far easier to transport and distribute than gaseous fuels and, unlike LPG, can be purchased in any quantity. For households with cash constraints, the ability to buy kerosene in small quantities is attractive. Kerosene stoves, however, typically are more expensive than wood stoves.

2.3 Kerosene can also be used in gaseous form, but to do so requires equipment that is more expensive that that used to burn it in liquid form. To gasify kerosene, the liquid is pressurized and then released to the atmosphere. Starting a high-pressure kerosene stove is more time-consuming than starting an LPG stove, but cooking with gasified kerosene otherwise is similar to cooking with LPG. It does not deposit soot. Kerosene burned in a wick stove as a liquid, in contrast, emits soot, although not as much as does traditional biomass. The prices of high-pressure kerosene stoves are higher than those of wick stoves. While a number of urban households cook with kerosene, rural households tend to use it predominantly for lighting. As such, the market for kerosene in rural areas is closely tied to power sector reform and the availability of an affordable and reliable supply of electricity.

2.4 LPG is used worldwide for cooking and heating, especially in areas without connection to piped natural gas. It is a clean fuel. Two disadvantages of LPG for low-income households are its relatively high start-up cost and the large (lumpy) cash outlays needed for

cylinder refills.

2.5 What distinguishes LPG from other fuels is cylinder management. Because LPG has to be stored under pressure, metal cylinders are required. To cover the cost of cylinder manufacture, an initial deposit fee is required. This may be in excess of US$20, and to this must be added the purchase cost of an LPG stove and possibly also the cost of cylinder deliveries. The combination of the start-up cost and the cash outlay at each refill (which typically cannot be broken up into smaller installments) presents a serious barrier to the uptake and regular use of LPG by low-income households.

2.6 Another problem is assuring the reliable supply of refill cylinders. For small and remote markets, refills may be delivered once a week or once every other week. For those users that do not keep a second cylinder, this could mean going without fuel for as long as two weeks. Signing up for two cylinders to avoid running out of cooking fuel would further increase the start-up cost of LPG service. Again, this infrequent delivery of refill cylinders serves as a disincentive against switching entirely to LPG.

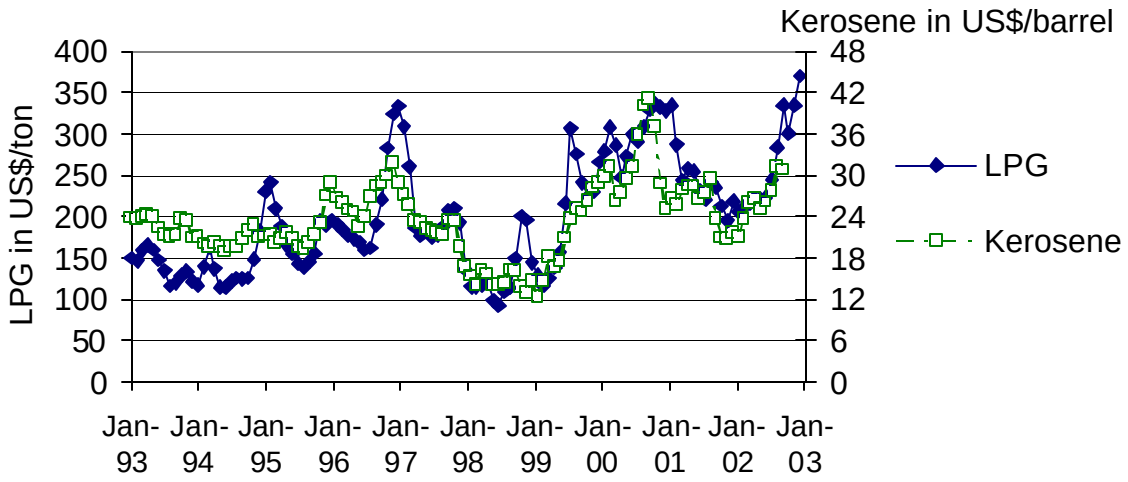
2.7 One option for reducing the "lumpiness" of LPG purchase is to provide smaller cylinders. With smaller cylinders, each refill costs less, potentially enabling low-income households to refill more regularly, and the initial cylinder deposit fee can be lowered. Smaller cylinders potentially yield double benefits: more regular LPG consumption by users, especially in rural areas, and a higher uptake rate of LPG. It is important to stress, however, that international experience with smaller cylinders is mixed: the negative aspects of small cylinders include (a) a much higher cost of cylinder management and hence higher per-unit LPG price and (b) the need for households to refill more frequently—a problem especially if cylinder delivery entails logistical difficulties (such as slow delivery or the need to arrange for cylinder pick-up when the dealership is far away).

2.8 For LPG dealers considering rural markets, low population density, poor road infrastructure, low LPG uptake, and low consumption among those who sign up for LPG can make it difficult to establish a commercially viable LPG distribution network. The lack of economies of scale in catering to rural domestic consumers is one of the main factors hindering ready access to LPG.

2.9 In a deregulated market, prices of kerosene and LPG are closely linked to their international prices, and these have fluctuated significantly in recent years. Figure 2.1 shows the average prices of kerosene and LPG in the Arabian Gulf for the past 10 years. The nominal price of kerosene ranged between the low of US$12 per barrel in February 1999 and a high of US$41 per barrel in October 2000. Similarly, the nominal price of LPG varied from a low of US$93 per metric ton in July 1998 to a high of US$370 in January 2003. Consumers in India have thus far been shielded from these large price fluctuations, but as the petroleum sector and pricing in particular become deregulated they will be increasingly exposed to the price volatility of the international market. Price fluctuations of this magnitude for something as essential as a cooking fuel would impose a disproportionate hardship on those, such as rural farming households, who do not have a reliable and steady source of cash income. Where wood is

competing with kerosene and LPG (for example, in areas with depleted biomass), wood prices would also be expected to fluctuate in tandem with kerosene and LPG prices, but presumably not to the same extent. In rural areas where there is abundant biomass as an alternative, the viable use of LPG or kerosene as the primary cooking fuel would thus be restricted mainly to middle- and high-income families.

Figure 2.1 Average Arabian Gulf Prices of Kerosene and LPG



Source: Petroleum Economics Limited

Kerosene and LPG Markets in India

2.10 The Government of India historically has provided large universal price subsidies for kerosene (distributed through the Public Distribution System [PDS]) and LPG (sold by dealers working with state-owned oil companies). The subsidized fuels are handled exclusively by four state oil companies that have in the past enjoyed benefits over and above the price subsidies, including historically a guaranteed 12 percent return post-tax on net worth. This guaranteed fixed rate of return, and the assurance of a domestic market for LPG and kerosene, means that the focus in the past has tended to be on investment rather than on marketing and market analysis.

2.11 1993 marked the beginning of the liberalization of the petroleum sector, with the entry of the first private marketers. Private companies have historically been licensed to sell only imported fuels carrying no subsidies. In the 1990s, about one-half of the kerosene and one-third of the LPG consumed in India was imported. Subsidized fuel prices have been kept stable for the most part regardless of fluctuations in international prices, making it extremely difficult for private marketers to expand their market share. Private sector dealers realistically can be competitive only on the quality of service: offering no waiting list, a quick turnaround for refill cylinders, and home delivery of refill cylinders, for example. Even so, in the LPG sector typically

only those households that do not have easy access to subsidized LPG, due either to there being a long waiting list or a lack of local dealers, have signed up with private dealers.

2.12 Subsidized LPG historically has been supplied in 14.2 kg cylinders. Smaller, 5 kg cylinders were introduced several years ago but were withdrawn as a commercial failure. In August 2002, they were reintroduced. Until recently, the state oil companies marketed LPG only in towns and cities with a minimal population of 20,000. Having saturated these urban markets, they are now expanding into the rural areas where private marketers have historically operated. The government has been actively pursuing market expansion for the state oil companies, and has eliminated the LPG waiting list that as recently as April 2000 included 6 million potential customers. This closed to the private sector a segment of the market in which it could previously compete. The LPG market today is dominated by state oil companies.

2.13 Kerosene supplied through the PDS is sold at the "fair price" shops which sell subsidized goods. The allocation of subsidized kerosene by the central government varies from state to state and is based on historical patterns rather than on demand or on consideration of relative poverty levels. The allocation within a state depends on whether the household is in a rural or urban area, and typically on whether or not the household has taken up LPG. The lowest allocation quantity typically is set aside for those with double-cylinder connection (that is, households that have two LPG cylinders). Kerosene allocation by state and the quantities to which households falling under different categories were entitled in fiscal 1999–2000 are shown in Table 2.1. There is an urban bias in several states. As will be shown later, the amounts to which households, especially in rural areas, are entitled tend to be higher than what they can purchase in practice.

Table 2.1 Kerosene Allocation During Fiscal 1999–2000

States / Union Territories	Allocation (metric tons)	Household kerosene allocation (liters per month) URBAN Households with no LPG	URBAN Households with 1 LPG cylinder	URBAN Households with 2 LPG cylinders	RURAL Households with no LPG	RURAL Households with 1 LPG cylinder	RURAL Households with 2 LPG cylinders
Northern Region							
Haryana	171,732	10	3	0	6	3	0
Himachal Pradesh	61,846	25	10	0	25	10	0
Jammu and Kashmir	111,764	10/15	10/15	10/15	2/5	2/5	2/5
Punjab	343,128	20	3	0	20	3	0
Rajasthan	443,179	10	2	0	10	2	0
Uttar Pradesh	1,410,902	8	3	3	8	3	3
Chandigarh	15,408	10/20	3	0			
Delhi	204,672	12/22	0	0	12/22	0	0
Sub Total	2,762,631						
Eastern Region							
Assam	272,628	5–6	5–6	5–6	5–6	5–6	5–6
Bihar	870,036	3–5	3	0	3–5	3	0
Manipur	22,854	5	5	5	5	5	5
Meghalaya	21,038	9.4	9.4	9.4	9.4	9.4	9.4
Nagaland	14,358	2–5	2–5	2–5	2–5	2–5	2–5
Orissa	381,693	4	4	4	4	4	4
Sikkim	7,896	2	2	2	2	2	2
Tripura	32,556	1	1	1	1	1	1
West Bengal	820,086	2	2	2	1	1	1
Arunachal Pradesh	10,919	4.5	4.5	4.5	4.5	4.5	4.5
Mizoram	8,148	3	3	3	2	2	2
Andaman and Nicobar	7,033	5–10	5–10	5–10	5–10	5–10	5–10
Sub Total	2,469,245						
Western Region							
Gujarat	837,292	8–16	2	0	7–10	2	0
Maharashtra	1,573,902	4–24	4	0	2–20	4	0
Goa	28,080	3	6	6	3	6	6
Diu	1,212						
Daman	1,224						

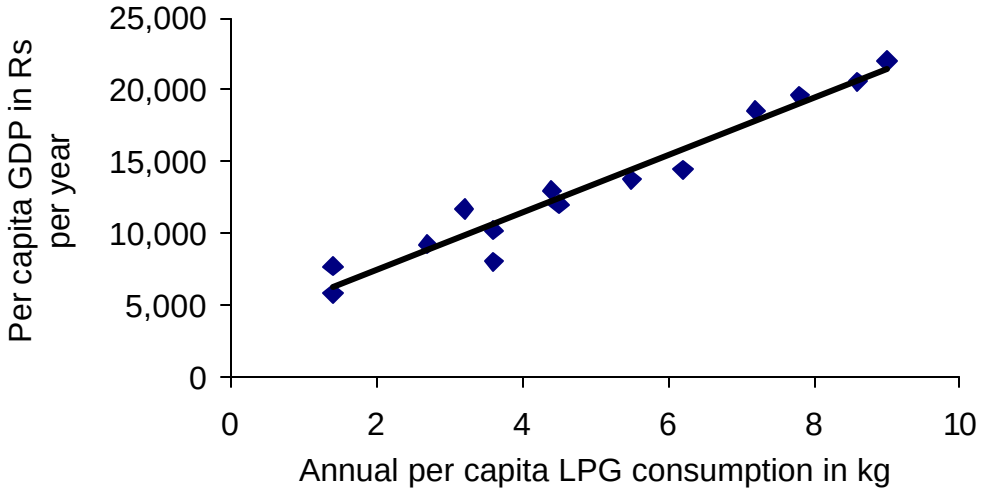
States / Union Territories	Allocation (metric tons)	Household kerosene allocation (liters per month) URBAN Households with no LPG	URBAN 1 LPG cylinder	URBAN 2 LPG cylinders	RURAL Households with no LPG	RURAL 1 LPG cylinder	RURAL 2 LPG cylinders
Dadar Nagar Haveli	3,240						
Madhya Pradesh	666,636	5	5	5	5	5	5
Sub Total	3,111,586						
Southern Region							
Andhra Pradesh	675,011	10–23	3	0	3	3	0
Karnataka	531,168	6–8	2	2	4	2	2
Kerala	302,076	6	3	3	6	3	3
Tamil Nadu	732,523	10–15	3	0	3–5	3	0
Pondicherry	15,360	7	2	2	7	2	2
Lakshwadweep	924	5	5	5	5	5	5
Sub Total	2,257,062						
All India Total	***10,600,524***						

Notes on household kerosene allocation: Data as of 1 January 2000. Jammu and Kashmir, the figures are for summer and winter; Chandigarh urban with no LPG, 10 liters for households with 2 members or fewer, 20 liters for households with more than 2 members; Delhi 12 liters for families with 1-5 members, 22 liters for family with 9 members or more; Sikkim 2 liters per family member; Tripura 1 liter per family member; Maharashtra, no LPG, first number minimum per person, second number per family with more than 7 members; Goa 3 liters per person for no LPG, 6 liters per card holder otherwise; Andhra Pradesh for no LPG, 23 liters for below poverty line white card holders, 10 liters for above poverty line pink card holders in Hyderabad, and 10 liters per household in the rest of the state in urban areas; Kerala 2 liters for electrified houses and 5 liters for non-electrified houses, with figures in the table for cooking purposes against permits.

Source: Oil Coordination Committee (now Petroleum Planning and Analysis Cell) of the Ministry of Petroleum and Natural Gas

2.14 The consumption of subsidized LPG is a strong function of income. Figure 2.2 shows LPG consumption in fiscal 1997–98, when the consumption of subsidized LPG was seriously constrained by supply problems. It is clear that proportionally the subsidy favored better-off households. This trend is confirmed in the analysis of the 1999–2000 household survey data, as Chapter 3 shows.

Figure 2.2 Annual per Capita LPG Consumption as a Function of Annual per Capita Gross Domestic Product (GDP) in 14 Indian States, Fiscal 1997–98



Notes: The data from the following states were used in this figure: Andhra Pradesh, Bihar, Gujarat, Haryana, Kanartaka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal. The annual per capita consumption includes all residents in the states, users as well as non-users of LPG.

Source: Oil Coordination Committee (now Petroleum Planning and Analysis Cell) of the Ministry of Petroleum and Natural Gas

2.15 In a gazette notification issued in November 1997, the government set a timetable for the staged phase-down of subsidies on kerosene and LPG. The stated policy called for the retention of smaller universal price subsidies: 33.3 percent for kerosene and 15 percent for LPG for household use. The subsidy phase-down was originally planned to be completed by the time of sector deregulation in April 2002, but has fallen behind schedule. The government later decided that the subsidy on domestic LPG and PDS kerosene would be provided on a specified flat rate basis from the Consolidated Fund from April 1, 2002.

2.16 Fiscal 2002–03 was the first time fuel subsidies were made explicit in the national budget. The subsidy for the petroleum sector was the second highest subsidy after that on food. For LPG and kerosene, the Ministry of Finance allocated Rs 50 billion (approximately US$1 billion), but rising international prices drove the actual subsidy up to 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 during the fiscal year, amounting to some Rs 30 billion between April and December 2002 alone (Business Standard 2003b). In interpreting these numbers it is important to note that they are inclusive of all government taxes, including import duties on kerosene and LPG. Another consideration is that about one-half of the kerosene and one-third of the LPG consumed are produced locally. These subsidy figures thus represent an upper bound rather than the actual costs to the government and oil companies. The unsubsidized prices in February 2003 based on import-parity were Rs 470 per cylinder of

LPG and Rs 16.5 per liter of kerosene (Business Standard 2003b). The market LPG and kerosene prices corresponded to these levels.

2.17 These subsidy figures are of the same order of magnitude as the central government's spending on education in fiscal 2002–03—the Central Plan allocation for education in fiscal 2002–03 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). For fiscal 2003–04, the Ministry of Finance increased the kerosene and LPG subsidy to Rs 81 billion (Business Standard 2003c). In June 2003, however, the Ministry of Finance announced that the LPG and kerosene subsidies would be phased down in three years and eliminated by April 2006. The Ministry of Petroleum and Natural Gas was reported as favoring a five-year phase-down period to reduce the burden on the state oil companies from cost under-recovery as occurred in fiscal 2002–03 (Business Standard 2003d).

Fuel Expenditure Comparison

2.18 It is informative to compare the operating costs of LPG and kerosene with and without price subsidies. Ultimately what influences a household's choice is how much it would have to spend to do a given amount of cooking and other household activities. Here, cooking is taken for illustration purposes because it accounts for the majority of all household energy used (World Bank 2002b). Table 2.2 compares the cost per unit of energy delivered to the burner tip. The subsidized and unsubsidized prices of LPG and kerosene as informed by the Minister of Petroleum and Natural Gas Minister, Ram Naik, to the Ministry of Finance in February 2003 and reported in the Business Standard (2003) are used as retail prices. There is only a limited amount of in-field stove efficiency data available in India, and these data are the largest source of uncertainties in the calculations. While LPG stoves are required to be designed to operate at 60 percent efficiency or higher, field measurements show efficiencies considerably lower than the design specifications. The computation in the table assumes 50 percent stove efficiency for LPG, 35 percent for kerosene in wick stoves, and 40 percent for kerosene in high-pressure stoves (where kerosene is gasified before combustion). On the basis of the assumed efficiency figures, one 14.2 kg cylinder of LPG is equivalent to 21 liters of kerosene as a liquid and 19 liters gasified kerosene. Expressed in rupees per mega-joule (MJ) of energy delivered, LPG is more expensive than kerosene. The higher start-up cost of LPG makes LPG even more expensive. The last column shows the monthly expenditure of a household consuming the equivalent of one LPG cylinder a month.

Table 2.2 Cost of Using LPG and Kerosene

Fuel	*Price*	*Stove efficiency*	*Rs/MJ*	*Equivalent quantity*[5]	*Rs/month*[6]
LPG	Rs 241/cylinder[3]	55%	0.67	14.2	241
LPG	Rs 469/cyliner[4]	55%	1.31	14.2	469
kerosene[1]	Rs 9/liter[3]	40%	0.52	21	188
kerosene, high pressure[2]	Rs 9/liter[3]	45%	0.47	19	167
kerosene	Rs 16.54/liter[4]	40%	0.96	21	345
kerosene, high pressure	Rs 16.54/liter[4]	45%	0.85	19	307

[1] Kerosene used as a liquid; [2] Kerosene used in a high-pressure stove; [3] Subsidized price in New Delhi as of February 2003; [4] Unsubsidized price; [5] Fuel quantity required to deliver the same amount of energy to the cooking pot; [6] Rs per month per household for purchasing the quantity indicated under "Equivalent quantity"

2.19 At the subsidized retail price levels observed in February 2003, which are regarded as unsustainable by both the finance and petroleum ministries, it costs about Rs 240 per month to cook with LPG. This assumes cooking uses one cylinder a month, which is representative of urban households. The figures of Rs 170 and 190 for cooking with kerosene are not realistic, because few households are able to purchase 20 liters of PDS kerosene every month: rather, it is likely that the bulk of the kerosene used for cooking comes from the parallel kerosene market. Absent price subsidies, it would have cost Rs 310–350 per month to cook with kerosene and Rs 470 per month using LPG at the international price levels in February 2003.

2.20 In February 2003 world prices were among the highest ever. The above calculations therefore show what households might have to pay at times if prices were not subsidized, fuel tax levels remained the same, and prices were allowed to fluctuate in tandem with international prices. The LPG price in February 2003, for example, was 45 percent higher than the average of the preceding two years. However, even if the prices are adjusted accordingly, the monthly expenditures remain higher than those at the subsidized prices. As Chapter 3 shows, these compare to about Rs 110 per month for the value of wood (purchased) used by wood-using households found in the 55th round of the NSS, adjusted for the consumer price index (CPI). All the figures on kerosene and LPG expenditure in Table 2.2 are markedly higher than the expenditures on fuels reported in the 1999–2000 NSS, even by high-income urban families (see Table 3.14). Increasing in-field stove efficiency though the use of improved stove design and better stove maintenance and operation could considerably lower the cost of using kerosene and LPG.

2.21 The world price of crude oil is expected to decline from the high level of early 2003, and with it the prices of kerosene and LPG. Short-term and even occasional prolonged price hikes nonetheless also can be expected. The subsidies are planned to be phased down in the coming years, but the political challenges remain formidable. This study is intended to serve as an analytical basis to inform this process.