

5

Role of LPG

5.1 The preceding chapters show that switching entirely to LPG for cooking and heating is one way of substantially reducing, if not eliminating, indoor air pollution from household fuel use. However, unlike biomass which may be collected by household members, the use of LPG requires cash outlays, a significant consideration for low-income households. These cash outlays include not only the purchase cost of LPG, but more importantly the start-up cost consisting of LPG cylinder and stove purchase. The start-up cost in turn is a barrier to many low-income households to using LPG. Further, international experience suggests that, even when government provides support to reduce the start-up cost, the poor are often not able to come up with cash needed to refill the cylinder on a regular basis to meet their household energy needs.

5.2 Because the requirement for cash makes it difficult for low-cash income households to use LPG, it is important to ensure that end-user LPG prices are as close as possible to “best practice” levels for comparable market environments elsewhere. Economically inefficient higher prices would otherwise constrain the penetration of LPG use into household markets lower down the income scale. Whether or not the end-user LPG prices in Guatemala are markedly higher than best international practice benchmark levels is therefore an important question to examine. Factors that might contribute to prices being higher could include:

Excessive market concentration, leading to possible market control and reduced competition

Fraudulent practices such as short-selling of LPG, so that the nominal price may seem reasonable but the actual price is much higher

Smuggling of new LPG cylinders out of Guatemala to neighboring countries. This causes excessive costs to the industry and constrains their investment in new cylinder stocks, which they would need in order to support market growth/penetration.

5.3 This study assessed the LPG market in Guatemala to gain a better understanding of some of the current and potential future problems that might discourage households

from using LPG. To this end, the market structure, institutional and policy framework, recent price history, and cylinder management were examined.

Fuel Use Patterns

5.4 Wood, LPG and kerosene are the most commonly used household fuels in Guatemala. According to the data obtained in the year 2000 National Survey of Living Conditions (ENCOVI '2000), over half of the households in Guatemala use a single fuel for cooking and heating—one-third use only wood and one-fifth use only LPG. Most others use multiple fuels. It is difficult to assign usage to kerosene because it is used for lighting as well as cooking and heating. However, it appears that the use of kerosene as a cooking or heating fuel is quite limited. The survey results are summarized in Table 5.1. Data on household income are not available, but household expenditures, including imputed values of items given in kind and those collected for free by household members, are used as a proxy for income. In the table the households are divided into five expenditure quintiles based on per capita expenditure, with the same number of individuals in each quintile. The top quintile is dominated by urban households, the bottom quintile by rural.

Table 5.1: Household Fuel Use Patterns for Cooking and Heating Percentage of Households in Each Category

<i>Per capita expenditure quintile</i>	<i>LPG only</i>	<i>LPG/kerosene</i>	<i>LPG/wood</i>	<i>LPG/wood/kerosene</i>	<i>Kerosene only</i>	<i>Kerosene/wood</i>	<i>Wood only</i>
Urban							
1 (poorest)	0.0	0.0	5.9	0.3	1.2	27.8	64.7
2	7.5	0.1	18.1	0.0	0.0	11.2	63.2
3	23.7	0.1	36.0	2.0	0.1	4.3	33.9
4	37.0	0.5	44.5	1.6	0.0	1.4	15.0
5 (richest)	73.2	0.6	22.5	0.7	0.0	0.2	2.7
Urban, average	45.4	0.4	30.0	1.1	0.1	3.4	19.6
Rural							
1 (poorest)	0.0	0.0	1.6	0.0	0.0	59.7	38.7
2	0.3	0.0	5.0	1.1	0.1	44.4	49.1
3	1.6	0.2	16.7	2.2	0.0	28.9	50.5
4	5.7	0.0	36.5	5.2	0.0	18.0	34.7
5 (richest)	20.4	0.3	43.0	9.2	0.5	8.2	18.3
Rural, average	2.6	0.1	13.6	2.1	0.1	39.4	42.2
National	19.0	0.2	19.9	1.7	0.1	25.6	33.6

Source: Heltberg (2003)

5.5 In urban areas, close to a half of households use only LPG for cooking and heating. As expected, the percentage of LPG-only users increases with increasing

expenditure quintile. Among low expenditure households, wood is the most common fuel, used by close to two-thirds of urban households.

5.6 In rural areas, the most common fuel combination among the bottom quintile households is kerosene/wood. However, in many of these households, kerosene is likely used for lighting rather than cooking and heating for which wood is the primary fuel. Therefore, many of the households in the kerosene/wood category may actually be single-fuel users for the purpose of cooking and heating. Even among the top quintile households, it is more common to supplement LPG with wood than to switch entirely to LPG.

5.7 Access is an issue with LPG. If there are no LPG dealers in the area, even those households that could otherwise afford LPG cannot use it. Table 5.2 shows the availability of LPG in different regions of the country, the uptake rate, and the coverage (availability multiplied by the uptake rate). The vast majority of urban households have access to LPG, compared to only a little over half of rural households. Less than a third of households in the Northwest region have access to LPG, the lowest of any region in the country. Only a third of the “extreme poor” live in areas where LPG is available. Access increases with increasing household expenditure, suggesting that the well-off tend to live in areas with better infrastructure and enough LPG purchasing households to justify setting up LPG dealerships, while many of the poor are isolated in remote areas. Similarly some indigenous groups have low access to LPG.

Cost of LPG Consumption

5.8 LPG is a gas and needs to be stored under pressure in a cylinder. Cylinder management is one of the unique features of LPG trade. It is also what makes the start-up and distribution costs of LPG much higher than for solid or liquid fuels, especially with respect to delivery in rural areas. Even if LPG had the potential of becoming the primary cooking fuel in rural areas, many rural areas lack economies of scale for cylinder distribution because of much lower population density. If in addition 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 dealerships.

**Table 5.2: LPG Availability and Uptake by Households
Percentage of Households in Each Category**

<i>Parameter</i>	<i>Availability</i>	<i>Uptake</i>	<i>Coverage</i>
National	74	61	45
Urban	98	79	77
Rural	55	37	20
Region			
Metropolitan	96	86	83
North	44	35	15
Northeast	86	53	46
Southeast	71	45	32
Central	87	57	50
Southwest	72	50	36
Northwest	30	46	14
Peten	60	38	23
Poverty			
Non-poor	91	79	72
All poor	53	25	13
Extreme poor	33	4	1
Per capita expenditure quintile			
1 (poorest)	38	6	2
2	61	29	18
3	80	55	44
4	92	80	74
5 (richest)	98	90	88
Ethnicity			
Non-indigenous	85	69	59
Indigenous	56	42	24
Quiche	73	52	38
Q'eqchi	45	30	14
Kaqchiquel	80	46	37
Mam	32	28	9
Other groups	39	34	13

Source: Foster and Araujo (2001)

5.9 The majority of LPG is sold in 25 pound (lb.) cylinders, as shown in Table 5.3. While much smaller cylinder sizes have been marketed to enable the poor to buy LPG more regularly by making the cash payment for each refill smaller, international experience with smaller cylinder size 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. The latter is especially a problem in areas where LPG cylinder delivery presents logistical problems.

Table 5.3 Cylinder Sizes in Guatemala

<i>Cylinder Size in lb.</i>	<i>Share of cylinder LPG market</i>
20	0.5%
25	77.0%
35	17.0%
40	1.5%
60	1.5%
100	2.5%

5.10 As mentioned above, the start-up cost of LPG is a significant barrier to LPG uptake in developing countries. The costs of purchasing an LPG cylinder, accessories and a stove are shown in Table 5.4. The figures are based on buying the equipment in one cash payment. If the retailer finances the purchase for the buyer over three equal monthly payments, the total cost increases by about 20 to 25 percent. This means, for example, that the two-burner package would cost about US\$65 spread over three payments of US\$22 each.

Table 5.4: Retail Cost of LPG Cylinder and Stove

<i>Item</i>	<i>Quetzales</i>	<i>US\$</i>
25 lb. cylinder, valve/regulator tubing, with about 5 to 10 lb. of LPG	250	31.60
All the above plus 2 burner stove	425	53.80
All the above with 3 burner stove	470	59.50

Data as of May 2002

Source: Matthews, W (2002)

5.11 To appreciate how these expenses compare to the overall household expenditures, Table 5.5 shows mean monthly expenditures per capita as well as household in different quintiles. For the bottom quintile, the start-up cost, after taking account of the consumer price index, in one payment is close to two-fifths of the monthly household expenditure. Even installments in three equal payments can amount to a sixth of the total household expenditure, and exceeds the monthly per capita expenditure. Given that expenditures calculated here include imputed costs, the percentage of actual cash expenditures would be even higher, especially in rural areas engaged in agriculture.

Table 5.5: Mean Monthly Per Capita and Household Expenditures in Quezales (from ENCOVI 2000)

<i>Region</i>	<i>Expenditure</i>	<i>Quintile 1</i>	<i>Quintile 2</i>	<i>Quintile 3</i>	<i>Quintile 4</i>	<i>Quintile 5</i>	<i>Average</i>
Urban	per capita	141	224	326	521	1,588	1,011
	per household	1,056	1,389	1,913	2,590	5,642	3,941
Rural	per capita	132	221	325	497	1,056	363
	per household	975	1,321	1,805	2,140	3,455	1,728
National	per capita	133	222	325	509	1,477	643
	per household	981	1,332	1,839	2,368	5,185	2,685

Souce: Heltberg (2003)

5.12 Retail prices throughout Guatemala during the last week in April 2002 are shown in Table 5.6. There is about 50 percent variation in price from region to region, ranging from the lowest in Guatemala and El Progreso to the highest in Jutiapa. The rationale for price differentiation by location is generally a combination of logistics costs as well as scale of storage, bottling and distribution operations. Guatemala City, although not the closest location to the main receiving points, has by far the largest scale in terms of storage, bottling and distribution operations. Degree of market competition may be a factor in the nature of price differentiation in some locations but is not believed to play a significant role. With the exception of Jutiapa and Jalapa, most upcountry locations had price differentials over the capital of Q. 2 to 6 per cylinder. Jutiapa and Jalapa are special cases: the total LPG market is very small and, since they are close to the El Salvador border, most of it is supplied through smuggling (“contrabando hormiga”), since El Salvador prices are low. The price shown is for the single dealer in each area; this dealer supplies LPG sourced through Guatemalan channels, but in fact sells very little. The effective average price to the public, in these two population areas including El Salvador supplies at low price prevailing in that country, would be much lower than the dealer price shown in the table.

**Table 5.6: Retail Prices of LPG sold in 25 lb. Cylinder
Week of April 22-28, 2002**

<i>Location</i>	<i>Quetzales/cylinder</i>
Guatemala City	38.00
Escuintla	44.00
Retalhuleu	42.50
Cobán	42.75
Petén	46.50
Huehuetenango	44.33
Quetzaltenango	40.00
San Marcos	42.33
Chiquimula	40.60
Santa Rosa	41.13
El Progreso	38.00
Zacapa	43.00
Jutiapa	57.83
Jalapa	57.50

Source: Matthews (2002)

Institutional and Regulatory Framework

5.13 The regulatory framework for the Guatemala's hydrocarbon sector was substantially reformed by the Marketing of Hydrocarbons Law of 1997 and its General Regulation which include LPG as one of the petroleum products and subjects it to the general health, safety and environment (HSE) rules and a few special provisions for the licensing of LPG storage, transport and distribution facilities and operations. Otherwise, a specific regulatory framework for LPG does not exist in Guatemala.

5.14 According to the applicable legislation, the Comisión Guatemalteca de Norms (COGUANOR, Guatemalan Commission for Standards) is the only government body in Guatemala authorized to prepare and issue norms and standards. However, in practice, confusion has arisen due to the fact that various other government entities, including the Ministry of Energy and Mines, are adopting international standards or have put in effect other instruments which are called norms, but frequently are mixtures of technical standards, regulations and manuals of procedure. According to Article 71 of the Marketing of Hydrocarbons Regulation No. 522 of 1999, the Dirección General de Hidrocarburos (DGH, General Directorate of Hydrocarbons) as the enforcement agency for the hydrocarbon sector, is authorized to issue instructions, manuals and circulars

relative to the publication and compliance with quality specifications, HSE rules, inspection procedures and other requirements as to the location, construction, operation and maintenance of petroleum installations. The relationship between those overlapping rule making authorities should be clarified by legislative action.

5.15 The regulatory framework for the petroleum sector in general, and specifically for the LPG supply, consists to a large extent of general references to international standards. In practical terms, the generality of those references makes it nearly impossible for the users as well as the enforcement agency to define the exact rules for each particular case. This creates a high degree of uncertainty for the operators and leaves too much discretion within the inspection and sanctioning process.

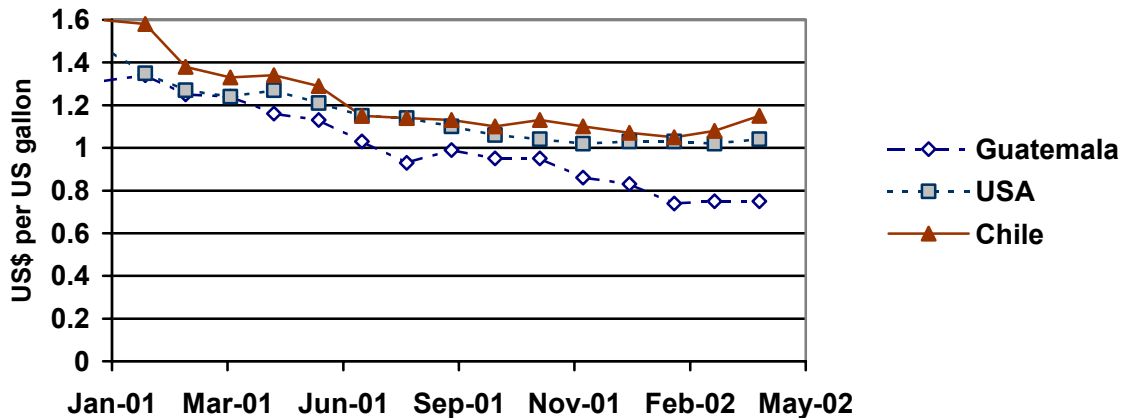
5.16 In highly developed jurisdictions, such as most of the United States and Europe as well as a few developing countries, the successful approach has been to issue general regulations which define the institutional attributions, licensing requirements and enforcement authorities with relatively few technical specifications. The latter are covered by the formal adoption of internationally accepted norms and standards under the respective general legislation. The adoptions are made by specific, rather than general, references to individual standards and codes of practice and include exceptions and other adaptations according to local requirements.

Market Structure and Competitiveness

5.17 The LPG market in Guatemala is dominated by the two Mexican Zaragoza family groups TOMZA (Tomás Zaragoza) and ZETA (Miguel Zaragoza). Starting some time around early 2001, ZETA began to pursue an aggressive business strategy incorporating logistics, pricing, vertical integration, acquisitions and market penetration. The logistics and market positions of the two dominant companies are so strong that it is difficult to envision the possibility of new entry to the market, particularly while ZETA is in the price-cutting mode. In view of those circumstances, the main issue of some concern to DGH officials was that of excessive market concentration. Although this market concentration has led to potential for market control and reduced competition, it has not as yet manifested itself in higher margins and prices. The caution to both DGH and anti-monopoly authorities would be to remain vigilant to possible future moves to increase margins and prices to monopolistic market levels.

5.18 A comparison of LPG small cylinder prices exclusive of taxes in several countries was carried out in this study. As Figure 5.1 shows, LPG prices in Guatemala in recent months have fallen sharply relative to other countries as a result of strong price-cutting practiced by ZETA who has set the objective of capturing 75 percent of the Guatemalan LPG market. As such, imputed margins for supply and distribution of the product to final consumers rank among the lowest in the region at present.

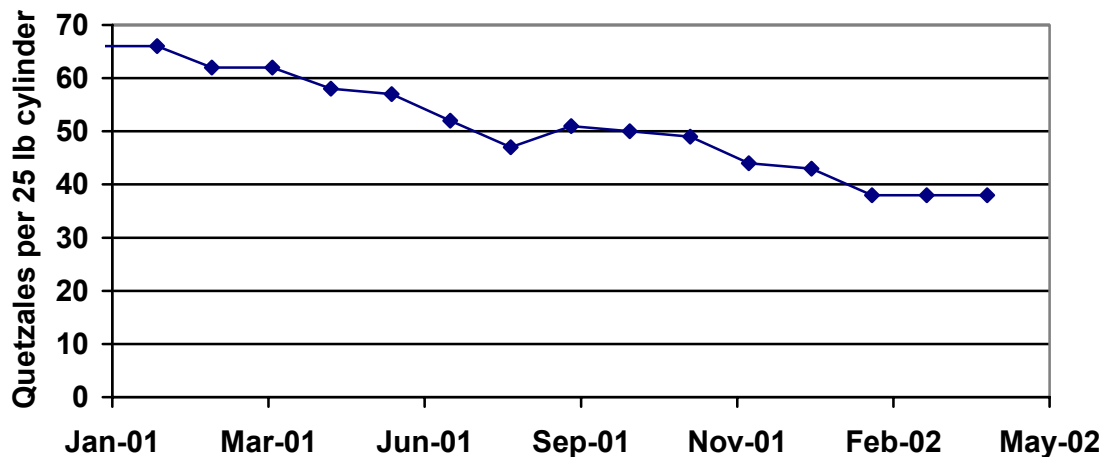
Figure 5.1: Comparison of LPG Prices Exclusive of Taxes



5.19 As a result, the retail price of LPG has fallen steadily in recent months, nearly halving between January 2001 and April 2002 as shown in

Figure 5.2. If these low margins can be maintained for a long time, then consumers benefit considerably. However, if this is a result of aggressive price-cutting to reduce competition, then these price drops represent at best a temporary relief before large price rises. In particular, those who have decided in recent months to take up LPG because its low cost has made it affordable would be especially adversely affected by such price rises.

Figure 5.2: Price of LPG Sold in 25 lb. Cylinder in Guatemala City



Commercial Malpractice

5.20 The issue of short selling of LPG was discussed with DGH officials in this study. The Sección Gas (Gas Section) of Departamento de Transformación y Distribución (Department of Manufacturing and Distribution) has responsibility for the supply and distribution chain up to and including the filling of cylinders. The Departamento de Licencias (Licensing Department) has the responsibility downstream of this—cylinder transportation, retailing and end-use. As part of their duties the Sección Gas inspectors do spot checks on cylinder filling equipment and practices. They had no records confirming any major problem at this level, but there is a possibility that there might be cylinder “decanting” malpractice downstream of the filling plant. There were no records as to the extent of this problem. The consumer protection body “DIACO” of the Ministerio de Economía (Ministry of Economy) is charged with this responsibility in its role of surveillance and enforcement of weights and measures. The Licensing Department also deals with issues concerning the final, household consumer of LPG, but these are mainly issues of safety in terms of the consumers’ equipment setup and practices.

5.21 The smuggling of new LPG cylinders out of Guatemala to neighboring countries was not highlighted as a major problem by either DGH officials or the operators in relation to the overall problem of maintenance and renewal of the cylinder stock in general. It was mentioned that there was a certain amount of small-scale smuggling (“contrabando hormiga”) mainly targeting the high-quality “Sherwood” valves rather than the cylinders themselves. In this type of operation it was common to see an exchange of valves, replacing (and retaining) the Sherwood valves in place of lower-quality Chilean or Mexican models.

Safety and Cylinder Management

5.22 The existing legislation and regulations provide the DGH with wide ranging authority and sufficiently defined faculties for supervision, inspections and sanctions of the supply chain of all products, including LPG. By adopting the principal international standards by specific reference, it could maintain a very efficient enforcement system, if it had the necessary political support, sufficient staff and technical means. The present personnel and other resources of the DGH appear, however, to be insufficient to inspect and control the installations and operations of the LPG supply chain with appropriate frequency and rigor.

5.23 The ownership of the cylinders in Guatemala has not been established by law or regulation or in any other means. Although the total stock of cylinders is estimated to be about 4 million, the number of cylinders in circulation is not known with any precision, nor is it known how much repair and replacement is needed. Any cylinder may be filled

at any filling plant regardless of its color—the distribution companies paint their cylinders in different colors in order to create their identity in the market place—or markings. No rules exist for the exchange of cylinders or any related mechanism, and no formal exchanges between companies need to take place because cylinder ownership has not been defined. No rules exist concerning the painting or marking of cylinders for identification purposes. In spite of regulations establishing quality and maintenance standards for LPG cylinders, the lack of ownership definition means that there is effectively no legal responsibility defined to maintain or repair the cylinders and valves.

5.24 In the worldwide LPG market there are two principal methods of cylinder ownership: LPG company owned and customer owned.

Company owned: The company either loans or leases the cylinder to the customer. The customer exchanges an empty cylinder for a full one paying only for LPG. The company is responsible for filling and supplying safely maintained cylinders. It is common to have the owner's investment secured through a system of refundable deposits or guarantees in cash.

Customer owned: There are two modalities under this scheme.

- 1) Centralized cylinder filling and distribution system. Upon replenishment, the customer exchanges a legally owned cylinder for one of like kind. Since the customer does not have physical possession of the same cylinder brought to the exchange transaction, the customer is not responsible for replacement at the end of the cylinder's useful life. The LPG supplier has the responsibility of maintenance and replacement, since the initial cylinder is somewhere in the inventory "float".
- 2) Bulk distribution, "mini-filling plant" system. The customer has a personally identified cylinder and brings it to the local filling plant to be filled and then taken away. The customer retains the same cylinder through its life and is responsible for any maintenance or replacement. The key safety element in this system is the diligence of the mini-plant operator in rigorously inspecting and rejecting as necessary any sub-par cylinders. The customer with a sub-standard cylinder must be refused a filling, unless a new cylinder is purchased. In this case, the filling plant or its supplier would have the responsibility to recycle or dispose the used cylinder in an appropriate manner.

5.25 Guatemala fits the centralized cylinder filling and distribution system, since it has been the practice in Guatemala to sell LPG cylinders to final consumers but the customer does not retain the same cylinder at the time of refill. Looking at countries in the region, both Chile and Brazil have the system of company owned cylinders with refundable deposits. The two principal countries that have the bulk distribution system with localized filling plants are the United States and Canada.

5.26 The system in Chile may offer useful lessons for Guatemala. One of the positive features of the company-owned, refundable deposit system of Chile are clear rules and regulations on the interchangeability of cylinders of the different companies. This means that each operator is assured of retaining most of its cylinder stock for its own use, thus making it worthwhile for it to spend money from its margin on cylinder rehabilitation and replacement. It is strongly recommended that the Government of Guatemala investigate the possibility of converting its cylinder management system to that of company owned cylinders using the Chile regulatory framework as a model.

Conclusions

5.27 There are no obvious market or regulatory distortions in the cylinder LPG market in Guatemala that could be said to be deterring more widespread use of LPG by households. In the last couple of years the situation, if anything, has been favorable to LPG use because of steadily falling LPG price. One worrying sign is increasing market power concentration, potentially reversing the recent price trend. Government needs to anticipate future changes in the sector and keep one step ahead to avoid negative characteristics of a duopoly or a monopoly.

5.28 There are indications that some households are paying as much cash to purchase wood or kerosene as they would were they to switch to LPG (Heltberg 2003). An understanding of why these households that can seemingly afford LPG are not yet using LPG may help expand the LPG market in the future and reduce exposure to indoor air pollution. A large fraction of the cylinders currently in circulation are estimated to require retirement and renewal in the near future. A better cylinder management system needs to be put in place, for which the regulatory framework in Chile may serve as a useful example.