



## South Asia Region Internal Discussion Paper

# Promoting Clean Household Fuels Among the Rural Poor

*Evaluation of the Deepam Scheme in Andhra Pradesh*

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**THE WORLD BANK**  
Washington, DC

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The findings and conclusions of this report are those of the authors and should not be attributed to the World Bank.

## Abbreviations and Acronyms

<b>AGS</b>	Additional Gram Sevika
<b>ANG</b>	Anganwadi (child care centre for children under the age of five)
<b>AP</b>	Andhra Pradesh
<b>APCPC</b>	Andhra Pradesh Civil Supplies Corporation
<b>APL</b>	above poverty line
<b>BC</b>	Backward Castes
<b>BPC</b>	Bharat Petroleum Corporation
<b>BPL</b>	below poverty line
<b>CMEY</b>	Chief Minister's Scheme for Employment of Youth
<b>DPAP</b>	Drought Prone Area Programme
<b>DRDA</b>	District Rural Development Agency
<b>DWCRA</b>	Development of Women and Children in Rural Areas (type of self-help group)
<b>DWCUA</b>	Development of Women and Children in Urban Areas (type of self-help group)
<b>ESMAP</b>	Energy Sector Management Assistance Programme
<b>GCC</b>	Girijan Cooperative Corporation
<b>HPC</b>	Hindustan Petroleum Corporation
<b>IOC</b>	Indian Oil Corporation
<b>ISI</b>	Indian Standard Institute
<b>ITDA</b>	Integrated Tribal Development Agency
<b>JFM</b>	Joint Forest Management
<b>LPG</b>	liquified petroleum gas
<b>NGO</b>	non-governmental organisation
<b>NIRD</b>	National Institute of Rural Development
<b>OBC</b>	Other Backward Class
<b>PDS</b>	Public Distribution System
<b>RCC</b>	reinforced concrete cement
<b>SC</b>	Scheduled Castes
<b>ST</b>	Scheduled Tribe
<b>UNDP</b>	United Nations Development Programme
<b>VDO</b>	Village Development Officer
<b>VSS</b>	Van Sanghrakshan Samiti (Forest Protection Committee)

## Units

<b>kg</b>	kilogram(mes)
<b>km</b>	kilometre(s)
<b>Rs</b>	Indian rupee(s); US\$1.00 = Rs 43.05 in 1999, 44.91 in 2000 and 47.16 in 2001

$\mu\text{g}/\text{m}^3$  micrograms per cubic metre

# Glossary

Indian society has traditionally been based on a social hierarchy associated with caste-based divisions of labour. Certain communities have historically been deprived of basic economic and other rights on the basis of their position in the social hierarchy. In an effort to right past wrongs, the Government of India has been pursuing a policy of affirmative action since independence. In order to identify the communities that have been historically disadvantaged, communities are categorised into Scheduled Castes, Scheduled Tribes, Backward Castes and Other Backward Classes.

- Backward Castes** Certain castes have been categorised as “backward” because of socio-economic and educational deprivation.
- Other Backward Classes** The Mandal Commission Report of the Government of India identified certain Other Backward Classes and included them in the list of the Backward Castes for the purpose of extending reservations and concessions in employment and education.
- Scheduled Castes** Any social group can be included in this category as per the provisions of Article 341 of the Indian Constitution. This includes any social group or community that has been socially, economically and educationally disadvantaged because of the historical practice of “untouchability”. Members of the Scheduled Castes include Hindus, Buddhists and Sikhs.
- Scheduled Tribes** As per Article 342 of the Indian Constitution, communities and tribes living outside of the mainstream society are called *Scheduled Tribes*. Scheduled tribes can profess any religion. They have the least exposure to technology.

# Executive Summary

## Background and Objectives

Biomass is the energy source of the poor. According to the 55<sup>th</sup> round of the National Sample Survey conducted in 1999–2000, 69 percent of India’s households use traditional biomass fuels—wood, crop residues and dung—for cooking and heating. It is also the major source of indoor air pollution, which is one of the most serious health hazards in India, affecting poor women and children disproportionately. In India, smoke from the combustion of biomass in traditional stoves may be responsible for approximately half a million premature deaths a year.<sup>1</sup> Cooking with biomass is very time-consuming, and fuelwood collection further diverts the time of women and children away from more productive activities, including education. Absent alternatives to the traditional use of biomass, rural women will remain disadvantaged by the consequent deleterious health effects and the drudgery of wood collection. One particularly effective alternative is to change the fuels being burned from biomass to liquefied petroleum gas (LPG).

The Government of India has historically attempted to encourage fuel switching from biomass to cleaner commercial fuels by providing large universal price subsidies to kerosene, sold through the Public Distribution System (PDS), and LPG sold in 14.2-kilogram (kg) cylinders by dealers belonging to state-owned oil companies. A scheme providing price subsidies, however, does not address one of the barriers to household fuel switching to LPG: the high upfront cost associated with the start-up of LPG service. For example, a new LPG user in the state of Andhra Pradesh (AP) must (i) pay Rs 1,000 for “LPG connection” in order to receive an LPG cylinder and (ii) purchase an LPG stove and associated accessories at an additional cost of Rs 1,000 or so. The combined cost of LPG connection and stove purchase makes it difficult for many poorer households to start using LPG as a cooking fuel.

In order to help overcome this barrier, the Government of Andhra Pradesh launched the so-called Deepam scheme in July 1999 whereby the connection fee was paid by the government for below-poverty-line (BPL) households possessing white ration cards. Those who do not possess white ration cards are also eligible provided that their self-help groups pass a resolution attesting to their BPL status, or that they have been recommended by Mandal Revenue Officers. The policy objectives of the Deepam scheme are said to include (i) reducing drudgery among women and children from wood

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<sup>1</sup> See, for example, Y. Von Schrinding, N. Bruce, K. Smith, G. Ballars-Treemeer, M. Errati, and K. Lvovsky, *Addressing the Impact of Household Energy and Indoor Air Pollution on the Health of the Poor: Implications for Policy Action and Intervention Measures* (Commission on Macroeconomics and Health Working Paper, WG5:12, July 2001).

collection and cooking; (ii) improving the health of household members by reducing ambient concentrations of smoke and other harmful pollutants; and (iii) protecting forests from further degradation. The scheme was originally designed to cover 1 million rural and 0.5 million urban households. To this end, the State Government of AP agreed to pay the total cost of Rs 1.5 billion (US\$35 million at the time) for the 1.5 million LPG connections. The total number of connections authorised has since been increased to 1.715 million, with the overall target increased to 3.0 million.

In return for the release of additional subsidised LPG provided by the Centre Government to cover the Deepam scheme, the State Government of AP agreed to surrender 5 litres of kerosene per month for each household enrolled in the scheme. This was done by reducing kerosene rations for urban Deepam beneficiaries and rationalising the distribution of kerosene through the PDS. The Deepam beneficiaries have to cover other upfront costs of taking up LPG—the purchase of a stove and associated accessories—amounting to some Rs 1,000.

Only members of self-help groups satisfying certain criteria may participate in the scheme. There are more than 373,000 self-help groups in Andhra Pradesh with a total of more than 5 million members. About 150,000 of these self-help groups are in rural areas. As of February 2002, more than 1.5 million LPG connections had been released through the Deepam Scheme, including 1.2 million in rural areas. The majority of recipients were members of groups under the Development of Women and Children in Rural (or Urban) Areas (DWCRA and DWCUA, respectively).

The Deepam scheme differs from traditional fuel subsidies in four respects. First, it is a one-off subsidy, covering the capital cost in the form of cylinder connection fee, rather than the operating cost—the purchase of the fuel itself—by giving a price subsidy. Second, only poor households are eligible for the subsidy, whereas the current LPG price subsidy in India is available to all income groups, and benefits mainly the well-off in urban areas. Third, the program is targeted to rural areas. Last, it is implemented through women self-help groups, thus linking the promotion of LPG to support for women's development and financial independence. As such, an examination of the Deepam scheme can provide valuable insights into the effectiveness of different forms of fuel subsidies. The objective of this study was independently to assess the Deepam scheme's performance, effectiveness, sustainability and replicability.

This study relied on primary data supplemented by secondary data. For primary data collection, in mid-2001 the team conducted focus-group discussions with 66 self-help groups as well as interviews with 134 Deepam beneficiaries who had enrolled in the scheme prior to December 2000. The self-help groups and beneficiaries were selected on the basis of random sampling to collect representative data. In addition, discussions were held with other LPG users and non-users, oil company representatives, dealers and government officials involved in the scheme. The majority of the study findings reflect the status of the Deepam scheme as of mid-2001.

### **The Characteristics and Experience of Deepam Beneficiaries: Focus-group Discussions with Self-Help Groups**

Of the 66 self-help groups that participated in focus-group discussions, more than one-half were more than four years old. Judging from housing conditions, assets and land-holding status, about one-half of the beneficiaries belonging to groups other than the Scheduled Castes (SC) and Scheduled Tribes (ST) did not appear to be genuinely poor although they were white-card holders. There seemed to be more ineligible beneficiaries in urban areas, though it should be mentioned that DWCUA groups are relatively young and record-keeping and documentation is not yet well organised.

The scheme has attracted some who are not intending to use LPG much; SC and ST families regard the possession of LPG cylinders as a status symbol. The Deepam Scheme seems to have hastened the pace of formation of new groups so as to be able to take advantage of this subsidy.

The number of days lapsed between the time a group was selected for participation in the Deepam scheme and when the cylinders were delivered to homes averaged 64 days, or about 2 months, with the median being 29 days. The majority of this time lag was between selection and sanction. In some cases, there were marked differences in the number of people selected and the number of those who actually received LPG cylinders. These differences were due to mistakes in the names of people selected, incorrect names recorded on ration cards, and non-possession of white cards.

Over 80 percent of Deepam beneficiaries purchased the stove and associated accessories using their own funds. The rest borrowed money from their own self-help groups; very few borrowed from other sources. While stoves were available from District Rural Development Agencies (DRDAs) at prices lower by about Rs 100 than elsewhere, the focus-group discussion participants indicated that they preferred to purchase from the dealers because delivery was prompt and quality was assured.

Gas agencies are required to deliver refill LPG cylinders to homes to the extent possible, setting up sub-depots if necessary. The cost of cylinder delivery is built into the refill cost. However, of the 66 self-help groups, only 14 responded that as of mid-2001 they relied entirely on home delivery to obtain refill cylinders. In fact, 42 groups did not have home delivery at all. In response to the shortage of LPG distributors, three state-owned oil companies supplying LPG to Deepam beneficiaries opened an additional 103 outlets in rural areas between September 2001 and February 2002, and plan to open 200 more outlets by the end of 2002.

Only one-tenth of the respondents were consuming half a cylinder of LPG or more a month, the amount estimated to be needed to meet cooking needs fully using LPG. One-third refilled every three months, another third every three to four months, 14 percent every four to six months, and 5 percent less frequently than every six months. The refill rate was not well correlated with the distance to the closest dealership. Predictably, the most common reason given for low consumption of LPG was the higher cost of switching to LPG. While one of the guidelines in the scheme required that the beneficiaries who do

not refill at least once every 90 days would forfeit the connection, this did not seem to be enforced.

LPG was found to be most extensively consumed during the monsoon season. Reasons for higher usage of LPG were (i) the agricultural season begins during the monsoon, making more cash available to agricultural labourers who earn regular wages; (ii) there is less time for biomass collection and cooking; and (iii) keeping biomass dry is difficult. The use of LPG was reported to be lowest in summer.

Questions concerning energy use indicated that wood is still used more than any other fuels for cooking, and is also the dominant fuel for heating water and other non-cooking purposes. The only exception is “other cooking”, where LPG seems to have made an inroad, most likely to make tea and perform other simple tasks for which getting a fire going using wood would take up a disproportionate amount of time. After wood and LPG, crop residues ranked third. Kerosene was used primarily for lighting in rural areas and rarely for cooking, but some urban households were relying on kerosene for cooking.

Four-fifths of the respondents cited clean and healthy cooking as the principal advantage of using LPG. Half also cited time saved. Other reasons for using LPG included time made available for labour (30 percent) and the social status associated with LPG use (9 percent). Focusing on the first aspect, the cleanliness of cooking with LPG (lack of soot deposits on pots and pans, making cleanup easier) was most important (88 percent), and cited twice as many times as the absence of smoke during cooking (45 percent). In terms of economic benefits, there was a near universal consensus that savings in cooking time were the most significant aspect of LPG use (97 percent), cited twice as many times as not having to spend time collecting biomass (45 percent).

The reduction in kerosene allocation at the state level was cited as an important negative feature of the Deepam scheme by a large number of beneficiaries (84 percent). The urban beneficiaries, who were directly affected, were especially vocal on this point. Other considerations included extra expenses incurred being a financial drain (33 percent) and having to pay a commission to fetch refill cylinders (10 percent). Some, presumably those who have signed up for the Deepam scheme but have not been using LPG, referred to their participation in the scheme as a “dead investment”. More than one-half mentioned that the use of LPG was inviting envy from non-beneficiaries.

Two-thirds of the respondents said that LPG was “partially” affordable. One-fifth said that LPG was affordable, but 14 percent replied that it was not affordable. Predictably, 89 percent wanted to see a reduction in the price of LPG to facilitate its greater use. In terms of the level of satisfaction with the Deepam scheme, 97 percent were satisfied with the selection process, 77 percent were satisfied with the coverage of the scheme, and 65 percent were satisfied with the distribution arrangements. For the coverage of the scheme, 18 percent were only partially satisfied. Thirty percent of the self-help groups were only partially satisfied with the distribution arrangements.

## The Characteristics and Experience of Deepam Beneficiaries: Individual Interviews

Most of the 134 beneficiaries interviewed lived in rural areas. Two-fifths owned land, and one-half owned livestock. Two-thirds had kitchens inside the house (equally split between those with and without partitions from the rest of the house). Close to one-half of the households owned two-wheelers. There was essentially no difference between the urban and rural households interviewed in this study in the possession of durable goods.

Most of the beneficiaries learned about the Deepam scheme from their self-help groups and government officials. As they had during focus-group discussion findings, the study team found that most used their own funds to pay for the purchase of the stove and associated accessories. Two-fifths lived within 5 kilometres (km) of an LPG distribution point. However, of those who lived within 5 km, only a quarter had home delivery of refill cylinders. The rest had to collect the cylinders themselves, or else pay a third party for cylinder collection. One-half of the respondents reported that they had to pay up to Rs 55 for each cylinder collection, averaging Rs 22 per refill. The remaining half did not pay anything extra for cylinder delivery.

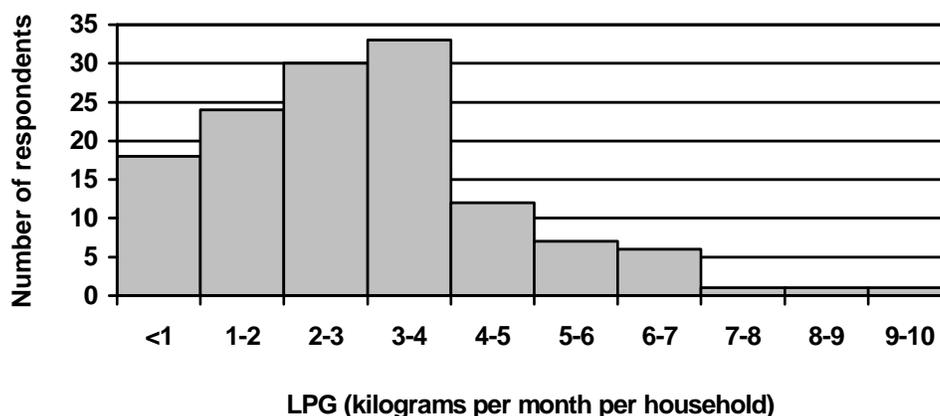
On the basis of when the cylinders were installed and the number of times refilled, LPG consumption was calculated. The results, expressed in kilograms per month per household, are shown in Figure E.1. Average LPG consumption was 2.9 kg per month, and the average refill rate was one every seven months (median one every five months), which is lower than what the focus groups reported. However, there was a marked difference between urban and rural households: urban households consumed on average 4.8 kg per month, whereas rural households consumed 2.6 kg per month. Aside from relative lack of availability of free or cheap biomass in urban areas, the maximum monthly income levels allowed for urban and rural BPL households (Rs 457 per capita and Rs 263 per capita, respectively) in part explain this difference, since many urban BPL households would have more disposable cash income than their rural counterparts. A quarter of the respondents reported that they used LPG for all cooking, which is estimated to require about half a cylinder a month. This consisted of one-fifth of rural respondents but over two-fifths of urban respondents. One-third said that they used LPG regularly to make tea, and a quarter said they used LPG to cook meals for guests.

Multiple regression analysis was carried out to correlate LPG consumption with potential explanatory variables. The variables found to be statistically significantly associated with LPG consumption are shown in Table E.1.

These results show that living in rural areas decreases monthly consumption. More specifically, DWCRA group members tended to consume 1.6 kg less per month, and VSS group members 1.4 kg less. Those who cooked outside consumed 1 kg less, and those with an outside kitchen 0.5 kg less. For each consumer durable category that a household had, they would consume 0.5 kg more a month. Having home cylinder delivery increased consumption by 0.9 kg. On the other hand, for every Rs 10 paid for cylinder delivery,

consumption decreased by 0.2 kg. Those with no ration cards (numbering some 8 percent) consumed substantially more, about 1.8 kg of LPG more a month.

**Figure E.1 Calculated LPG Consumption**



**Table E.1 Factors Affecting LPG Consumption in kg/month**

<i>Variable</i>	<i>Coefficient<sup>1</sup></i>
Constant	3.37 ( $\pm 0.41$ )
DWCRA membership (1 if member/0 otherwise)	-1.55 ( $\pm 0.39$ )
Membership in Forest Protection Committee, VSS (1 if member/0 otherwise)	-1.35 ( $\pm 0.57$ )
Open air cooking (1 if cooking is done in open air/0 otherwise)	-1.03 ( $\pm 0.28$ )
Kitchen outside (1 if the kitchen is outside/0 otherwise)	-0.51 ( $\pm 0.22$ )
Wealth index (based on the possession of a television set, washing machine, fan, two-wheeler and "others")	0.50 ( $\pm 0.10$ )
Home delivery of refill cylinder (1 if the refill cylinders are delivered to home/0 otherwise)	0.85 ( $\pm 0.31$ )
Possesses no ration cards (1 if the household possesses no ration cards/0 otherwise)	1.81 ( $\pm 0.80$ )
Delivery expenses incurred in Rs	-0.022 ( $\pm 0.007$ )

<sup>1</sup> Coefficients in kg/month. The values in parentheses are standard errors.

All of the respondents cited time saved as the primary benefit of using LPG. Other benefits reported include cleaner cooking (84 percent), better for health (75 percent) and giving a status symbol (47 percent). The biggest problem cited was the additional expenses incurred in switching to LPG (89 percent), followed by inconvenience and expenses incurred in collecting refill cylinders (55 percent), having to spend money up front (17 percent), and the use of LPG being "unsafe" (13 percent). When asked about the loss of kerosene quota by the State Government, three-quarters replied that this was a problem.

## Conclusions

The Deepam scheme is a rare example of targeted capital subsidy for LPG, and as such it provides valuable insights for designing subsidies to promote better energy services for the poor. The Deepam beneficiaries report time savings, cleaner house environment and improved social status among the main attractions of the scheme.

Achieving the policy objectives of the scheme—reducing the drudgery of biomass collection and cooking, improving health and slowing down deforestation—in a tangible manner would require substantial use of LPG as the primary fuel. This study found that for the majority of rural households, the incremental cost of substituting biomass with LPG was sufficiently high to deter significant switching to LPG. Instead, the financial considerations limit the extent of LPG use in quite a number of cases to incidental use (such as making tea or preparing meals for unexpected guests), or to when the opportunity cost of fuelwood use is high, such as the monsoon season. Reliance on biomass as the primary fuel continues among the majority of Deepam beneficiaries.

Capital subsidy to alleviate the high upfront cost of energy service is generally acknowledged to be far better than operating cost subsidies (such as fuel price or power tariff subsidies). However, capital subsidy facilitates access to quality service only if consumers can pay for the operating costs themselves so that a viable energy market can develop. This study shows that urban households are more willing to pay for LPG cylinder refills than rural households, because biomass is less available (and consequently more expensive), and cash income is probably more consistent and higher. In this regard the capital subsidy provided in the Deepam scheme has been better utilised in urban areas. But the question remains as to how to help the rural poor, the principal target of the Deepam scheme, to enjoy similar benefits of LPG connection.

The beneficiaries universally cited time savings in cooking as the chief benefit of LPG use. There is less awareness about the health benefits of LPG use. Women have noticed the absence of smoke and the impact on eyes, throat and lungs. Exposure monitoring in Andhra Pradesh and elsewhere indicates that unless LPG becomes the primary energy source, substituting the majority of biomass used, indoor air pollution levels remain high. At the level of LPG consumption found in this study, and given that fuelwood was reported to remain the primary energy source for the majority of households, health benefits of LPG connection remain low in rural areas.

The State Government of AP has taken the decision to add an additional 1.3 million new connections under the Deepam scheme at the cost of Rs 1.3 billion. In this context, an important question is whether and how a commercially viable market can be developed and sustained in rural areas. Currently, the development of such market is constrained by the low consumption level—an estimated average consumption of 30 kg of LPG per year; given the dietary habits and energy needs of the target group, the consumption level might, at best, reach 60 kg per year. The fundamental issue is how to get the majority of the rural poor to the point of consuming much more LPG without offering a price subsidy.

The experience with the Deepam scheme has confirmed the worldwide experience with the household use of LPG. The uptake of LPG is strongly income elastic at low income levels, so that the poor will use LPG sparingly. As long as free or cheap biomass is available, households will continue to use traditional fuels rather than LPG in the short run. Further, the Government of India plans to reduce the LPG subsidy to 15 percent in time. This will increase the end-user price of LPG and make it more difficult for low-income households to consume LPG. A silver lining, however, is that the awareness about the benefits of LPG has grown in rural areas and there seems to be a willingness to increase the use of LPG if some alternative to the high cost of refills could be found. The private sector has been considering the introduction of smaller cylinders, but the denial of “double subsidies”—universal price subsidy for LPG provided by the Centre Government, and the connection fee waiver provided by the State Government of AP—has made it difficult to launch a new cylinder size in AP in recent years.

An important consideration is the deregulation of the downstream petroleum sector by April 2002. One of the objectives is to create an open and competitive market with a level playing field, designed to increase efficiency in the sector and ultimately reduce the cost of service to consumers. Differential treatment given to state-owned oil companies and private sector LPG distributors (in the form of subsidies reserved exclusively for the former) goes against the spirit of sector deregulation and its objectives. By continuing to give not only a price subsidy but also a cylinder connection fee subsidy only to the dealers for state-owned oil companies, the Deepam scheme in its current form slows down the move towards a market-based petroleum sector that could facilitate higher LPG consumption in rural areas in the long run.

For the next stage of the Deepam scheme, the findings of the study point to several recommendations that may be considered by the Government of AP:

- Introduce smaller cylinders. If smaller cylinders can be introduced, not only will each refill cost be considerably smaller, enabling many households to refill more regularly, but the initial cylinder deposit fee (basically covering the cost of cylinder manufacture), for which the State Government of AP is currently paying Rs 1,000, can also be lowered. Smaller cylinders may therefore yield double benefits: more regular consumption of LPG by the beneficiaries, especially in rural areas, and a lower subsidy bill for the government. It is important to stress, however, that international experience with smaller cylinders is mixed: negative aspects include much higher cost of cylinder management and hence higher LPG price on a unit basis, and the need for households to refill more frequently. Therefore, market forces, and not government policy, should guide the sizes of cylinders to be made available on the market.
- Allow the transfer of Deepam connections to other eligible beneficiaries in cases where the recipients find themselves incapable of purchasing refill cylinders. Some beneficiaries cannot afford LPG, and view the participation in the scheme, which requires the purchase of a stove and associated accessories, as a “dead

investment”, and yet under the current set of rules, they cannot transfer their connections.

- Publicise the health benefits of reducing exposure to indoor air pollution to increase demand for cleaner cooking. Such public education campaigns should, however, be conducted in a broader context and emphasise a number of measures, including “smokeless” chullahs (chullahs with chimneys) and separate kitchens, so that households can choose from several options. Awareness-building should also cover simple practices that can improve the health of household members at no additional cost, such as taking small children out of cooking areas, and ventilating cooking areas more.

For others considering a comparable targeted capital subsidy scheme, the following additional considerations may be worth incorporating in the design of such a scheme:

- Rather than making the scheme universally available, consider concentrating on those areas where the availability of free or cheap biomass is diminishing. This will concentrate limited state financial resources on those households who are most likely to consume LPG.
- Bear in mind the importance of creating a sufficiently level playing field for all LPG distributors, in the spirit of sector deregulation and its ultimate objective of providing better service at the lowest cost.



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## Study Background and Methodology

Biomass is the energy source of the poor. According to the 55<sup>th</sup> round of the National Sample Survey conducted in 1999–2000, 69 percent of India’s households use traditional biomass fuels—wood, crop residues and dung—for cooking and heating. It is also the major source of indoor air pollution which is one of the most serious health hazards in India, affecting poor women and children disproportionately. Recent evidence in India indicates that indoor air pollution may be responsible for approximately half a million premature deaths annually. Cooking with biomass is very time-consuming, and fuelwood collection further diverts the time of women and children away from more productive activities, including education. Absent alternatives to the traditional use of biomass, rural women will remain disadvantaged by the consequent deleterious health effects and the drudgery of wood collection. One particularly effective option for addressing these problems associated with the use of biomass is to switch to liquefied petroleum gas (LPG).

The Government of India has historically attempted to encourage fuel switching from biomass to cleaner commercial fuels by providing large universal price subsidies to kerosene, sold through the Public Distribution System (PDS), and LPG sold in 14.2 kilogram (kg) cylinders by dealers belonging to state-owned oil companies. The subsidy for kerosene has been accompanied by rations favouring urban households. Distributors for subsidised LPG were not located in rural areas until recently, and kerosene rations for rural households in nearly all states have been inadequate for cooking. In the face of mounting fiscal deficit, the Government of India has taken steps to reduce kerosene and LPG subsidies, scheduled to be brought down to 33 percent and 15 percent, respectively, by April 1, 2002, when the downstream petroleum sector is slated to be deregulated. This is at present no plan to lower or eliminate these fuel subsidies. In calendar 2000, there were two major price increases: one in March 2000, and the other in October 2000, when the price of subsidised LPG for domestic households was raised by 30 percent and 18–20 percent, respectively.

## Study Description

For the purpose of developing efficient strategies and determining the need and priorities for specific interventions, it is necessary to examine the potential and the barriers associated with the penetration of clean fuels in the rural sector. One of the barriers is the high upfront cost associated with the start-up of LPG service. For example, a new LPG user in the state of Andhra Pradesh (AP) must (i) pay Rs 1,000 for LPG “connection” in order to receive an LPG cylinder and (ii) purchase an LPG stove and associated accessories. The combined cost of LPG connection and stove purchase makes it difficult for many poorer households to start using LPG as a cooking fuel. In order to help overcome this barrier, the Government of AP launched the so-called Deepam scheme in July 1999 whereby the connection fee was paid by the government for households below the poverty line (that is, white-card<sup>2</sup> holders only). The objective of the scheme was to help poor women to improve their health, reduce the drudgery associated with the collection of fuelwood and cooking with biomass using traditional stoves, and to arrest deforestation. Only members of self-help groups satisfying certain criteria may participate in the scheme. There are more than 373,000 self-help groups in AP with a total of more than 5 million members. About 150,000 of these self-help groups are in rural areas.

The Deepam scheme differs from traditional fuel subsidies in four respects. First, it is a one-off subsidy, covering the capital cost in the form of cylinder connection fee, rather than the operating cost—the purchase of the fuel itself—by giving a price subsidy. Second, only poor households are eligible for the subsidy, whereas the current LPG price subsidy in India is available to all income groups, and benefits mainly the well-off in urban areas. Third, the program is targeted to rural areas. Last, it is implemented through women self-help groups, thus linking the promotion of LPG to support for women’s development and financial independence. As such, an examination of the Deepam scheme can provide valuable insights into the effectiveness of different forms of fuel subsidies. The objective of this study was independently to assess the Deepam scheme’s performance, effectiveness, sustainability and replicability. The scope included

- outlining design and implementation;
- collecting performance information by conducting focus-group discussions and beneficiary interviews, emphasising factors affecting consumption; and
- drawing lessons and conclusions and making recommendations.

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<sup>2</sup> In Andhra Pradesh, there are three types of cards classifying households according to their income level. Holders of white and pink cards are from households below and above the poverty line, respectively. Recently a third, blue-card category was introduced to cover indigent senior citizens with no income, entitling them to 10 kilograms of free rice a month.

Some of the key questions that this study attempted to answer include the following:

- Is the scheme effective in reaching the poor?
- How much LPG have the beneficiaries been using on average, and for what purpose?
- What is a typical profile of a rural Deepam scheme beneficiary? An urban beneficiary? Do the files match those targeted by the AP Government?
- To what extent has this scheme helped to overcome the barriers to fuel switching from biomass to LPG?
- How have the logistical problems concerning the distribution of LPG cylinders in rural areas been addressed in this scheme?
- What is the potential for, and what are the barriers associated with, scaling up the programme to the entire state?
- What can we learn about promoting the use of LPG among the rural poor in India?

### **Deepam Scheme**

Initially intended to cover only rural households, the scheme was later expanded to include urban areas. It was originally designed to cover 1 million rural and 0.5 million urban households. To this end, the State Government of AP agreed to pay the total cost of Rs 1.5 billion (US\$35 million at the time) for the 1.5 million LPG connections. The total number of connections sanctioned has since been increased to 1.715 million, with the overall target increased to 3.0 million. In return, for each LPG connection released, the Government of India reduces the allocation of subsidised household kerosene to AP by 5 litres per month. The State Government of AP has paid Rs 1.7 billion to state-owned oil companies on behalf of the beneficiaries and committed to pay an additional Rs 1.3 billion to achieve a total of 3 million LPG connections.

Initially, 740,000 connections were set aside for DWCRA (Development of Women and Children in Rural Areas) groups, 240,000 for DWCUA (Development of Women and Children in Urban Areas) and other self-help groups in municipalities in urban areas, and 50,000 for village-level Van Sanghrakshan Samiti<sup>3</sup> (VSS, Forest Protection Committee) groups. These target figures were revised upwards later. Overall, out of 1.7 million connections authorised to date, 1.3 million—or over three-quarters—have been allocated to rural areas, and the balance of 0.4 million to urban areas.

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<sup>3</sup> Under the Joint Forest Management Scheme of the Government of India, forest departments have set up VSSs, whose membership comprises villagers. The objective is to increase the participation of villagers in the conservation of forested lands. In most of the villages where VSS operate, no self-help groups have been formed, although there are DWCRA groups in some VSS villages. In some cases, a few VSS members possessing white cards have been given LPG cylinders through the Deepam scheme.

The Deepam participants cover the following start-up costs:

- The cost of an LPG stove with an Indian Standard Institute (ISI) mark
- Rs 30 towards the purchase of rubber tubing with an ISI mark
- Rs 20 towards the dealer administrative charge.

LPG itself is purchased by the participants at the official price set by the Centre Government. When the scheme was launched in July 1999, a 14.2 kg LPG cylinder refill cost Rs 160. Because of the two subsequent price hikes, the same LPG cylinder costs about Rs 250 today. Four public sector oil companies—the Bharat Petroleum Corporation (BPC), the Hindustan Petroleum Corporation (HPC), IBP and the Indian Oil Corporation (IOC)—have been involved in providing LPG to the beneficiaries.

During the initial phase of the Deepam Scheme, the AP State Civil Supplies Corporation (APCSC) finalised the arrangements for the procurement of stoves and their prices. The stoves were made available to beneficiaries through the District Rural Development Agencies (DRDAs) at the distribution points. Subsequently, the beneficiaries have been given freedom to choose stoves of their choice. In particular, they are not required to purchase stoves from the dealers who supply them with LPG.

Several committees oversee the implementation of the scheme:

- An eight-member state-level task force chaired by the Principal Secretary of the Department of Rural Development, State Government of AP
- A seven-member task force at the district level chaired by the District Collector
- A five-member committee for the Hyderabad Municipal Corporation chaired by the Commissioner of the Corporation.

### ***Selection of Beneficiaries***

In rural areas, eligible participants included members of self-help groups that had been in existence for one year or more, and that had received assistance under the DWCRA Revolving Fund, matching grants, bank loans and matching grants from other government agencies such as the Scheduled Caste Corporation, women's development corporations and the Integrated Tribal Development Agency (ITDA) as of 1 June 1999 (at the time of the launching of the scheme). The seniority of the self-help groups was an important consideration, with preference given to older groups. Thrift groups that have not yet been included in any of the matching grant schemes are not eligible. The beneficiaries selected must be living in rural areas and must be white-card holders. However, in both rural and urban areas, women who possess no cards (white, pink or blue) are considered on the basis of their groups' recommendations, or a BPL certificate issued by the Mandal Revenue Officer concerned.

In urban areas, members of thrift and credit societies and DWCUA groups already in existence as of February 4, 2000, were eligible. Within each municipality, selection of different groups is based on seniority. If two groups or more were formed on the same day, selection is based on a lottery. The BPL survey under the Swarna Jayanthi Shahari

Rozgar Yojana (Golden Jubilee Urban Employment Scheme) forms the basis for classifying households. In rural areas, BPL households have to earn less than Rs 262.94 per month per capita, and in urban areas, Rs 457.40 per month (1999–2000).

The self-help groups are to conduct meetings on the dates fixed by the District Collectors and pass resolutions listing the names of the members willing to sign up for LPG connection, and furnish a list of animators, motivators<sup>4</sup>, AGS (Additional Gram Sevikas; they operate at the village level under DWCRA) and Village Development Officers (VDO). A number of conditions have to be met:

- The urban beneficiaries are to surrender 5 litres of subsidised kerosene per month distributed through the PDS.
- If a beneficiary does not refill the LPG cylinder for more than 90 days, the LPG connection may be withdrawn. The beneficiary is to be notified to the effect.
- Each household is entitled to one LPG connection under the scheme. Even if two members from the same household are recommended, only one member will be selected.
- The responsibility for ensuring proper identification of the beneficiary and delivery of LPG to the correct beneficiary rests with the leader of the self-help group.
- In the case of diversion of the LPG connection to someone other than the beneficiary selected, the LPG connection will be cancelled and the BPL card withdrawn.
- Oil companies are to offer training programmes for animators, motivators and AGS in the installation and safe handling of LPG. The latter in turn are to train the beneficiaries.
- Newsletters containing all the guidelines and rules of the scheme are to be published by the departments concerned in consultation with the Department of Civil Supplies and state-level coordinators, and circulated to all members of the self-help groups before the meetings to discuss the Deepam scheme take place.

### ***Implementation to Date***

The Deepam scheme targets three groups of women: members of DWCRA, DWCRA and VSS. The implementation arrangement varies with each target group, as shown in Table 1.1. The scheme has been implemented in two phases with an increase in the allotment of cylinder connections between the phases. The current overall target (after expanding the scheme to cover an additional 1.3 million households) of 3 million connections will cover about 60 percent of the self-help groups in AP. As of March 2002, a total of 1.56 million connections had been released, consisting of 1.2 million in rural areas and 0.36 million in

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<sup>4</sup> *Animators* and *motivators* are trained workers hired by DRDA on contract wages to motivate women to form self-help groups and to facilitate discussions with villagers, particularly women, on issues of concern.

urban areas. The district-wise distribution of LPG cylinders to Deepam beneficiaries as of March 2002 is shown in Table 1.2.

**Table 1.1 Design of the Deepam Scheme**

<i>Target groups</i>	<i>Implementing agency</i>	<i>Distribution agency</i>	<i>Target connections (Phases I &amp; II)</i>	<i>Phase I target connections</i>
DWCRA + VSS	DRDA	State oil companies,	1,304,381	1,204,381
DWCUA	Municipal Administration, Urban Development Department	Civil Supplies Department <sup>1</sup> , Girijan Cooperative Corporation <sup>1</sup> , CMEY group <sup>1</sup>	410,500	295,600
Total	DPAP/ITDA <sup>2</sup>		1,714,881	1,499,981

<sup>1</sup> Where dealers for state-owned oil companies are not present.

<sup>2</sup> DPAP/ITDA are implementing agencies for VSS groups.

*Notes:* DPAP (Drought Prone Area Programme), CMEY Chief Minister's Scheme for Employment of Youth. In this table, motivators have been excluded. Some motivators have approached Civil Supplies for LPG connection allotment and been covered under the Scheme.

The initial target number of connections was 1,204,381 for DWCRA and VSS groups, of which 94.7 percent had already been released by the time the second phase target of another 100,000 connections was announced. In urban areas, the achievement was 104 per cent of the target of 295,600 during the Phase I. The number of connections released relative to the target varied from district to district among DWCRA and VSS groups, ranging from 73 percent in Mahaboobnagar to 113 percent in Adilabad. Nizamabad and Ranga Reddy had achieved or exceeded their (total phase I & II) targets as of March 9, 2002. The implementation of the scheme among VSS groups has been slow (the target numbers of connections are not available). Barring Mahaboobnagar and Cuddapah, other districts have achieved impressive implementation results. As for the performance in urban areas, Nizamabad, Adilabad, Warrangal, Srikakulam, Krishna, Guntur and East Godavari had exceeded the targets. Karimnagar, Ranga Reddy Hyderabad, Nellore, Kurnool and Cuddapah were the low achievers (around 75 percent).

Classification of districts by achievement in rural and urban areas is presented in Table 1.3, and the performance of the oil companies in Table 1.4. The three companies have done uniformly well with respect to DWCRA and urban self-help groups. They have not been nearly as successful with VSS, primarily due to the delay in the identification of beneficiaries, a process that involves more than one agency.

**Table 1.2 Distribution of LPG Cylinders to Deepam Beneficiaries as of March 9, 2002, by District**

<i>District</i>	<i>Rural</i>		<i>Urban</i>		<i>% Target achieved</i>		<i>Ranking</i>	
	<u>Allocated</u>	<u>Released</u>	<u>Allocated</u>	<u>Released</u>	<u>Rural</u>	<u>Urban</u>	<u>Rural</u>	<u>Urban</u>
<b>Telangana</b>								
Nalgonda	64,280	57,650	6,719	5,869	90	87	16	12
Medak	48,658	41,142	6,964	6,259	85	90	19	11
Khammam	48,258	43,736	8,020	6,441	91	80	13	16
Mahaboobnagar	74,846	54,795	8,409	8,199	73	98	22	8
Nizamabad	42,176	45,470	7,784	8,705	108	112	2	3
Karimnagar	65,749	59,027	12,140	9,152	90	75	15	20
Adilabad	56,536	63,789	10,710	13,928	113	130	a1	2
Warangal	70,303	63,350	11,829	19,076	90	161	14	1
Ranga Reddy	47,483	50,000	40,857	29,633	105	73	3	21
Hyderabad	—	—	101,500	76,941	—	76	—	19
<b>Coastal Andhra</b>								
Srikakulam	40,902	39,594	6,597	6,977	97	106	7	6
Prakasam	60,024	50,439	6,003	4,846	84	81	20	15
Nellore	55,911	48,906	7,608	5,288	87	70	17	23
Vizianagaram	38,360	33,106	7,437	7,197	86	97	18	9
West Godavari	57,913	53,586	14,976	12,608	93	84	10	14
Krishna	79,232	78,737	13,648	14,344	99	105	4	4
Visakhapatnam	62,422	61,188	21,442	20,256	98	94	5	10
Guntur	73,622	71,900	22,243	23,342	98	105	6	5
East Godavari	77,547	74,776	33,225	33,838	96	102	9	7
<b>Rayalaseema</b>								
Chittoor	66,318	61,328	25,515	22,194	92	87	11	13
Anantapur	68,827	62,557	15,364	12,262	91	80	12	17
Kurnool	56,459	54,585	15,240	10,731	97	70	8	22
Cuddapah	48,534	36,505	6,270	4,869	75	78	21	18
<b>Grand Total</b>	1,304,360	1,206,166	410,500	362,955				

— not applicable.

**Table 1.3 Classification of Districts as of March 9, 2002, by Achievement Level**

<i>Percent of target</i>	<i>Name of district, rural connections</i>	<i>Name of district, urban connections</i>
100% and above	(3 total) Adilabad, Nizamabad, Ranga Reddy	(7 total) Adilabad, Nizamabad, Warangal, Krishna, East Godavari, Guntur, Srikakulam
90–99%	(13 total) Nalgonda, Khammam, Kareemnagar, Warangal, West Godavari, Krishna, Visakhapatnam, Guntur, East Godavari, Srikakulam, Chittor, Anantapur, Kurnool	(4 total) Medak, Vizianagaram, Visakhapatnam, Mahaboobnagar
80–89%	(4 total) Medak, Prakasam, Nellore, Vizianagaram	(6 total) Nalgonda, Khammam, Prakasam, West Godavari, Chittor, Anantapur
< 80%	(2 total) Mahaboobnagar, Cuddapah	(6 total) Kurnool, Cuddapah, Nellore, Kareemnagar, Hyderabad, Ranga Raeddy

**Table 1.4 New LPG Connections Released by the Oil Companies in the Deepam Scheme as of February 2002**

<i>Company</i>	<i>Rural</i>		<i>Urban</i>		<i>Total</i>	
	<i>Allocated</i>	<i>Released</i>	<i>Allocated</i>	<i>Released</i>	<i>Allocated</i>	<i>Released</i>
IOC	506,022	450,252	155,221	121,771	661,243	572,023
HPC	537,859	492,967	177,573	154,008	715,432	646,975
BPC	258,387	245,565	77,706	63,738	336,093	309,303
IBP	2,113	1,434	0	0	2,113	1,434
Total	1,304,381	1,190,218	410,500	339,517	1,714,881	1,529,735

The beneficiaries are given passbooks that they need to bring for LPG refills. Discussions with dealers and verification of supply registers suggested that this procedure was not being followed strictly. No entries were seen in passbooks.

To verify that the cylinder deposit fees transferred to the oil companies have actually been used for new cylinder connections, the State Government of AP requires utilization certificates. To this end, LPG dealers are asked to prepare lists of connections released and have them certified by the government authorities concerned—in rural areas, Project Director, DRDA; in municipal areas, Municipal Commissioner or Nodal Officer or Chief Rationing Officer, Hyderabad; and for VSS, Divisional Forest Officer or Nodal Officer—confirming that the connections released have been received by the selected beneficiaries.

## Study Methodology

This study relied on primary data supplemented by secondary data to evaluate the Deepam scheme. For primary data collection, focus-group discussions with a sample of 66 self-help groups, as well as interviews with 134 Deepam beneficiaries from those who had enrolled prior to January 2001, were conducted between May 25 and August 2, 2001. Care was taken to ensure as much as possible that selected groups/beneficiaries had participated in the scheme for at least a year at the time of the data collection. In addition, discussions were held with other LPG users and non-users, oil company representatives, dealers and government officials involved in the scheme.

The focus-group discussions by their nature concern primarily qualitative information. Some quantitative information was collected in these group discussions as well as individual interviews with the beneficiaries. These findings should be interpreted with caution given the small sample sizes.

### **Selection of Study Subjects**

On the basis of the discussions held with the Departments of Civil Supplies and of Rural Development, the following criteria were established for selecting six districts:

- Select two districts in each of the three regions (Telengana, Rayalaseema and Coastal Andhra).
- Select the best- and worst-performing districts in the respective regions as a first criterion. Although DWCRA group performance is the primary criterion—because LPG distribution in rural areas is typically more difficult logistically than in urban areas, and rural households have greater access to free biomass, both factors inhibiting the use of LPG—a district with balanced performance in all the three types of target groups may also be selected.
- Avoid districts known to have high political or official patronage (such as Chittor) in order to minimise biased observations.

On the basis of these criteria, the districts shown in Table 1.5 and Figure 1.2 were selected for the study using the information on implementation progress reported at the end of December 2000.

Three mandals<sup>5</sup> were selected in each district, typically in consultation with the authorities concerned. Preference was given to those where supply agencies other than the oil companies (such as the Department of Civil Supplies and Girijan Cooperative Corporation) were operating. Since the logistics of LPG cylinder delivery were expected to be a major issue, villages and self-help groups within mandals and municipalities were grouped into three broad categories on the basis of the distance to the closest LPG dealer: those within 5 kilometres (km), those between 5 and 10 km, and those farther away from

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<sup>5</sup> A *mandal* is an administrative unit below the district but above the *gram pachayat*. A *mandal* may comprise around 15 *gram panchayats*.

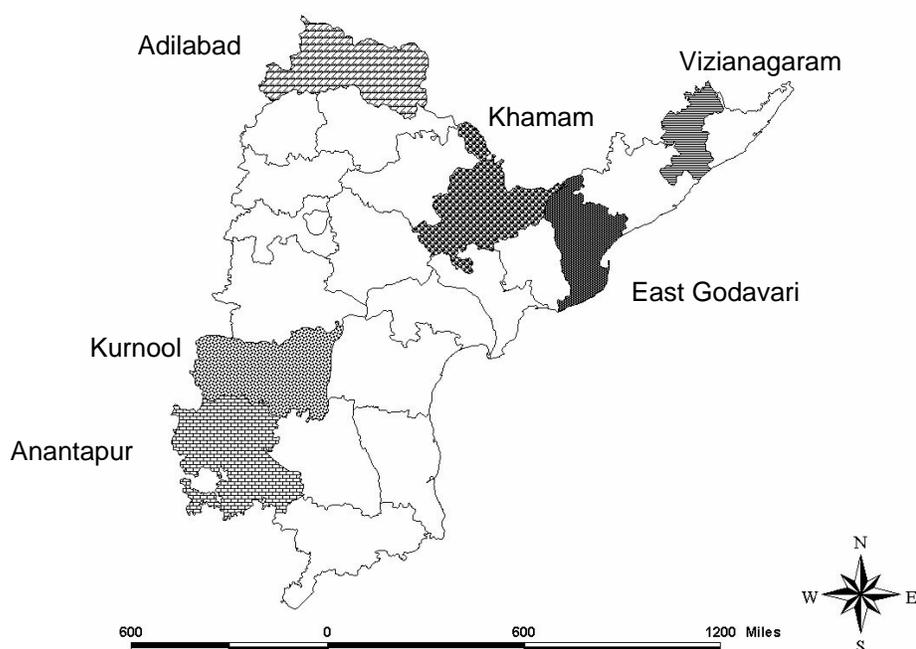
10 km. Only those self-help groups that had been participating in the scheme for more than a year were selected in order to have a meaningful assessment of LPG consumption and experience with the scheme. A list of villages and municipalities studied is presented in Table 1.6. Table 1.7 shows the numbers of self-help groups that participated in focus-group discussions and beneficiaries interviewed, as well as others with whom the study team had meetings and discussions.

**Table 1.5 Districts Selected for the Study**

<i>Region</i>	<i>Highest Performance</i>	<i>Lowest Performance</i>	<i>Remarks</i>
Telengana	Adilabad	Khammam	Although Warangal is the highest performer, it has high municipal connections.
Coastal Andhra	East Godavari	Vizianagaram	
Rayalaseema	Anantapur	Kurnool	Although Chittoor is a high performer, it has political patronage. Cuddapah has done extremely poorly and may not be representative <sup>1</sup> .

<sup>1</sup> For various reasons the uptake of the Deepam scheme in Cuddapah is the lowest in the state as well as within the Rayalaseema region. Officials suggested that this district is highly faction-ridden and may not be a representative district for the study.

**Figure 1.2 Districts Selected for the Study**



**Table 1.6 Villages and Municipalities Examined in This Study**

<i>District</i>	<i>Mandals</i>	<i>Villages</i>	<i>Municipalities</i>
Adilabad	Tallamadugu	Sunkidi	Nirmal Bhagyanagar Ward Adilabad Ward 7
		Kodad	
		Kothur	
	Sarangapur	Jam	
		Chincholi	
		Dhani	
	Indervally Utnoor (VSS)	Galiyabai Tanda	
		Rampur(B)	
		Pulimadugu	
Anantapur	Gooty	Chethanapalli	Gooty Ananthapur
		Issarallpally	
		Chattanapally	
	Bathanapally	Suryachaandrapuram	
		Potlamarri	
		Anatahsagaram	
	Puttaparthi	Jagarajupally	
		Guvvaguntapally	
		Kapalabanda	
Khammam	Khammam	Nayudupeta	Khammam Palavancha
		Thallampadu	
		Venkatayapalem	
	Vemsur	Dudipudi	
		Bhimavaaram	
		Kondigalta	
	Palavancha	Thoggudem	
		Pullaigudem	
		Vanambilli	
Vizianagaram	Poosapatirega	Kandivalasa	Bobbili Salur
		Karada	
		Chinthapalli	
	Bobbili	Karadi	
		Piridi	
	Gummalakshmi Puram (VSS)	Rella	
		Glpuram	
		Dhulikuppa	
East Godavari	Peddapuram	Kattamurruchinnabrahmadevaram	Rajahmundry
	Tallrevu	Thoorpeta Neelapally Chollangi	

<i>District</i>	<i>Mandals</i>	<i>Villages</i>	<i>Municipalities</i>
Kurnool	Allavaram	Komaragiripatnam Allvaram Bodasarru	
	Orvakal	Orvakal Kannamadakala Nannoor	Adoni Farooq nagar (Ward) Ambedkar nagar (Ward)
	Asperi	Benegedi Chigili Chirumandoddi	
	Nandyal	Chabolu Chakirevula Pandurangapuram	

Note: A ward is a sub-division of a municipality.

**Table 1.7 Number of Group Discussions and Interviews**

<i>District</i>	<i>Mandals</i>	<i>DWCRA</i>	<i>VSS</i>	<i>DWCUA</i>	<i>Non-Users</i>	<i>Private Users</i>	<i>Beneficiaries</i>	<i>Gas Agencies</i>
Adilabad	Tallamadugu	3	0	0	3	2	6	1 (IOC, HPC)
	Sarangapur	3	0	0	3	4	6	0
	Indervally Utnoor	0	0	3	0	0	6	0
	Adilabad (U)	0	1	0	6	3	2	1 (IOC)
	Nirmal (U)	0	1	0	6	3	2	1 (HPC)
	Sub-total		6	2	3	18	12	22
Anantapur	Gooty	3	0	0	2	1	6	1 (IOC)
	Bathanapally	2	0	1	2	2	6	0
	Puttaparthi	3	0	0	2	1	6	1 (HPC)
	Gooty (U)	0	1	0	2	2	2	1 (BPC)
	Ananthapur (U)	0	1	0	2	1	3	0
	Sub-total		8	2	1	10	7	23
Khammam	Khammam	3	0	0	2	2	6	1 (IOC)
	Vemsur	3	0	0	2	2	6	0
	Palavancha	3	0	0	2	2	6	1 (HPC)
	Khammam (U)	0	1	0	2	2	2	1 (HPC)
	Palavancha (U)	0	1	0	2	2	2	0
	Sub-total		9	2	0	10	10	22

<i>District</i>	<i>Mandals</i>	<i>DWCRA</i>	<i>VSS</i>	<i>DWCUA</i>	<i>Non-Users</i>	<i>Private Users</i>	<i>Beneficiaries</i>	<i>Gas Agencies</i>
Vizianagaram	Poosapatirega	3	0	0	2	3	6	1 (IOC)
	Bobbili	3	0	0	2	3	6	1 (HPC)
	Gummalakshmi Puram	0	0	3	2	0	6	1 (IOC)
	Bobbili (U)	0	1	0	2	2	2	0
	Salur (U)	0	1	0	2	2	3	0
	Sub-total		6	2	3	10	10	23
East Godavari	Peddapuram	3	0	0	2	3	6	1 (HPC)
	Tallarevu	3	0	0	2	3	6	0
	Allavaram	3	0	0	2	3	6	1 (BPC)
	Rajahmundri (U)	0	2	0	2	2	4	1 (IOC)
	Sub-total		9	2	0	8	11	22
Kurnool	Orvakal	3	0	0	2	2	6	1 (IOC)
	Asperi	3	0	0	2	2	6	1 (IOC)
	Nandyal	3	0	1	2	2	8	1 (HPC)
	Adoni	0	0	1	0	0	2	0
Sub-total		9	0	2	6	6	22	3
Total		47	10	9	62	56	134	18

A total of 66 DWCRA, DWCUA and VSS groups participated in focus-group discussions. These discussions focused on the mode of implementation, sources of information, problems encountered, perceptions of benefits and disadvantages of LPG use, and suggestions for changes. In addition, 134 Deepam beneficiaries were interviewed using a semi-structured questionnaire to develop their personal profiles as well as document their experience to date. Discussions were also held with non-beneficiaries within self-help groups, members of non-self-help groups, LPG users who are not Deepam beneficiaries, local leaders, animators, ANG (Anganwadi, child care centres for children under the age of five) workers, and various government officials and LPG supply agency representatives to supplement or corroborate the information collected.

### ***Issues Investigated***

Prior to holding focus-group discussions and individual interviews, the study team visited households in villages to observe the use of LPG, housing conditions and other factors relevant to the study. This facilitated the mobilisation of participants for the focus-group discussions and identified the key issues for discussion.

The team drafted schedules of questions and checklists on the basis of pilot surveys in one of the districts. The checklist for the focus-group discussions was used as a guide for the study team rather than as a survey questionnaire. Extensive notes were taken during the discussions. This approach was used to ensure a minimal level of uniformity across the 66 focus-group discussions and to facilitate their execution.

In the focus-group interviews, beneficiary interviews and other discussions and meetings held, the study team collected data on the following key issues:

- The process for enrolling in the Deepam scheme, including the selection of self-help groups, selection of members within each group, the steps between selection and the final instalment of the LPG cylinder, problems encountered, and marked differences (for example, time lag between selection and cylinder installation);
- The genuineness of Deepam beneficiaries, particularly with regard to socio-economic status indicators;
- The factors affecting LPG consumption;
- Mechanisms for the delivery of LPG cylinders;
- Changes resulting from the use of LPG, including the purchase of new cookware and kitchen alterations;
- Perceived benefits and adverse impacts; and
- Suggestions for improvement.

# 2

## Evidence from Self-Help Groups

The self-help groups in Andhra Pradesh began forming in the early 1980s through the efforts of non-governmental organisations (NGOs) and gained strength over the years. By the 1990s, DW CRA groups had become an essential aspect of rural development. Today, with more than one-half of all the women self-help groups in the country, Andhra Pradesh today is at the forefront of the self-help group movement in India, particularly with regard to women's groups. This chapter presents the profile of typical self-help groups covered under the Deepam scheme.

### Characteristics of the Self-Help Groups Studied

The Deepam scheme guidelines specify that preference be given to older self-help groups. Although self-help groups have taken root in rural areas for quite some time, they are relatively new in urban areas. In villages where VSSs have been formed, self-help groups have been formed only in recent years. The age distribution of the 66 groups that participated in the focus-groups discussions is shown in Table 2.1. Over one-half were more than four years old, whereas those that were two years old or younger accounted for only 11 percent and were confined to four districts.

**Table 2.1 Age Distribution of Self-Help Groups Studied**

Age (years)	East						Total
	Adilabad	Anantapur	Godavari	Khammam	Kurnool	Vizianagaram	
1-2	2 (18)	2 (18)	2 (18)	0	1 (9)	0	7 (11)
3	2 (18)	1 (9)	2 (18)	3 (27)	2 (18)	0	10 (15)
4	4 (36)	1 (9)	2 (18)	0	1 (9)	2 (18)	10 (15)
> 4	3 (27)	7 (64)	5 (46)	8 (73)	7 (64)	9 (82)	39 (59)
Total	11 (100)	11 (100)	11 (100)	11 (100)	11 (100)	11 (100)	66 (100)

*Note:* The figures in parentheses represent percentages of the total in each district.

Self-help groups are generally formed on the basis of social groups or occupational groups belonging to BPL families. The social groups in this study include the Scheduled Castes (SC), Scheduled Tribes (ST) and Backward Castes (BC). There are a few groups of mixed social classes or economic classes (both below- and above-poverty-line families). The size of the groups in this study varied from 11 to 55 members, with a median size of 15 and a mean size of 17 (Table 2.2). The landless accounted for about three-fourths of the members on average. Whereas BPL families are identified by their white ration cards, non-white-card holders were frequently found in the self-help groups and among the Deepam beneficiaries. Because the non-white-card holders include those who have missed the chance to obtain white cards, they do not necessarily belong to APL (above-poverty-line) families. Conversely, not all white-card holders are BPL families because some have “managed” to get a white card when their income levels should have disqualified them from being classified as BPL.

**Table 2.2 Composition and Size of Self-Help Groups Studied**

Category	Adilabad	Anantapur	East			Vizianagaram	Average
			Godavari	Khammam	Kurnool		
Landless	13 (0)	12 (9)	12 (24)	10 (5)	13 (26)	16 (17)	13 (14)
Land owners	4 (0)	9 (4)	1 (38)	4 (4)	3 (68)	5 (38)	4 (18)
SC	10 (0)	3 (3)	4 (23)	7 (23)	6 (34)	6 (0)	6 (13)
ST	4 (0)	1 (0)	0 (—)	1 (0)	0 (—)	8 (39)	2 (22)
BC	4 (0)	16 (8)	9 (27)	5 (12)	10 (31)	7 (21)	9 (18)
NWCH	7 (0)	4 (9)	2 (6)	3 (6)	4 (47)	9 (17)	5 (15)
Total	17 (0)	21 (7)	13 (26)	14 (17)	16 (32)	21 (21)	17 (17)

*Notes:* The figures in parentheses represent percentages in individual categories who are not participating in the Deepam scheme. NWCH non-white-card holders. — not applicable.

Not all white-card holders have chosen to participate in the Deepam scheme, with about one-fifth not participating. The primary reasons for non-participation were cited as (i) demand for connections exceeding supply in the initial period of the scheme; (ii) the inability of the eligible members to pay for the remaining up-front costs such as stove purchase; and (iii) the members being away during the launch of the scheme because of migratory labour. Quite a few non-white-card holders are participating in the scheme, with about five-sixths of non-white-card-holding members of self-help groups having become Deepam beneficiaries. As mentioned earlier, the scheme provides for the coverage of non-white-card holders, subject to a resolution certifying their poor status having been passed by their self-help groups and approval by the officials concerned. Several groups have chosen not to pass such resolutions recommending that non-white-card holders be allowed to participate in the Deepam scheme.

The focus-group discussions held with those belonging to groups other than SC and ST suggested that about one-half of the beneficiaries do not appear to belong to the BPL

category, based on their housing conditions, their assets, and land-holding status, although they are on paper white-card holders and members of self-help groups in rural areas. The situation of the SC/ST members was quite different: nearly all the beneficiaries appeared to be from BLP families. There appeared to be more cases of ineligible beneficiaries in urban areas, although it should also be remembered that DWCUA groups are relatively young and record-keeping and documentation of these groups is not yet well organised.

The attraction of having the cylinder deposit fee waived has prompted many people to sign up for the scheme, even those who have no serious plans to start using LPG because of the availability of free or considerably cheaper fuelwood. SC/ST families in rural areas view the possession of LPG cylinders as a status symbol. The Deepam scheme seems to have hastened the pace of formation of new groups. As to be expected when any subsidies are handed out, the study team learned of a few cases of defunct self-help groups that were included in the Deepam scheme owing to political pressure.

The self-help groups were originally formed to pool together members' savings in order to provide micro-credits through their own sources. As the movement grew, support in various forms—matching grants, revolving funds, incentive grants and bank credits—became available to these groups. The interest earned through their lending operations together with these funds constitute the corpus of self-help groups. The financial details and operations of the 66 groups in this study are given in Table 2.3. One of the selection criteria for being considered for inclusion under the Deepam scheme is a good track record of lending and repayment performance. All the groups were found to have very good repayment performance records. Quite a few groups have access to bank credit, and they were found to have taken up economic activities. Self-help groups and members engaged in economic activities were found to have higher LPG retention rates and consumption.

**Table 2.3 Micro-Finance Operations of Self-Help Groups**

<i>Parameter</i>	<i>East</i>					
	<i>Anantapur</i>	<i>Adilabad</i>	<i>Godavari</i>	<i>Khammam</i>	<i>Kurnool</i>	<i>Vizianagaram</i>
Total corpus	41,657	41,263	61,536	44,620	51,085	41,818
Own savings	22,389	19,445	25,795	24,409	32,266	21,090
Government subsidy	24,068	15,454	21,090	16,030	20,181	16,818
Amount lent	41,330	13,327	39,801	21,000	51,085	24,272
% Repayment	62	99	100	100	100	99
% Groups linked to bank credit	55	100	91	100	82	100

## Implementation of the Deepam Scheme

The numbers of days between the time a group was selected for participation in the Deepam scheme and its selection was sanctioned (that is, a letter is sent from DRDA to gas agencies giving detailed information on self-help group members who have been selected), and between sanction and when the LPG cylinders were given to the selected beneficiaries, are shown in Table 2.4. The time lapsed varied dramatically from region to region as well as from group to group within the same region, ranging from 0 to 550 days between selection and sanction, and from 0 to 183 days between sanction and installation. The average numbers of days lapsed were 58 and 6, medians being 19 and 0, respectively. The beneficiaries in East Godavari had the shortest wait on average, and those in Anantapur the longest wait, primarily because of the time it took between selection and sanction. Overall, the beneficiaries waited an average of 64 days, or a little over 2 months, between selection and installation, the median being 29 days, or about a month

**Table 2.4 Time Taken for Cylinder Installation**

<i>Time lapse between</i>	<i>Adilabad</i>	<i>Anantapur</i>	<i>East Godavari</i>	<i>Khammam</i>	<i>Kurnool</i>	<i>Vizianagaram</i>
Selection and sanction	54	131	9	48	27	78
Sanction and installation	3	0	2	13	0	17

The above findings must be interpreted with caution, however. There is a selection bias in that the study selected only those with a minimum of one year of participation in the scheme. As a result, many of them were selected early on in the programme. The Government of AP made extra efforts to put the scheme in place before the elections in May 1999, and the pace of the implementation of the scheme was extraordinary in the early days. Later on, longer time lapses were seen, particularly between selection and sanction as the releases are announced only during the subsequent round of Janmabhoomi<sup>6</sup>, which takes place once every three months.

In some cases, there were marked differences in the number of people enrolled and the number of those who actually received LPG cylinders. The differences were due to mistakes in the names of people enrolled, incorrect names recorded on ration cards, and non-possession of white cards (that is, they were not able to produce white cards).

Training on the use of LPG cylinders, and especially how to handle cylinders safely, is stressed in the Deepam scheme. Discussions with focus groups as well as dealers

<sup>6</sup> Janmabhoomi, meaning the place of birth, was initiated in 1997 by the Government of AP to increase the participation of villagers in decision-making through village meetings. It takes place every three months and lasts one week.

indicated that training camps were organized on the premises of gas agencies or, alternatively, training was given in the homes of the beneficiaries during stove installation. In addition, the DRDAs have, to a limited extent, distributed pamphlets and brochures on the use of LPG. Training on repairs of LPG gas stoves was also provided to cluster-level motivators who worked with self-help groups.

Although the Government of AP covers the cylinder connection fee of Rs 1,000, the Deepam beneficiaries have to cover the upfront costs for taking up LPG—the purchase of a stove and associated accessories, amounting to some Rs 1,000. As Table 2.5 shows, about 85 percent of the beneficiaries paid for these extra costs themselves without having to borrow from their self-help groups or anyone else.

**Table 2.5 Percentage Breakdown for Sources of Funds for Upfront Charges**

<i>Category</i>	<i>Own</i>	<i>Borrowed from self-help group</i>	<i>Borrowed from others</i>	<i>Average Rs borrowed<sup>1</sup></i>
Landless	85	14	1	657
Land owners	82	13	5	225
SC	87	13	0	335
ST	82	18	0	356
BC	83	13	4	83

<sup>1</sup> The average amount borrowed by a borrowing beneficiary.

At the beginning, the DRDA supplied gas stoves. Because of the delay in the supply of the stoves, the beneficiaries asked for the option of purchasing gas stoves directly, and this request was granted. There are price differences between the DRDA and other suppliers. Beneficiaries pay about Rs 950 for a single-burner stove and associated accessories when purchasing them from the DRDA, but pay Rs 100 more (total of Rs 1,050) if purchasing from the dealers for the state oil companies or private marketers. No cases of compulsory purchase by the dealers were reported. The beneficiaries reported, however, that they preferred to purchase from the dealers because delivery was prompt and quality was assured.

Accessories such as rubber tubings, electric lighters, regulators and gas stoves are to be supplied by the gas agencies under the supervision of the DRDA. Some gas agencies such as HPC and BPC have been delivering all the accessories at the time of cylinder installation. However, the Andhra Pradesh Civil Supplies Corporation has not been able to coordinate well the delivery of these accessories with local administrations (Mandal Offices, Forest Department). As a result, as of July 2001, some tribal beneficiaries had not been able to procure stoves even after having waited for months. Because of the location of tribal areas, self-help groups have not been well established. VSS groups are more active in these areas, but forest departments have not promoted thrift. The tribal beneficiaries who participated in this study are VSS members.

Once the cylinders are installed, the gas agencies are required to deliver refill LPG cylinders to homes as far as possible. The cost of cylinder delivery is indeed built into the refill cost. In order to achieve a high degree of home delivery, the gas agencies are required to open sub-depots. However, the establishment of sub-depots has been slow and not taken place for the most part, requiring the beneficiaries to come up with other means of collecting refill cylinders. Of the 66 groups studied, only 14 responded that they relied entirely on home delivery to obtain refill cylinders. The remaining groups had to rely on other means, including paying a third party and going to the dealers to collect the refill cylinders themselves. In fact, 42 out of 66 groups did not have home delivery at all. The results are summarised in Table 2.6. Considerable variations across different regions are seen, varying from self-collection being the dominant form of cylinder delivery in Kurnool to dealer delivery in Khammam. Only 18 self-help groups in total out of 66 said that they paid a third party to collect refill cylinders.

**Table 2.6 Arrangement for Refill Cylinder Delivery**

Mode	Adilabad	Anantapur	East				Total
			Godavari	Khammam	Kurnool	Vizianagaram	
1	1 (9)	1 (9)	2 (18)	3 (27)	0 (0)	3 (27)	10 (15)
1,2	0 (0)	2 (18)	0 (0)	0 (0)	0 (0)	0 (0)	2 (3)
1,2,3	0 (0)	5 (45)	0 (0)	0 (0)	0 (0)	0 (0)	5 (8)
1,3	0 (0)	0 (0)	1 (9)	0 (0)	0 (0)	0 (0)	1 (2)
2	3 (27)	0 (0)	0 (0)	7 (64)	1 (9)	3 (27)	14 (21)
2,3	0 (0)	1 (9)	2 (18)	0 (0)	0 (0)	0 (0)	3 (5)
3	5 (45)	2 (18)	6 (55)	1 (9)	10 (91)	5 (45)	29 (44)
4	2 (18)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (3)

Notes: 1 Payment to third party for collection; 2 home delivery by dealer; 3 self-collection; 4 other modes. The figures in parentheses are percentages of the total in each column.

### Consumption of LPG

A concern with any subsidy scheme is that beneficiaries pass on the subsidy to those for whom the subsidy is not intended. The study team attempted to obtain a broad measure of the cylinder retention rate during the focus-group discussions. Such a direct approach is likely to yield an upper bound on the retention rate, as those who have passed on the cylinder connections have little to gain from disclosing the information but potentially much to lose if the fact of their having given away their connections to others becomes publicly known. With this limitation in mind, the study team found that the overall retention rate was about 90 percent, varying from 75 percent in Anantapur to 100 percent in Adilabad and East Godavari (Table 2.7). The most recent estimate, as reported by officials managing the scheme at a workshop held on February 20, 2002, suggested that the actual retention rate may be much lower. Only 2 percent openly admitted to having sold the Deepam connection, prompted by a cash crunch and the need to raise cash

quickly. Most gave their connections to their friends and relatives who are working in town or to daughters as a dowry. There were also cases of LPG cylinders being lent, usually to civil servants such as teachers working in villages. Among those who had given away their connections, most cited the high cost of LPG as the primary reason for not continuing with LPG use.

**Table 2.7 Retention Rate (%)**

<i>Parameter</i>	<i>Adilabad</i>	<i>Anantapur</i>	<i>East</i>			<i>Vizianagaram</i>
			<i>Godavari</i>	<i>Khammam</i>	<i>Kurnool</i>	
SC	100	51	100	99	80	75
ST	100	64	—	100	—	96
Others	100	85	100	91	91	95
Overall	100	75	100	96	87	85
Percentage of connections:						
Sold	—	15	—	—	—	27
Given to relatives	—	85	—	100	100	63
Given to friends	—	—	—	—	—	3
Given to others	—	—	—	—	—	7

— not applicable.

For those who have retained the connection, the next question is how much LPG they have been consuming. If the primary purpose of enrolment in the scheme was to obtain an LPG cylinder as a status symbol and not much more, then it defeats the purpose of the program, bringing few time-saving and health benefits. The information collected in the focus-group discussions showed that 33 percent of the respondents refilled every 3 months, 30 percent every 3–4 months, 14 percent every 4–6 months, 9 percent every other month, 5 percent less frequently than every 6 months, and 2 percent every month. One of the guidelines in the Deepam Scheme—requiring that the beneficiaries refill cylinders every 90 days or else forfeit the connection—did not seem to be adhered to. Lastly, eight percent of the respondents had never refilled. Private LPG dealers report that their rural household clients consume about half a cylinder a month. Only one-tenth of Deepam beneficiaries were found to be using half a cylinder or more every month. A detailed breakdown is given in Table 2.8.

It may be reasonable to speculate that the refill rate falls with increasing distance from the LPG distribution point, because those closest may be virtually guaranteed home delivery whereas those farther away will likely have to make arrangements for cylinder refill. For this reason the respondents were divided into three groups, indicated as zones 1, 2 and 3 in Table 2.8, corresponding to three regions measured from the distribution point (0–5 km, 5–10 km, and greater than 10 km, respectively). No clear pattern emerges. As a matter of fact, those who were farther away refilled more frequently than those who were closer by in Adilabad and Vizianagaram. About one-half of those who had never

refilled were in zone 3. Three self-help groups accounted for 36 out of 70 people who had never refilled. Predictably, the most common reason given for low consumption of LPG was the incremental cost of switching to LPG.

**Table 2.8 Cylinder Refill Rates (Number of respondents)**

Interval <sup>1</sup>	<i>Adilabad</i>			<i>Anantapur</i>			<i>East Godavari</i>			<i>Khammam</i>			<i>Kurnool</i>			<i>Vizianagaram</i>		
	Z1	Z2	Z3	Z1	Z2	Z3	Z1	Z2	Z3	Z1	Z2	Z3	Z1	Z2	Z3	Z1	Z2	Z3
1 month	0	0	0	0	8	0	0	0	0	8	0	0	0	0	0	0	0	0
2 months	0	0	0	0	24	2	4	5	2	2	5	0	10	0	0	8	16	0
3 months	0	2	15	7	37	5	26	17	9	36	19	11	22	4	4	13	34	30
3–4 months <sup>2</sup>	33	23	31	25	10	17	13	3	11	19	10	11	13	3	6	13	0	23
4–6 months <sup>3</sup>	51	13	0	0	0	0	0	0	0	5	0	0	7	8	4	19	8	10
> 6 months	5	5	0	3	0	0	0	0	0	0	0	0	7	8	4	10	2	0
Never refilled	0	0	0	9	10	20	0	0	0	0	0	11	4	8	7	0	1	0
Total	89	43	46	44	89	44	43	25	22	70	34	33	63	31	25	63	61	63

<sup>1</sup> Interval between successive refills. <sup>2</sup> Greater than 3 months but less than 4 months. <sup>3</sup> Greater than 4 months but less than 6 months.

*Notes:* Z1 households located within 5 km of the gas agency distribution point; Z2 households located between 5 and 10 km; Z3 households located more than 10 km. Cooking with only LPG would require a refill rate of about one every two months.

LPG was found to be most extensively consumed during the monsoon season when 97 percent of the self-help groups responded that they used LPG frequently. The agricultural season begins with the monsoon, making more cash available to agricultural labourers who can earn regular wages, and at the same time field work reduces the amount of time available for cooking. In addition, crop residues, twigs and wood are wet, storing them in a dry place becomes problematic, and setting biomass on fire may require the use of kerosene as a source of ignition. All these factors promote the use of LPG: the availability of cash income makes it easier to pay for LPG, the much shorter cooking time with LPG when family members are taken up with field work makes LPG the cooking fuel of choice, and the lack of ready availability of dry biomass makes the use of traditional fuels difficult.

In contrast, family members have less work in summer, so that more time can be devoted to biomass collection. The use of LPG was said to be the lowest in summer, with only 11 percent stating that they used LPG frequently. In winter, cooking with crop residues and fuelwood also serves to keep the surrounding areas warm, making them attractive, so that LPG consumption declines, although not as much as in summer; 35 percent said that they used LPG frequently.

### **Box 1. Health Benefits of Using LPG**

The principal damage to health from the traditional use of biomass comes from small particles and harmful airborne toxins emitted by the combustion of biomass. In contrast, the

emission levels of these pollutants are significantly reduced when LPG is burned. A large number of studies across several countries have demonstrated the adverse impact of small particles, which are now widely recognized to cause respiratory illnesses and premature deaths. Some of the airborne toxins are carcinogens.

What matters for policy formulation is not pollutant ambient concentrations per se, but exposure of the public to elevated concentrations. To take an extreme example, if the concentration of fine particulate matter is alarmingly high in the kitchen during cooking, but all the household members, including the cook, are outside the house and unexposed to pollution (for example because of slow cooking requiring no attention even from the cook), then the health impact would be considerably smaller than if the cook and other household members stayed in or near the kitchen. Therefore, the time-averaged exposure of household members to pollution levels is an important parameter.

Monitoring of small particulate concentrations in Andhra Pradesh has been carried out under another component of the program, “India: Household Energy, Indoor Air Pollution and Health”, specifically designed to monitor exposure. Some 417 households participated in this component. The 24-hour averaged concentrations of small particles in living areas in households using solid fuels ranged from 150 to 320 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ), depending on the kitchen type and house configuration. In contrast, those using only LPG on the day of monitoring registered concentrations ranged between 70 and 150  $\mu\text{g}/\text{m}^3$ . Some of the particles in households who reported using only LPG are probably due to background concentrations from other houses and possibly the use of biomass in the same house on preceding days. As a rough guideline, for the particle size examined in this study, the 24-hour average concentration should preferably be smaller than 150  $\mu\text{g}/\text{m}^3$ , with the annual average not to exceed 50  $\mu\text{g}/\text{m}^3$ .

The majority of Deepam beneficiaries were found to be using both LPG and biomass. Because the combustion of biomass leads to high emissions of small particles that remain suspended in the air for a long time, such mixed fuel use results in high overall exposure of household members, greatly diminishing the health benefits of using LPG.

Nearly all studies quantifying the impact of small particles on health have involved ambient concentrations below 150  $\mu\text{g}/\text{m}^3$ . Therefore, the impact of concentrations typical of indoor air pollution is not known with precision, but it is undoubtedly serious. Another unknown is the impact of varying ambient concentrations above 150  $\mu\text{g}/\text{m}^3$ : how much more serious is, say, 300  $\mu\text{g}/\text{m}^3$  compared to 200  $\mu\text{g}/\text{m}^3$ ? Or 500  $\mu\text{g}/\text{m}^3$  compared to 350  $\mu\text{g}/\text{m}^3$ ? These are some of the questions researchers are trying to address in order to inform policymakers.

*Source:* “Monitoring for respirable particulates associated with household fuel use in rural districts of Andhra Pradesh”, report submitted to the World Bank by Sri Ramachandra Medical College and Research Institute, February 2002.

## Energy Use Pattern

Deepam beneficiaries were typically purchasing three litres of (subsidised) kerosene through the PDS, and additional (market-priced) kerosene in the open market. Households often have difficulties purchasing even this reduced ration through the PDS due to lack of availability of subsidised kerosene. Attempts were made in focus-group discussions to quantify energy use patterns. While such quantitative information

inevitably contains large error margins, the results shown in Table 2.9 give a broad-brush picture of household energy use. Barring a few exceptions in municipal areas, electricity was not used for cooking and is not included in the table.

**Table 2.9 Energy Use Pattern (%)**

<i>Fuel</i>	<i>C o o k i n g</i>				<i>Water heating</i>	<i>Other purposes</i>
	<i>Rice</i>	<i>Dal</i>	<i>Roti</i>	<i>Other</i>		
Wood	51	49	45	25	74	69
LPG	34	22	15	57	3	17
Crop residues	4	17	22	4	9	3
Kerosene	8	1	4	10	8	11
Cow dung	2	6	7	0	4	0
Coal	0	6	4	4	1	0
Gobar gas	1	0	3	0	0	0
Total	100	100	100	100	100	100

Clearly wood remains the fuel of choice, especially for heating water and other non-cooking purposes. For cooking, wood is used more than any other fuels, with the exception of the category “other cooking”. Here, LPG seems to have made an inroad, most likely to make tea and perform other simple tasks for which getting a fire going using wood would take up a disproportionate amount of time. These tasks would require little LPG compared to bulk cooking, making the use of LPG in BPL households for these purposes especially appealing. After wood and LPG, crop residues rank third. Kerosene and other fuels are rarely used for cooking.

### **Cost of LPG Use**

The participants of the focus-group discussions were asked how much more they had been spending on average to use LPG. Accurate and internally consistent quantitative information of this nature is virtually impossible to collect in informal group discussions. As a result, the findings summarised in Table 2.10 are indicative at best.

**Table 2.10 Cost of LPG Use**

<i>Parameter</i>	<i>Adilabad</i>	<i>Anantapur</i>	<i>East</i>			<i>Vizianagaram</i>
			<i>Godavari</i>	<i>Khammam</i>	<i>Kurnool</i>	
Average energy cost with LPG, Rs	225	181	190	113	115	132
Average energy cost without LPG, Rs	118	159	142	130	92	97
LPG incurs additional expenses <sup>1</sup>	11	4	5	1	2	11
LPG does not incur additional expenses <sup>1</sup>	0	7	6	10	9	0
Additional energy expenses per month <sup>2</sup> , Rs						
LPG used 25%	117	29	41	106	16	143
LPG used 50%	100	34	25	84	12	99
LPG used 75%	70	29	11	61	8	58
Additional hardware <sup>3</sup> expenses, Rs	216	78	176	261	224	185

<sup>1</sup> The number of self-help groups that replied that the use of LPG did or did not increase the cost of energy use.

<sup>2</sup> This question was asked only of those groups that replied that the use of LPG increased the average cost of energy use.

<sup>3</sup> Expenses for procuring cookware and making modifications to the kitchen in order to use LPG.

One-half of the self-help groups replied that the use of LPG did not increase the cost of energy use. This response must be interpreted with caution because the consumption of LPG is not correlated with the above responses. For example, the refill rates listed in Table 2.8 do not show noticeable differences between Khammam, the only region where the use of LPG on average was said to lower the cost of energy use, and East Godavari, where one-half the self-help groups said that using LPG increased the monthly energy bill. The question could possibly have been interpreted to mean how much extra they were currently paying to use LPG, in which case the additional cost decreases with decreasing use of LPG, so that those who are using essentially no LPG would reply that they have scarcely seen additional expenditures.

### Perceptions of Benefits and Disadvantages of LPG Use

The principal reasons cited for using LPG were clean and healthy cooking (81 percent of respondents), time saved in cooking (49 percent), greater availability of labour time as a result (30 percent), and the social status that comes with LPG use (9 percent). Focusing on the first aspect, the cleanliness of cooking with LPG (lack of soot deposits on pots and pans, making cleanup easier) was most important (88 percent), and cited twice as many times as the absence of smoke during cooking (45 percent). In terms of economic benefits, there was near universal consensus that savings in cooking time were the most significant aspect of LPG use (97 percent), cited twice as many times as not having to

spend time collecting biomass (45 percent). From a social viewpoint, the social status accorded to households possessing LPG cylinders was considered important (89 percent), much more so than having more time to socialise (17 percent).

The reduction in kerosene allocation at the state level was cited as a negative feature of the Deepam scheme (84 percent).<sup>7</sup> The complaint was widely expressed by urban beneficiaries who were directly affected. Other considerations included extra expenses incurred being a financial drain (33 percent) and having to pay a commission to fetch refill cylinders (10 percent). Some, presumably those who have signed up for the Deepam scheme but have not been using LPG, referred to participation in the scheme as a “dead investment”. A few (4 percent) said that they were under pressure from others to use LPG. More than one-half of the self-help groups mentioned that the use of LPG was inviting envy from non-beneficiaries.

Two-thirds of the respondents said that LPG was “partially” affordable. One-fifth said that LPG was affordable, but 14 percent replied that it was not affordable. Predictably, 89 percent wanted a reduction in the price of LPG. Since granting a greater LPG subsidy is not politically feasible given the total size of the subsidy that would result, the study team asked during the focus-group discussions if smaller cylinder sizes (which would reduce the refill cost but increase the price of LPG on a unit weight basis) might increase LPG consumption. Many were aware of economies of scale and mentioned that the smaller the cylinder size, the higher the cost of LPG on a unit basis. Nevertheless, a number indicated that they would consider smaller size cylinders that would make it easier to pay for a refill. The Government of India has recently announced the introduction of 5-kg LPG cylinders. By enabling consumers to carry LPG cylinders more easily, such a cylinder size may lower the cylinder delivery cost (from the retailer to the home), although increasing the distribution cost markedly because of the considerably larger number of cylinders in circulation and greater transport to and from bottling plants. A handful (5 percent) wanted to see the availability of credit for cylinder refills.

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<sup>7</sup> The agreement between the Government of India and the State Government of AP for the release of additional LPG connections for the Deepam scheme stipulated that the state surrender 5 litres of PDS kerosene per month for each LPG connection released. The actual entitlement of kerosene under PDS, prior to Deepam, stood at 23 litres in Hyderabad City, a maximum of 10 litres in urban areas and 3 litres in rural areas. After the launching of the scheme, the State Government of AP initiated the following steps in respect of kerosene supply under PDS:

- Restricting the entitlement of 23 litres per card in Hyderabad city to areas considered politically sensitive according to a set of criteria; in other areas the quota is around 10 litres.
- Weeding out ineligible and fictitious cards to the tune of 0.86 million cards across the state (including of BPL and APL cards);
- Restricting the maximum entitlement to 5 litres per month among Deepam beneficiaries in urban areas.
- Strictly enforcing the rule stipulating that households with two LPC cylinders forfeit PDS kerosene allocation altogether.

In terms of the level of satisfaction with the Deepam scheme, 97 percent were satisfied with the selection process, 77 percent were satisfied with the coverage of the scheme, and 65 percent were satisfied with the distribution arrangements. For the coverage of the scheme, 18 percent were only partially satisfied, especially those in Anantapur and East Godavari. Thirty percent of the self-help groups were only partially satisfied with the distribution arrangements, most prominently those in Anantapur and Kurnool.



# 3

## Beneficiary Interviews

In addition to focus-group discussions, 134 Deepam beneficiaries were interviewed to gain a better understanding of their experience. Basic socio-economic information was collected as well as specific data related to LPG use and experience with the Deepam scheme.

### Socio-economic Information

The breakdown of the 134 interviewees into the districts in which they resided and social class stratification is given in Table 3.1. The scheduled and Backward Caste/Other Backward Class (OBC) members made up over two-thirds. In terms of ration card-holding, 118 (88 percent) were white-card holders, 5 (4 percent) were pink-card holders and 11 (8 percent) possessed no ration cards.

**Table 3.1 Social Class Stratification, by District**

<i>District</i>	<i>SC</i>	<i>ST</i>	<i>BC/OBC</i>	<i>Others</i>	<i>Total</i>
Adilabad	5	5	12	1	21
Anantapur	6	0	4	12	24
East Godavari	7	2	9	4	22
Khammam	9	0	8	5	22
Kurnool	5	2	8	9	22
Vizianagaram	9	1	10	1	23
Total	41 (31%)	10 (8%)	51 (38%)	32 (24%)	134 (100%)

The majority of the interviewees were from rural areas. A breakdown of the type of self-help groups to which they belonged is given in Table 3.2. Over four-fifths (83 percent) had been members for more than two years, the average being five.

**Table 3.2 Self-Help Group Membership, by District**

<i>District</i>	<i>DWCRA</i>	<i>VSS</i>	<i>DRWUA</i>	<i>GCC</i>	<i>Others</i>
Adilabad	16	4	1	0	0
Anantapur	12	7	0	4	0
East Godavari	18	0	4	0	0
Khammam	16	1	4	0	1
Kurnool	18	0	4	0	0
Vizianagaram	17	1	4	0	0
Total	97 (73%)	13 (10%)	17 (13%)	4 (3%)	1 (1%)

Note: GCC is operating in Vizianagaram for Deepam LPG distribution.

Two-fifths of those interviewed owned land, and one-half owned livestock, the most common being milch animals, followed by draught animals and sheep. Milch animals are an obvious choice because selling milk gives income to the family and dung can be used as a source of energy. The results are shown in Table 3.3.

**Table 3.3 Land and Animal Holding Status**

<i>District</i>	<i>Land holding</i>			<i>Livestock</i>		
	<i>Landless</i>	<i>Up to 5 acres</i>	<i>&gt; 5 acres</i>	<i>No animals</i>	<i>Up to 2</i>	<i>&gt; 2</i>
Adilabad	12	5	4	12	8	1
Anantapur	7	7	10	5	4	15
East Godavari	14	6	2	10	6	6
Khammam	11	8	3	7	7	8
Kurnool	18	2	2	15	5	2
Vizianagaram	18	4	1	16	1	6
Total	80 (61%)	32 (24%)	22 (16%)	65 (49%)	31 (23%)	38 (28%)

For housing, 32 percent had thatched roofs, 30 percent reinforced concrete cement (RCC), another 30 percent cement tiled, and the balance other materials of construction. The majority of the houses in Anantapur had RCC roofs. Thatched and cement tiled roofs are more common among the poor in India.

Four types of kitchen were reported (Table 3.4). Those outside the house included a separate (rudimentary) construction for the kitchen as well as open air cooking with no kitchen. Those inside could be without partitions so that the kitchen was not separated from the rest of the house, and those with partitions so that kitchens were separate rooms. Poor households tend to have kitchens outside the house because the amount of living space is small (11 to 14 square metres) and unventilated. Some may have a small veranda (covered space) outside while others may cook in the open air. Having a kitchen outside

in both cases is an indication of “poorer” status. One-third of the interviewees cooked outside the house. Four-fifths of the Deepam beneficiaries interviewed had traditional chullah stoves for cooking. A quarter of them had kerosene stoves, and one-fifth had smokeless chullah stoves (that is, improved stoves with chimneys).

**Table 3.4 Type of Kitchen**

<i>District</i>	<i>Outside the house</i>	<i>Open air</i>	<i>Inside with no partition</i>	<i>Inside, with partition</i>
Adilabad	1	1	16	3
Anantapur	4	0	5	14
East Godavari	16	0	4	2
Khammam	12	1	8	1
Kurnool	2	0	4	16
Vizianagaram	2	3	10	8
Total	37 (28%)	5 (4%)	47 (35%)	44 (33%)

Although no attempt was made to ask questions about income or total household cash expenditures, a few questions about the possession of consumer durables were asked in order to gauge the economic status of the household. The results, summarised in Table 3.5, show that close to three-quarters of the households had at least one fan, close to two-thirds had a television set, and nearly one-half had a two-wheeler. Nineteen households (14 percent) did not possess any of the consumer durables listed in the table. There was little variation between urban and rural households.

**Table 3.5 Possession of Consumer Durables (number of households)**

<i>District</i>	<i>Television</i>	<i>Washing machine</i>	<i>Fan</i>	<i>Two-wheeler</i>	<i>Others</i>
Adilabad	15	0	18	9	8
Anantapur	15	0	18	6	0
East Godavari	10	3	13	15	0
Khammam	15	0	17	1	1
Kurnool	16	0	16	17	1
Vizianagaram	14	0	15	15	5
Total	85	3	97	63	15

### Participation in the Deepam Scheme

On average, those interviewed had been participating in the Deepam scheme for 18 months as of July 2001, ranging from half a year to two years. They learned about the Deepam scheme primarily from their self-help groups and government officials. The

findings are given in Table 3.6. About a quarter of them responded that they had two sources of information: self-help groups and government officials.

**Table 3.6 Source of Information about the Deepam Scheme**

<i>District</i>	<i>Self-help group</i>	<i>Government officials</i>	<i>Other agencies<sup>1</sup></i>	<i>Friends</i>	<i>Relatives</i>
Adilabad	19	18	3	1	1
Anantapur	3	14	6	0	0
East Godavari	21	2	0	0	0
Khammam	5	15	2	0	0
Kurnool	18	10	0	0	0
Vizianagaram	16	21	0	0	0
Total	82	80	11	1	1

<sup>1</sup> Other agencies include non-governmental organisations, Panchayat Raj Institution<sup>8</sup> elected members, youth leaders and opinion leaders.

The majority of those interviewed said that they used their own funds to pay for the upfront cost of starting LPG service (for stove purchase and so on). Less than one-tenth had borrowed money or take out a loan.

The beneficiaries were located at varying distance from the LPG distribution points. Predictably, all the DWCUA members lived within 3 km of the closest gas supplier. The distances are given in Table 3.7.

**Table 3.7 Distance to the Nearest LPG Distribution Point**

<i>District</i>	<i>&lt; 3 km</i>	<i>3–5 km</i>	<i>5–10 km</i>	<i>10–15 km</i>	<i>&gt; 15 km</i>
Adilabad	4	4	6	0	7
Anantapur	0	4	7	11	1
East Godavari	2	8	6	4	2
Khammam	4	4	5	6	2
Kurnool	4	6	6	4	2
Vizianagaram	9	3	10	1	0
Total	23 (17%)	29 (22%)	40 (30%)	26 (20%)	14 (11%)

*Note:* The distances are less than 3 km, between 3 and 5 km, greater than 5 km but equal to or less than 10 km, greater than 10 km but equal to or less than 15 km, and greater than 15 km.

While LPG suppliers may be required on paper to deliver cylinders to anyone living within 5 km of the distribution point free of charge, not all of the 52 beneficiaries who replied that they lived within 5 km had free home delivery. The mode of LPG cylinder delivery as a function of distance from the dealer is shown in Table 3.8. About a quarter of the respondents had home delivery, 70 percent collected the cylinders themselves, and

<sup>8</sup> Panchayat Raj Institutions are local self-government bodies operating at three levels.

a few said they paid a third party for cylinder collection. Even in the case of home delivery and self-collection, expenses can be incurred. For home delivery, the deliverer may collect a tip, and in the case of a member of the household collecting the cylinder, transport costs may be incurred.

**Table 3.8 Cylinder Delivery Mode**

District	<i>0 to 5 km</i>			<i>5 to 10 km</i>			<i>More than 10 km</i>		
	<i>Home</i>	<i>Self</i>	<i>Comm.</i>	<i>Home</i>	<i>Self</i>	<i>Comm.</i>	<i>Home</i>	<i>Self</i>	<i>Comm.</i>
Adilabad	5	3	0	2	4	0	0	7	0
Anantapur	2	1	1	0	6	0	2	5	4
East Godavari	0	8	2	2	4	0	2	4	0
Khammam	5	3	0	3	2	0	3	5	0
Kurnool	2	8	0	0	5	0	2	3	0
Vizianagaram	0	12	0	1	8	0	0	1	0
Total	14	35	3	8	29	0	9	25	4

*Note:* The distances are up to 5 km, greater than 5 but equal to or less than 10 km, and greater than 10 km. *Home* is free home delivery; *self* is a member of the household collecting the cylinder; *comm.* is delivery by paying a commission to a third party.

One-half of the respondents reported that they had to pay up to Rs 55 for each cylinder collection, averaging Rs 22. The remaining half did not pay anything extra for cylinder delivery. Table 3.9 shows the average price paid including the cost of delivery as a function of distance from the nearest LPG distribution point. As expected, the total price paid typically increased with increasing distance.

**Table 3.9 Cost of Cylinder Refill (Rs)**

District	<i>0 to 5 km</i>	<i>5 to 10 km</i>	<i>More than 10 km</i>
Adilabad	271	293	299
Anantapur	286	284	293
East Godavari	245	250	250
Khammam	263	282	272
Kurnool	265	269	273
Vizianagaram	251	254	270
Average	261	272	278

*Note:* The distances are to the nearest LPG distribution point and are the same as those in Table 3.8.

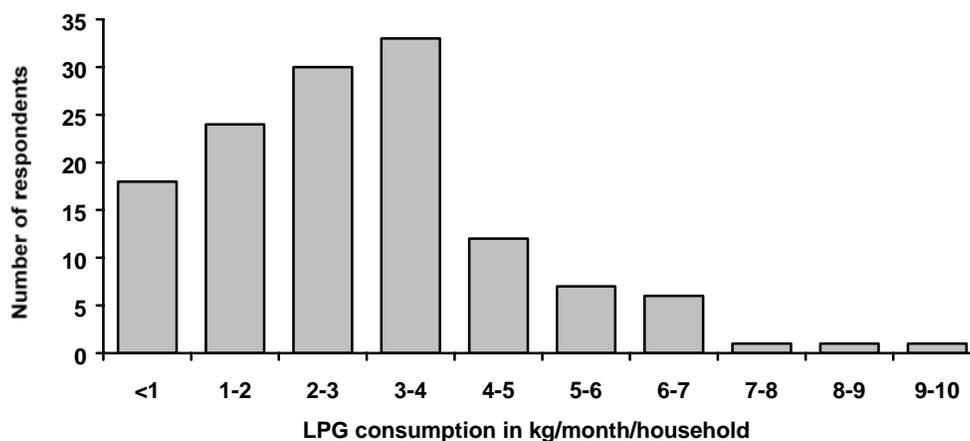
### Consumption of LPG

On the basis of when the cylinders were installed and how frequently they were refilled, team estimated the amount of LPG consumed to date. One simplifying assumption used

in this calculation is that the last refill has been half used up. For those who have had a number of refills, this will not affect the estimate markedly, but for those who have had only one or two refills, or who have never had one, this could over- or under-estimate LPG consumption considerably. Indeed, there were 21 households that had never had a refill. On average, the respondents had had three refills, ranging from 0 to 16, since enrolling in the Deepam scheme. This translates to refilling every 7 months on average, with the median being 5 months.

The refill rates reported here are considerably lower than those reported in focus-group discussions, where both the average and the median were smaller by about 2 months. The difference may in part arise from wanting to appear to be utilising LPG more regularly in the presence of one's peers during the focus-group discussions. Average LPG consumption was calculated to be 2.9 kg per household per month (Figure 3.1). There was, however, a marked difference between urban and rural households: urban households consumed on average 4.8 kg per month, whereas rural households consumed 2.6 kg per month. Aside from relative lack of availability of free or cheap biomass in urban areas, the maximum monthly income levels allowed for urban and rural BPL households (Rs 457 per capita and Rs 263 per capita, respectively) in part explain this difference, since many urban BPL households would have more disposable cash income than their rural counterparts. A quarter of the respondents reported that they used LPG in all cooking. This consisted of one-fifth of rural respondents but over two-fifth of urban respondents. One-third said that they used LPG regularly to make tea, and a quarter said they used LPG to cook meals for guests.

**Figure 3.1 Calculated LPG Consumption, Mid-point Estimates**



An upper and lower bound on LPG consumption can be calculated by assuming that all of the LPG from the last refill had been used, and none had been used, respectively. In this way, high, mid and low estimates may be computed, depending on the assumption made about the consumption of the last cylinder refill. The data collected in the individual interviews give the three estimates for average LPG consumption as 3.4, 2.9 and 2.4 kg per month per household. These should be compared with a minimum of

about 7 kg required for meeting all cooking needs with LPG. The three estimates for urban households are 5.3, 4.8 and 4.3 kg per month per household, and the corresponding figures for rural households are 3.1, 2.6 and 2.4.

Correlation coefficients between LPG consumption in kg/month as calculated above on one hand and potential explanatory parameters on the other are tabulated in Table 3.10. The parameters that were positively correlated with LPG consumption included

- residing in urban areas indicated by DWCUA membership;
- having a kitchen inside the house with partitions, perhaps serving as a proxy for the household's general economic standing;
- having home delivery of LPG cylinders;
- not possessing any ration cards, which could mean that the individual was either relatively well-off or a newcomer;
- wealth index composed of the sum of the number of times the respondent answered "yes" to the question whether the household had the consumer durables listed in Table 3.5;
- being a member of a Backward Caste (they are generally better off); and
- being a member of other castes, which tend to be better off.

As the table shows, the materials of construction for the roof of the house, which could serve as another indicator of the economic standing of the household, did not seem to have much impact on LPG consumption.

**Table 3.10 Correlation Coefficients between  
LPG Consumption and Various Parameters (kg/month)**

<i>Parameter</i>	<i>Mid estimate</i>	<i>High estimate</i>	<i>Low estimate</i>
DWCUA membership (1/0)	0.37	0.38	0.38
Inside kitchen with partition (1/0)	0.22	0.30	0.26
Home delivery of LPG cylinder (1/0)	0.28	0.22	0.25
No ration card (1/0)	0.24	0.26	0.25
Wealth	0.23	0.21	0.22
Backward Caste member (1/0)	0.13	0.17	0.15
Member of other castes (1/0)	0.09	0.08	0.09
Refill cylinder cost in Rs, excluding delivery cost	0.04	0.09	0.07
Number of rooms in house	0.03	0.02	0.02
Inside kitchen with no partitions (1/0)	0.04	0.00	0.02
Cement tiled roof (1/0)	0.03	0.01	0.02
Number of children under 12	0.01	0.00	0.01
Thatched roof (1/0)	0.00	0.00	0.00

<i>Parameter</i>	<i>Mid estimate</i>	<i>High estimate</i>	<i>Low estimate</i>
RCC roof (1/0)	-0.03	-0.02	-0.02
Number of days since cylinder installation	0.10	-0.15	-0.02
Member of a minority group (1/0)	-0.01	-0.04	-0.03
Number of times a price hike was experienced	0.09	-0.16	-0.04
Member of self-help groups other than DWCUA, DWCRA, VSS and GCC (1/0)	-0.03	-0.04	-0.04
Family size	-0.03	-0.07	-0.05
Number of family members over the age of 12	-0.03	-0.07	-0.05
Number of adults	-0.03	-0.07	-0.05
Pink-card holder (1/0)	-0.10	-0.02	-0.06
Material of construction for roof other than RCC, cement tiled or thatched	-0.07	-0.08	-0.08
Scheduled Caste member (1/0)	-0.08	-0.11	-0.10
Number of wage earners in household	-0.07	-0.14	-0.10
Distance from distribution point in km	-0.15	-0.06	-0.11
Pay a third party for cylinder collection (1/0)	-0.12	-0.11	-0.12
Collect refill cylinders themselves (1/0)	-0.17	-0.13	-0.15
Cook in open air (1/0)	-0.15	-0.16	-0.16
VSS member (1/0)	-0.24	-0.09	-0.16
White-card holder (1/0)	-0.13	-0.20	-0.17
DWCRA member (1/0)	-0.11	-0.23	-0.17
Total refill cost in Rs, including delivery charge	-0.21	-0.14	-0.17
Scheduled Tribe member (1/0)	-0.20	-0.17	-0.19
Number of cattle owned	-0.20	-0.19	-0.20
Kitchen outside the house (1/0)	-0.22	-0.25	-0.24
Acres of land owned	-0.29	-0.23	-0.26
Kitchen outside the house or open air cooking	-0.27	-0.31	-0.29
Cylinder delivery cost in Rs	-0.32	-0.28	-0.30

*Notes:* (1/0) denotes a one-zero dummy. Wealth index is the sum of the number of times the answer “yes” was given in response to whether or not the household possessed the consumer durables shown in Table 3.5.

The following parameters most adversely affected LPG consumption:

- The amount paid for cylinder delivery;
- Having an outside kitchen or open air cooking, both indicators of poorer status of the household;
- Acres of land owned, suggesting that those with land may have access to more free biomass;

- The number of cattle owned, suggesting that free animal waste is used in preference to LPG;
- Being a member of a Scheduled Tribe;
- The total amount paid for LPG, including delivery charges;
- Residing in rural areas indicated by DW CRA membership;
- Possessing a white card, suggesting that non-white-card holders consume more;
- Being a member of VSS;
- Having to collect LPG cylinders;
- Having to pay a commission to a third party for LPG cylinder collection;
- Distance in km from the distribution point, with consumption falling with increasing distance;
- The number of wage earners in the household, which could mean that poor households have many of their members working;
- Being a member of a Scheduled Caste.

LPG consumption tended to decrease with increasing family size, perhaps because poor families tend to be larger.

Taking the above correlations as a starting point, mid-estimates for LPG consumption in kg per month were regressed on the above potential explanatory variables. The regressions were run in EViews. The model was constructed using White heteroskedasticity-consistent standard errors and covariances to allow for possible non-constancy of variance in the error terms arising from equation mis-specification. The dependent variables were entered in linear form. Residuals were obtained and the Jarque-Bera statistic was computed. The Jarque-Bera statistic is a measure of skewness and kurtosis, with a normal distribution giving a Jarque-Bera statistic of zero. This was checked to see if the residuals were normally distributed as a test of equation mis-specification. Two observations with very high LPG consumption were found to lead to high Jarque-Bera statistics. When they were omitted, the Jarque-Bera statistic fell markedly.

The models were initially fitted with all main effects, and then insignificant terms were successively deleted until the model contained only those independent variables that were statistically significant using a two-sided significance test of size 5 percent. (A 5 percent test is one such that the null hypothesis—that is, that in which the identified variable has no additional effect on LPG consumption—would be rejected in 5 percent of tests even if it were true.) Two-sided tests were used because there did not seem to be a basis for predetermining the sign of the expected impact of various parameters examined. Because step-wise deletion does not guarantee the inclusion of all the relevant independent variables, the rejected variables were added back individually and also in groups at the last stage to see if their t-statistics increased. The results, using 117 observations and excluding some outliers, are shown in Table 3.11.

**Table 3.11 Factors Affecting LPG Consumption (kg/month)**

<i>Variable</i>	<i>Coefficient</i>	<i>Standard error</i>	<i>t-Statistic</i>	<i>Probability</i>
Constant	3.37	0.41	8.18	0.000
DWCRA membership (1/0 dummy)	-1.55	0.39	-4.01	0.000
VSS membership (1/0 dummy)	-1.35	0.57	-2.36	0.020
Open air cooking (1/0 dummy)	-1.03	0.28	-3.69	0.000
Kitchen outside (1/0 dummy)	-0.51	0.22	-2.32	0.022
Wealth index	0.50	0.10	5.04	0.000
Home delivery of refill cylinder (1/0 dummy)	0.85	0.31	2.76	0.007
Possesses no ration cards (1/0 dummy)	1.81	0.80	2.26	0.026
Delivery expenses incurred in Rs	-0.022	0.007	-2.90	0.005
Mean dependent variable	3.0	Jarque-Bera statistic		0.39
Dependent variable standard deviation	1.6	Probability (Jarque-Bera)		0.82
R-squared	0.48	F-statistic		12.7
Standard error of regression	1.2	Probability (F-statistic)		0.00

For the independent variables, the dummy for DWCRA membership was 1 if the respondent was a member of a DWCRA group and 0 otherwise; the dummy for VSS membership was 1 if the respondent was a member of a VSS group and 0 otherwise; the dummy for open air cooking was 1 if the respondent cooked in the open air and 0 otherwise; the dummy for the outside kitchen was 1 if the respondent had an outside kitchen and 0 otherwise; the dummy for home cylinder delivery was 1 if the respondent replied that refill cylinders were delivered to her home; and the dummy for the possession of no ration cards was 1 if the respondent was not a holder of any ration cards and 0 otherwise.

These results show that living in rural areas decreases monthly consumption. More specifically, DWCRA group members tended to consume 1.6 kg less per month, and VSS group members 1.4 kg less. Those who cooked outside consumed 1 kg less, and those with an outside kitchen 0.5 kg less. For each consumer durable category that a household had, they would consume 0.5 kg more a month. Having home cylinder delivery increased consumption by 0.9 kg. This finding may suggest that arranging for cylinder delivery, even if it does not cost in monetary terms, discourages consumption of LPG. On the other hand, for every Rs 10 paid for cylinder delivery, consumption decreased by 0.2 kg. Those with no ration cards (which could mean either new comers or else relatively high income), amounting to some 8 percent of the total respondents, consumed substantially more: about 1.8 kg of LPG more a month.

### **Box 2. Confounding Conventional Wisdom: The Mexican Experience**

As a broad-brush picture, it seems reasonable to suggest that as households become richer, the level of indoor pollution should decline. This, however, was not found in a study of several states in Mexico.

The study found that, as expected, those who used only fuelwood for cooking tended to be concentrated among low-income households. However, when households began using LPG, they almost never abandoned fuelwood in rural areas, so that nearly all households that were using LPG were multiple-fuel users. Furthermore, mixed fuel (fuelwood and LPG) users tended to consume more overall energy than fuelwood-only users. As a result, the fuelwood savings from adopting LPG, which ranged from nil to 35 percent, were much smaller than what might have been expected based on stove efficiencies.

Surprising results were found when smoke was measured during cooking. More specifically, ambient concentrations of particles smaller than 7 microns found in smoke—in terms of health impact, the smaller the particle the more damaging, so that this is the particle size of interest for estimating the adverse impact of indoor air pollution on public health—were measured around the cook. The average particulate concentration did not decrease consistently as income rose. In fact, the average concentration among the lowest income households was 450  $\mu\text{g}/\text{m}^3$ , but rose to 845  $\mu\text{g}/\text{m}^3$  among the most affluent households where the highest proportion of LPG usage was found. While these findings need to be interpreted with caution because of the small sample size, they nevertheless illustrate the point that air pollution levels do not necessarily decrease monotonically with increasing wealth, or by simply “adopting” LPG.

There are several possible explanations for the above household pollution measurements results. As income rises, the kitchen area can be segregated to a “traditional” section of the house, becoming increasingly marginalized. Some affluent households remodel the kitchen, using materials that do not permit as much air flow: for example, replacing wooden walls with cement walls.

*Source:* Masera, O.R., B.D. Saatkamp and D.M. Kammen. 2000. “From linear switching to multiple cooking strategies: a critique and alternative to the energy ladder model”, *World Development* Vol. 28, No. 12, pp. 2083-2103.

### **Perceptions of Benefits and Disadvantages of LPG Use**

All of the respondents cited time saved as the primary benefit of switching to LPG. Other benefits reported include cleaner cooking (84 percent), better for health (75 percent) and giving a status symbol (47 percent). The biggest problem cited was the additional expenses incurred in switching to LPG (89 percent), followed by inconvenience and expenses incurred in collecting the cylinder (55 percent), having to spend money up front (17 percent), and the use of LPG being “unsafe” (13 percent). When asked about the loss of kerosene quota at the state level, three-quarters replied that this was a problem.

To address these problems, those interviewed said that they wanted some type of loan—for example, a loan from their self-help groups or a soft-loan from the government—to pay for LPG cylinder refills. They wanted to see more sub-centres established for cylinder distribution, or else to see dealers assume greater responsibility for regular

delivery of cylinders and bear the cost of doing so. A little over one-third suggested that smaller size cylinders be made available.

Lastly, perhaps to avoid friction in the village because of some being eligible for the connection fee waiver and while others were not, 37 percent wanted the Deepam scheme to be extended to everyone in the village, and 49 percent wanted the scheme expanded to include APL households.

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## Conclusions

### Pros and Cons of the Deepam Scheme

The Deepam scheme is a unique subsidy scheme in two respects. First, it targets only those households that are classified as being below the official poverty line. Second, rather than giving a recurring price subsidy that would last as long as the beneficiaries continue to consume the fuel being subsidised, the scheme supplies a one-off subsidy in the form of cylinder-connection fee waiver, potentially limiting the total amount of subsidy given. The fee waiver addresses one of the most important barriers to fuel switching: the high upfront cost of starting LPG service. However, because the Deepam scheme was implemented in the context of an LPG price subsidy by the central government, consumers' behaviour reflects the existence and interaction of both subsidy schemes.

Several arguments for and against the design of the Deepam scheme can be mounted. Arguments for the scheme might include the following:

- Those households that could not come up with Rs 2,000 just to sign up for LPG and procure stoves and accessories may now be able to afford LPG.
- The selection of beneficiaries has been confined to those belonging to self-help groups with good performance, enhancing the chances of continuing use as a result of possible financial assistance from other group members in times of need.
- The scheme targets primarily rural dwellers, who historically have been neglected in the distribution of subsidised LPG.
- By enrolling people in groups, more enthusiasm is generated, making more people willing to sign up for and use LPG.
- By encouraging villagers to start using LPG, a culture of LPG use is fostered, showing that LPG is safe to use, saves time, and enables much cleaner cooking—both in terms of lack of soot deposited on pots and pans, and near absence of smoke during cooking. Once these benefits are visibly demonstrated, others may consider taking up LPG.

At the same time, the following potential reservations can be expressed about schemes of this nature:

- True BPL households are in no position to switch to LPG in a meaningful manner—that is, for a substantial portion of cooking, with the associated time savings and health benefits. There are more pressing demands on their cash income. A household with a total monthly income of about Rs 1,000 cannot afford, just for cooking, a monthly fuel bill of close to Rs 150, which is the amount required for using LPG as the principal cooking fuel. Therefore, the scheme actually benefits only those who are relatively well off but have managed to obtain BPL ration cards.
- Because anything given away gratis attracts beneficiaries who actually cannot afford the good being offered, some who are in no financial position to use LPG may sign up anyway, resulting in dead investment (in the form of gas stoves and accessories purchased) and no LPG use.
- Cylinder management is one of the unique features of LPG trade. It is also what makes it much more costly to deliver LPG in rural areas. Even if LPG becomes the primary cooking fuel in rural areas, rural areas often lack economies of scale for cylinder distribution because of much lower population density. If they consume much less LPG because of the availability of free biomass, LPG distribution becomes even more costly, making it commercially unattractive for suppliers to set up sub-centres. In the absence of adequate infrastructure for LPG delivery (for these market-related reasons), the scheme would struggle with cylinder delivery after cylinders are installed.
- If the right groups are not targeted—for example, if genuine BPL families are too poor to afford LPG—then the scheme will suffer from considerable diversion and leakage, or else the error of inclusion (people who are actually ineligible by the strict criteria of the scheme manage to be selected).

### **Study Findings**

The study found that, by and large, the selection of beneficiaries appeared to be fair using the white ration card as the criterion for eligibility, although some white-card holders seemed to be above the poverty line. In the early days of the scheme, there was more haste in selecting beneficiaries, resulting in some guidelines being overlooked. The scheme was originally scheduled for launch in February 1999. Because the general elections were due in May, however, the launch was postponed until July, although the beneficiary selection process began before July. There was much pressure on the official machinery to distribute LPG before the elections. As a result, selection criteria were not necessarily followed. Predictably, as the scheme progressed, the pace of formation of new self-help groups increased. The selection of Deepam beneficiaries in some cases was reportedly based on political affiliation and influence.

The lack of adequate LPG distribution infrastructure has been a problem in the Deepam scheme. Only a minority of Deepam beneficiaries appear to have refill cylinders delivered to their homes. Complaints about the extra expenses incurred in cylinder delivery were common, and were one of the factors adversely affecting the consumption of LPG.

Although one would expect information on diversion to be difficult to obtain, some reported giving away their Deepam connections, usually to relatives. A few cases of local traders using Deepam beneficiary cylinders have also been reported. Initially, because of the waiting list for LPG connections, there was interest in obtaining diverted Deepam connections. However, the level of interest declined with time as the waiting list was eliminated and LPG cylinder connections became more readily available to the general public.

LPG consumption appeared to average about 3 kg per month per household. At this rate of consumption, wood (and other forms of biomass) remains the primary household fuel, with LPG used to supplement more traditional fuels. About 7 kg per month is estimated to be needed to meet the majority of cooking energy needs. As expected, LPG consumption was higher in urban areas where households are less likely to have access to free or cheap biomass, households with monthly cash income levels much higher than those in rural areas can still qualify as BPL, and the logistics of refill cylinder collection are less problematic than in rural areas. LPG consumption was negatively correlated with the amount of land and the number of cattle owned, reflecting the preference for using free biomass and animal waste as household fuels. A handful of wealth indicators examined in this study—possessions of durable consumer goods, having a kitchen inside the house rather than outside—were positively correlated with LPG consumption. LPG consumption did not increase with family size or the number of wage earners in the household.

There was universal consensus that the most significant advantage of using LPG was the time saved. Time was saved in two areas: fuel collection by women and children, and starting the flame for cooking. This made the use of LPG especially attractive for making tea, cooking rice and preparing food for unexpected guests. Having more time, some were able to work, earning more wages. However, the cost advantage is still in favour of cheaper or free fuels. LPG is used most extensively during the monsoon season when dry biomass was difficult to obtain and there was agricultural work to be done. In the summer, consumption falls because many cook outside, there is more free time because there is less agricultural work to be done, and dry fuelwood and crop residues are abundantly available.

There is less awareness about the health benefits of LPG use. Women have noticed the absence of smoke and the impact on eyes, throat and lungs. However, the consumption of LPG found in this study may not be high enough to have a significant impact on health. The health impact of partial switching to LPG requires further study.

Incidental, but significant in the rural social context, is the perceived improvement in social status and self-esteem among the poorer section, particularly among the members of Scheduled Castes and Scheduled Tribes.

### **Looking to the Future**

Because the Deepam scheme is a rare example of targeted capital subsidy for LPG, it provides valuable insights for designing subsidies to promote better energy services for the poor. The policy objectives of the Deepam scheme include (i) reducing drudgery among women and children from wood collection and cooking; (ii) improving the health of household members by reducing ambient concentrations of smoke and other harmful pollutants; and (iii) protecting forests from further degradation. The Deepam beneficiaries report time savings, cleaner house environment and improved social status as the main attractions of the scheme.

Achieving these objectives in a tangible manner would require substantial use of LPG as the primary fuel. This study found that for the majority of rural households, the incremental cost of substituting biomass with LPG was sufficiently high to deter significant switching to LPG. Instead, the financial considerations frequently limited the extent of LPG use to incidental uses (such as making tea or preparing meals for unexpected guests), or to when the opportunity cost of fuelwood use is high, such as during the monsoon season. Reliance on biomass as the primary fuel continues among the majority of Deepam beneficiaries.

Capital subsidy to alleviate the high upfront cost of energy service is generally acknowledged to be far better than operating-cost subsidies (such as fuel-price or power-tariff subsidies). However, capital subsidy facilitates access to quality service only if consumers can pay for the operating costs themselves so that a viable energy market can develop. This study shows that urban households are more willing to pay for LPG cylinder refills than rural households, because biomass is less available (and consequently more expensive) and cash income is probably more consistent and higher. In this regard the capital subsidy provided in the Deepam scheme has been better utilised in urban areas. But the question remains as to how to help the rural poor, the principal target of the Deepam scheme, to enjoy similar benefits of LPG connection.

The beneficiaries universally cited time savings in cooking as the chief benefit of LPG use. There is less awareness about the health benefits of LPG use. Women have noticed the absence of smoke and the impact on eyes, throat and lungs. Exposure monitoring in Andhra Pradesh and elsewhere indicates that unless LPG becomes the primary energy source, substituting the majority of biomass used, indoor air pollution levels remain high. At the level of LPG consumption found in this study, and given that fuelwood was reported to remain the primary energy source for the majority of households, health benefits of LPG connection remain low in rural areas.

The State Government of AP has decided to add an additional 1.3 million new connections under the Deepam scheme at a cost of Rs 1.3 billion. In this context, an

important question is whether and how a commercially viable market can be developed and sustained in rural areas. Currently, the development of such market is constrained by the low consumption level—an estimated average consumption of 30 kg of LPG per year. Given the dietary habits and energy needs of the target group, the consumption level might, at best, reach 60 kg per year. The fundamental issue is how to get the majority of the rural poor to the point of consuming much more LPG without offering a price subsidy.

The experience with the Deepam scheme has confirmed the worldwide experience with the household use of LPG. The uptake of LPG is strongly income-elastic at low income levels, so that the poor will use LPG sparingly. As long as free or cheap biomass is available, households will continue to use traditional fuels rather than LPG in the short run. Further, the Government of India plans to reduce the LPG subsidy to 15 percent in the near future. This will increase the end-user price of LPG and make it more difficult for low-income households to consume LPG. A silver lining, however, is that the awareness about the benefits of LPG has grown in rural areas and there seems to be a willingness to increase the use of LPG if some alternative to the high cost of refills can be found. The private sector has been considering the introduction of smaller cylinders, but the denial of “double subsidies”—universal price subsidy for LPG provided by the Centre Government, and the connection fee waiver provided by the State Government of AP—has made it difficult to launch a new cylinder size in AP in recent years.

An important consideration is the deregulation of the downstream petroleum sector by April 2002. One of the objectives is to create an open and competitive market with a level playing field; this is intended to increase efficiency in the sector and ultimately reduce the cost of service to consumers. Differential treatment given to state-owned oil companies and private sector LPG distributors (in the form of subsidies reserved exclusively for the former) goes against the spirit of sector deregulation and its objectives. By continuing to give not only a price subsidy but also a cylinder connection fee subsidy only to state-owned oil companies and their dealers, the Deepam scheme in its current form slows down the move towards a market-based petroleum sector that could facilitate higher LPG consumption in rural areas in the long run.

For the next stage of the Deepam scheme, the findings of the study point to several recommendations that may be considered by the Government of AP:

- Introduce a smaller cylinder size. If smaller cylinders can be introduced, not only will each refill cost be quite a bit less, enabling many households to refill more regularly; but also the initial cylinder deposit fee (basically covering the cost of cylinder manufacture), for which the State Government of AP is currently paying Rs 1,000, can be lowered. Smaller cylinders may therefore yield double benefits: more regular LPG consumption by the beneficiaries, especially in rural areas, and a lower subsidy bill for the government. It is important to stress, however, that international experience with smaller cylinders is mixed: negative aspects include (i) a much higher cost of cylinder management and hence higher per-unit LPG price and (ii) the need for households to refill more frequently. Therefore, market

- forces, not government policy, should guide the sizes of cylinders to be made available on the market.
- Allow the transfer of Deepam connections to other eligible beneficiaries in cases where the recipients find themselves incapable of purchasing refill cylinders. Some beneficiaries cannot afford LPG and view participation in the scheme, which requires the purchase of a stove and accessories, as a “dead investment”; and yet, under the current set of rules, they cannot transfer their connections.
  - Publicise the health benefits of reducing exposure to indoor air pollution to increase demand for cleaner cooking. Such public education campaigns should, however, be conducted in a broader context and emphasise a number of measures, including smokeless chullahs (improved stoves with chimneys) and separate kitchens, so that households can choose from several options. Awareness-building should also cover simple practices that can improve the health of household members at no additional cost, such as taking small children out of cooking areas and ventilating cooking areas better.

For others considering a comparable targeted capital subsidy scheme, the following additional considerations may be worth incorporating in the design of such a scheme:

- Rather than making the scheme universally available, consider concentrating on those areas where the availability of free or cheap biomass is diminishing. This will concentrate limited state financial resources on the households most likely to consume LPG.
- Bear in mind the importance of creating a sufficiently level playing field for all LPG distributors, in the spirit of sector deregulation and its ultimate objective of providing better service at the lowest cost.