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Pay-As-You-Go for LPG Supply - Exploring a New Business Model to Enhance Access to Clean Cooking Solutions in Urban Areas in Ghana

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Abstract

In Ghana, the vast majority of households (72.7%) still rely on wood and charcoal as their main cooking fuels. Liquefied petroleum gas (LPG) is used as the main cooking fuel by just 40.5% of urban households and by only 9.1% of rural households. The key reason is the lack of availability of clean cooking solutions, such as LPG, within a reachable distance and at an affordable price. Indeed, the high initial expenditure for LPG adoption, the need to buy the cylinder and the stove is a critical barrier for low-income households.

The objective of this study is to offer a brief assessment on the potential of providing LPG (fuel and stove) to urban areas in Ghana through the pay-as-you-go (PAYG) model to alleviate the aforementioned problems.

By reducing initial expenditure, eliminating the need to buy a whole cylinder of fuel and exchanging the LPG cylinders when needed, the model will be mitigating both affordability and accessibility problems.

The LPG market is in expansion, and there are more than two million urban households yet to be served. It is an interesting opportunity for companies already operating in the LPG supply chain, especially as a pivotal business model for the companies currently operating refilling stations that, with the implementation of the new cylinder recirculation model, are under threat of closure.

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In general, the PAYG model can benefit from current and future policies that aim to promote LPG and regulate the charcoal supply chain. Specifically, the new LPG recirculation model creates momentum, although its final implementation is still uncertain. In addition, mobile money is becoming more and more popular, and the country is well served by telecom operators. At the same time, although current LPG infrastructure is still limited, efforts are being made to enhance storage, depots and refilling facilities.

The implementation of this solution has several challenges, many of which can be solved with good management. In this sense, it is important to understand and manage the inherent risks of the PAYG model (high working capital and financing up-front expenditure) and the market risks (volatility of oil prices and foreign exchange risks). Finding a partner to provide the LPG smart-meter technology is another crucial aspect to take into consideration. If these barriers are overcome, we believe that the new LPG model could create excellent momentum to implement such business.

Keywords:

Ghana; Cooking; Fuels; Energy Poverty; Clean Cooking Solutions; LPG

Contents

1. Introduction

In Ghana, the vast majority of households (72.7%) still rely on wood and charcoal as their main cooking fuels. Liquefied petroleum gas (LPG) is used as the main cooking fuel by just 40.5% of urban households and by only 9.1% of rural households. The key reason is the lack of availability of clean cooking solutions, such as LPG, within a reachable distance and at an affordable price. Indeed, the high initial expenditure for LPG adoption—the need to buy the cylinder and the stove—is a critical barrier for low-income households.

The new LPG cylinder recirculation model being introduced in the country (currently in pilot phase) has the potential to improve the availability of LPG throughout the territory. However, it could negatively impact affordability, as with the new model the customer must exchange the whole cylinder each time—it no longer being possible to refill small quantities.

The objective of this study is to offer a brief assessment of the potential for implementing a specific business opportunity in Ghana that could help alleviate the problems described: providing LPG (fuel and stove) to urban areas through a pay-as-you-go (PAYG) model.

For a better understanding of the market in Ghana, we recommend complementing the reading of this report with our report entitled "The Cooking Fuel Sector in Ghana."

Example of a Company Using a PAYG Model for LPG — How It Works

Operating in Tanzania, KopaGas delivers customers a kit composed of a full LPG cylinder attached to a smart meter, a burner and a stove for a total value of about US$100, upon an up-front payment of only 10% (US$10). Customers then ensure their supply of gas through the payment of installments as small as US$0.30–US0.50 per day by mobile. Through the mobile, customers are also able to monitor their gas account and can decide when it is time to top it up for the amount they desire. The smart meter serves to switch off the butane flow if the client runs out of credit, and also to remotely monitor the level of gas in the customer's cylinder, registering when it is time to pick up the empty bottle and deliver a full one.

To recover the cost of the stove and the financial costs of the working capital needed to provide a full cylinder of gas—which a customer could take weeks or months to consume—the company has to include these costs in the LPG retail price or apply a specific charge or installment. Therefore, the LPG prices could be higher than that of competitors.

This business model is most suitable for urban and semi-urban areas, as it requires some level of density to optimize transportation and logistics costs.

Value Proposition Elements

The model serves to:

- reduce initial expenditure: the cylinder, fuel and stove are provided upon the payment of a fraction of their prices.
- reduce the need to buy a whole cylinder of fuel: the client can top up small quantities of credit.

- provide flexibility: clients can adapt the payments and usage of LPG to their cash flow, which is especially important for those that do not have a steady income.
- improve availability and convenience by bringing the LPG cylinders to the households and exchanging them when needed.

Who Could Implement It?

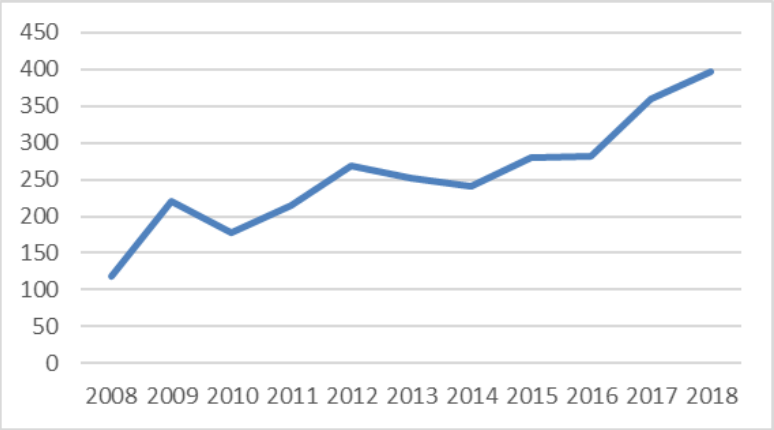
It is an interesting opportunity for companies already operating in the LPG supply chain, especially as a pivotal business model for the companies currently operating the refilling stations that, with the implementation of the new cylinder recirculation model, are under threat of closure.

2. LPG Market

Evolution, Shares and Potential in Urban Areas

The demand for LPG has been growing at an impressive 13% compound annual growth rate (CAGR) during the past decade (see Figure 1), demonstrating the increasing willingness to switch to modern fuels. This growth has been driven by consumption in urban areas, where 40.5% of households already use LPG, as they usually have higher incomes and better access to LPG refilling stations (see Figure 2).

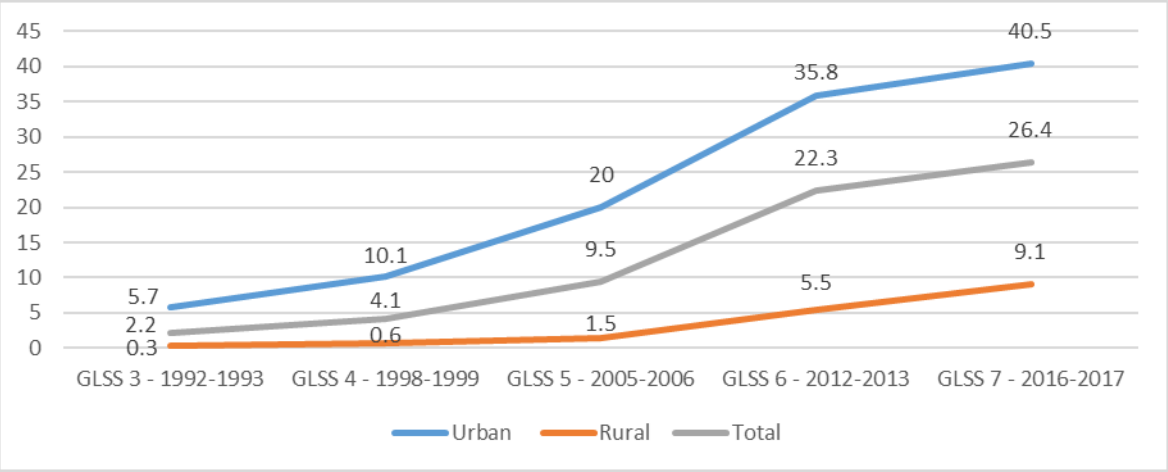
Figure 1
LPG Supplied to the Economy (in Kilotonne), 2008–2019



Source: (Energy Commission of Ghana 2019)

Note: The graph represents the total demand for LPG, not just for cooking purposes.

Figure 2
LPG Adoption Over the Year (in Percentage of Households) by Urban/Rural Locality, 2016–2017



Source: Prepared by the authors based on data from Ghana Statistical Service, Ghana Living Standard Surveys.

In 2018, LPG demand reached 389 kilotons.[1] Considering that an estimated 37% of LPG is used by vehicles, it leaves approximately 245 kilotons of LPG that were traded for cooking or heating purposes. At an LPG retail price of around 5 Ghanaian cedis per kilogram (price as of March 2019), this leads to a current market size of LPG for cooking of 1,226 million Ghanaian cedis, which corresponds to approximately US$245 million,2 of which US$208 million accounts for urban areas.

Although the current rate of 40.5% of urban households using LPG as a cooking fuel is high (if compared with other countries in the region), there are still more than two million urban households to serve.

If the figures are extrapolated to an LPG penetration of 100% of urban households, the urban LPG market could reach 514 kilotons (US$515 million), an attractive market for new players (see Table 1).

[1] 2018 demand calculated as (= 2018 production + 2018 imports 2018 - 2018 exports) = (87.9 + 306.2 - 4.8 = 389.3) based on data from the (Energy Commission of Ghana 2019). However, the Energy Commission indicates, in this same source, that LPG supplied to the economy is, indeed, 396.8 kilotons, while our calculation indicates 389.31 kilotons. The difference could be stocks, statistical differences or an error.

[2] Exchange rate used: 5 Ghanaian cedis = US$1.

Table 1
LPG Market Size

Current market			
	Tonnes (2018)	Households using LPG (2017)	Million US$
Total demand	389,300		389
Cooking and heating purposes	245,259	1,691,573	245
Urban areas	**208,469**	**1,437,826**	**208**
Maximum potential market—100% LPG penetration in urban areas			
	Tonnes	Households	Million US$
Urban areas	**514,737**	**3,550,189**	**515**

Source: Prepared by the authors.

Notes: (i) Estimated as 63% of total; (ii) Estimated considering a household LPG penetration rate of 26.4%, a population of 28.8 million and 4.5 inhabitants per household; (iii) Estimated as a proportion of the total LPG used for cooking and heating purposes, considering an LPG penetration rate of 40.5 in urban areas and an urban population of 15.9 million.

3. Suppliers: Fuel and Technology

In terms of fuel supply, most of the LPG is imported. Indeed, in 2018, just 33% of the total supply came from the local production at Atuabo Gas Processing Plant. The country has vast reserves of natural gas that, if extracted in a steady flow and coupled with adequate processing facilities, could meet LPG domestic demand in the future.

However, under the current situation, most of the supply is likely to come from imports, which creates two significant risks for any LPG business in the country: the volatility of LPG prices in the international market; and the foreign exchange risk, both of which are relevant threats under the current scenarios of increasing oil prices and devaluation of the cedi, the Ghanaian currency.

In terms of technology, the model requires the usage of a smart meter integrated with a platform to manage mobile payments and communicate with customers' mobile phones, monitor gas levels, control stocks, and optimize logistics and the distribution routes. Developing a proprietary LPG smart meter and the ancillary technology needed would require significant research and development (R&D) investment and could take years. Therefore, finding a technology partner or supplier that could provide an already developed solution is a key challenge to implement this model in a cost-effective way. However, there are few providers of such technology, given the innovative nature of the solution, and especially of the LPG smart meter. (KopaGas, in Tanzania, is one of the providers.)

4. Business Environment and Policies

What is the Government's Position Regarding This Solution?

The government has been promoting the use of LPG since 1989 through several programs, including —in the past—subsidies. The current aim of the government is to provide LPG access to 50% of Ghana's population by 2020. To achieve this goal, several measures are being taken.

In the table below (see Table 2), we summarized the main policies and measures, evaluating their prospective impact on the PAYG LPG business model.

Table 2
LPG Measures' Impact on the LPG PAYG Model

Policy/Measure	Impact on the LPG PAYG Model
Achieve 50% LPG access rate by 2020	The PAYG model could help reach this goal, especially in urban areas. Therefore, it is not expected that public policies will create barriers to the model.
LPG prices have not been subsidized since 2013, prices have been liberalized since 2015	The fact that there are no price distortions, and companies are free to set up prices according to market forces, is beneficial to the model.
LPG cylinder recirculation models (pilot phase): cylinders will be filled at designated bottling plants for onward distribution to retail outlets, substituting the current model where customers refill their own cylinders at refilling stations	In the PAYG model, the cylinders have to be refilled in a bottling plant and later distributed to clients. Therefore, the new recirculation model will facilitate the PAYG model. In addition, one of the drawbacks of the recirculation model is that the customers have to buy a whole cylinder of gas (it no longer being possible to refill small quantities), which creates a problem of higher initial expenditure. The PAYG model helps solve this barrier as the customers pay for the gas as they use it. On the other hand, with the recirculation model, it is expected that there will be many more retail points selling filled LPG cylinders. This could reduce the attractiveness of delivery to the door, one of the selling points of the PAYG model.
Rural LPG Promotion program (ongoing): free distribution of stoves and cylinders in rural areas	As the business should be, at least initially, set up in urban areas, it would not be directly impacted by rural policies. However, in the long run, any subsidies or donations provided to the rural population could jeopardize future expansion to rural areas or create a parallel market of unused stoves and cylinders. Indeed, the main barrier that the PAYG model tackles is the high initial expenditures—the same problem being addressed by the Rural LPG Promotion program.
Recapitalization of the Ghana Cylinder Manufacturing Company (GCMC) to expand production capacity (ongoing)	It improves the supply of cylinders in the country, which is positive to the solution explored in this document.
Renewable Energy Master Plan (to be implemented): it promotes renewable cooking fuels, such as pellets and briquettes, combined with improved cookstoves, and it aims to improve the efficiency of the charcoal supply chain	This plan promotes alternative clean cooking solutions that are LPG substitutes. However, as the market is still very large, these efforts are not expected to threaten the expansion of LPG, especially in urban areas.
Wood fuel regulation (future)	It is expected that this future regulation will introduce wood and charcoal production controls. Therefore, it is possible that charcoal prices will increase in the near future, which could make LPG more competitive.

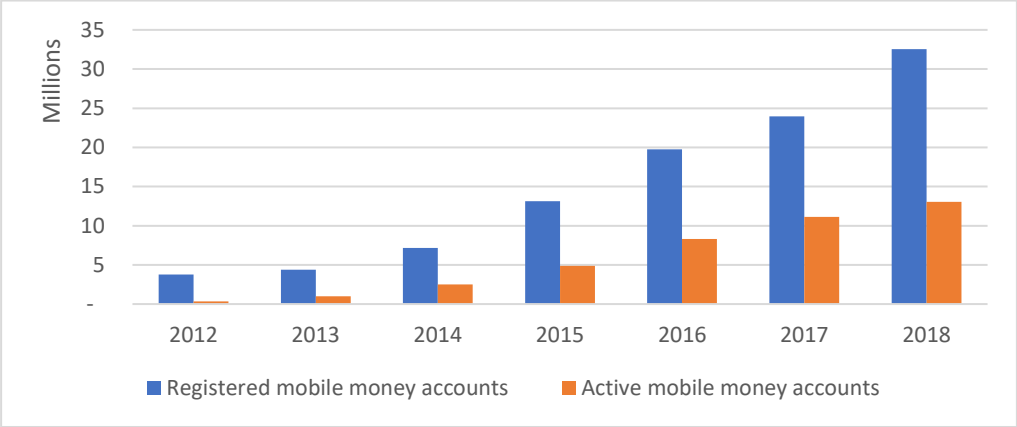
Source: Prepared by the authors.

Are There Other Market, Political or Cultural Circumstances That Could Promote or Jeopardize the Solution Proposed?

Several facets must be considered, including:

- Safety concerns: LPG has a bad reputation among part of the population, since several accidents/explosions happened in refilling stations and households in the past.
- The LPG market in Ghana is experiencing a moment of high uncertainty. Although the cylinder recirculation model has been officially announced in the media and a pilot is being tested in the Kumasi region, there is no official regulation backing the change yet. Several details are still to be defined, and the new model is facing strong resistance at the current LPG refilling stations, as many of them are about to have their outlets closed.
- Mobile money penetration is high in the country, with 29.5 million mobile accounts registered, of which 12.7 million are active—equivalent to a penetration rate of 69% (of the adult population). There are three mobile money operators: MTN, AirtelTigo and Vodafone. In addition to the growth of mobile money accounts (see **Figure 3**), the number of transactions per active user has increased from 52 in 2012 to 111 transactions in 2018.

Figure 3
Registered and Active Mobile Money Accounts (Cumulative), 2012–2018



Source: Prepared by the authors based on data from (Bank of Ghana 2019).

Note: Active mobile money accounts refers to the number of accounts that transacted at least once in the 90 days prior to reporting.

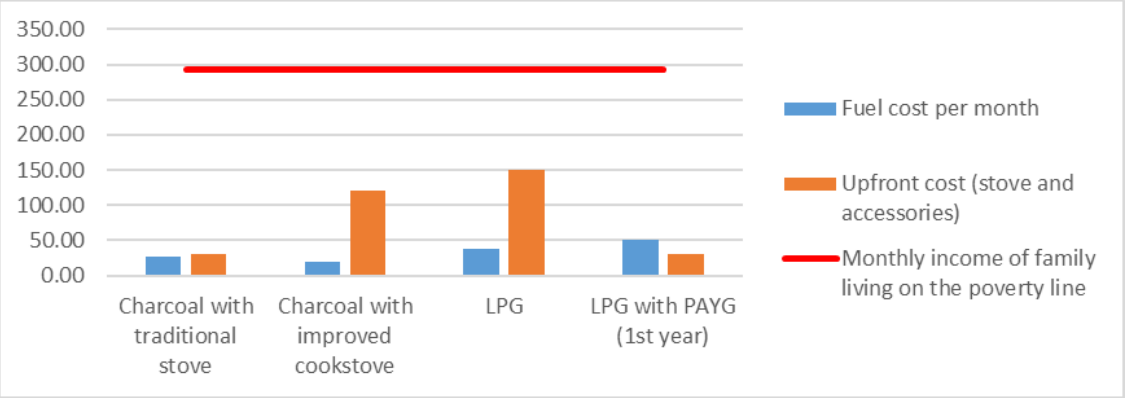
5. Comparison With Substitutes

In **Figure 4**, we compare the initial and monthly expenditure of four cooking alternatives: charcoal with traditional cookstoves; charcoal with improved cookstoves; LPG; and LPG using PAYG. For the LPG PAYG option, we are assuming that:

- In the first order, the client pays only 20% of the initial costs (stove and cylinder).
- The rest is split in 12 monthly installments, with an interest rate of 2% per month.
- The price of the fuel is increased by 2% to cover other financial cost (working capital).

As a result, the up-front cost defined is very competitive—the same as a traditional charcoal stove—while the monthly cost, during the first year, is increased by 32% in relation to the normal price of LPG. From the second year, with the stove and cylinder paid, the fuel cost is only 2% higher, to cover the working capital of the fuel.

Figure 4
Comparison of Initial and Monthly Costs of Charcoal, LPG and LPG PAYG, Adjusted for Stove Efficiency, in Ghanaian Cedis



Source: Prepared by the authors.

The net present value (NPV) of LPG using the PAYG model is similar to the NPV of the usual LPG model, as the client is not overcharged for financing the stove and cylinder (see Exhibit 1 and Exhibit 2, at the end of the report). However, charcoal is still a cheaper alternative. Therefore, LPG PAYG should be targeted at the customers who, willing to switch to a much cleaner source, such as LPG, see the up-front cost as the main barrier, as well as at those who want a convenient delivery and the flexibility of paying according to usage.

6. Barriers

The main challenges to overcome, to successfully implement the business, are summarized below:

- Policy: although the PAYG model could work under the current regulatory framework, there are more chances of succeeding with the new cylinder recirculation model, which is yet to be implemented. It is a moment of high uncertainty in the country's LPG business.
- Procurement strategy: the high volatility of LPG prices in the international markets can rapidly affect the retail price. Therefore, good procurement and hedging strategies are extremely important—especially in the PAYG model, where there is a significant gap between the moment of LPG procurement in the international market and the time when the customer uses and pays for it.
- Financing: the model demands high working capital, as the company must finance the LPG supply for several months (from procurement to the moment the client buys the credit to use LPG). Under the current scenarios of high interest rates and the devaluation of the Ghanaian cedi, finding the right financing strategy for the PAYG model remains a key challenge.

- Logistics and infrastructure: in general, logistics costs in Ghana are relatively high, due to a limited infrastructure and poor road conditions. In addition, specific LPG infrastructure, such as depots and storage facilities, is limited. Therefore, it could be difficult to extend the business model outside urban areas.
- Technology provider: there are few providers of LPG PAYG technology (smart meter); KopaGas, for example, is one of them. Reaching an agreement with one of these providers is key.

7. Conclusions

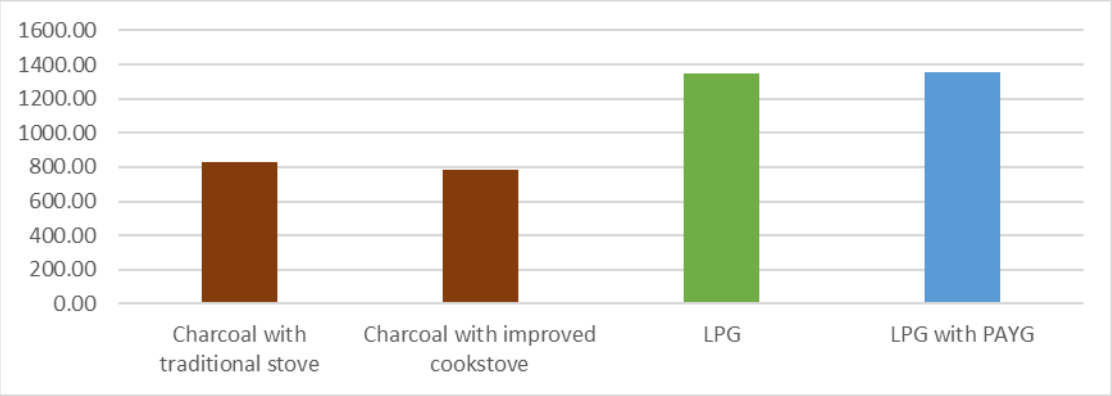
The PAYG model applied to the supply of LPG to households has a great potential in urban areas to mitigate both the problem of affordability and accessibility. The LPG market is in expansion, and there are more than two million urban households yet to be served. In general, the PAYG model can benefit from current and future policies that aim to promote LPG and regulate the charcoal supply chain. Specifically, the new LPG recirculation model creates momentum, although its final implementation is still uncertain. In addition mobile money is becoming more and more popular, and the country is well served by telecom operators.

Although the current LPG infrastructure is still limited, efforts are being made to enhance storage, depots and refilling facilities. There are several private LPG suppliers (LPG marketing companies) operating in the country, which shows that the market, despite difficulties, is working. Several operators could have some of their refilling stations closed as a consequence of the new cylinder recirculation model. For them, the PAYG could be an interesting pivotal business model.

The implementation of this solution has several challenges, many of which can be solved with good management. In this sense, it is important to understand and manage the inherent risk of the PAYG model (high working capital and financing up-front expenditure) and the market risks (volatility of oil prices and foreign exchange risks). Finding a partner to provide the LPG smart-meter technology is another crucial aspect to take into consideration. If these barriers can be overcome, we believe that the new LPG model could create excellent momentum to implement such businesses.

Exhibit 1

Comparison of Net Present Value of Charcoal (LPG and LPG PAYG) in Ghanaian Cedis (GHS) – 5 years period



Source: Prepared by the authors.

Exhibit 2

Data used for the calculation of the Net Present Value of Charcoal (LPG and LPG PAYG) in Ghanaian Cedis (GHS) – 5 years period

	price/unit in GHS	Unit	MJ/ unit	Stove efficiency	MJ of end use/unit	price/MJ of end use in GHS	Fuel cost per month (for a monthly final consumption of 212 MJ)	Up-front cost (stove and accessories)	Life span (years)	NPV 26% interest rate	Example of stove
LPG	4.98	1 kg	45.21	0.62	28.03	0.178	37.80	150.00	5.00	1345.26	6 kg cylinder + stove, 1 burner
LPG with PAYG model	5.08	1 kg	45.21	0.62	28.03	0.181	49.90 (1st year) / 38.56 (from 2nd year)	30.00	5.00	1357.24	6 kg cylinder + stove, 1 burner
Charcoal with traditional stove	0.76	1 kg	32.65	0.18	5.88	0.129	27.43	30.00	2.00	829.46	large coal pot
Charcoal with improved cookstove	0.76	1 kg	32.65	0.26	8.49	0.090	19.05	120.00	3.00	782.26	Gyapa

Source: Prepared by the authors.