Report
Stove Acceptability Assessment of the ACE Philips Stoves HD4012LS in Lao PDR

Mrs Keo uses two stoves for cooking in her house in the suburbs of Vientiane Capital

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SNV

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Summary

Objectives and methodology

1. At the end of 2013, SNV Lao PDR procured 25 Philips cook stoves from Africa Clean Energy with the purpose to identify its acceptance in the Lao cooking context.
2. In January 2014, 19 households were selected to trial the Philips stove for a 4-week period.
3. Data was collected using baseline, endline and focus group discussions conducted by SNV Advisors.
4. All households participated in the baseline survey, endline survey and the focus group discussions.

Quality of the stove

1. The stoves arrived from Lesotho in good condition; however some of the manuals were in a local language.
2. After four weeks of use, two stoves had problems with the fan regulator, which functioned awkwardly.
3. On the bottom of the chamber rust had been developed in all stoves varying in degrees.
4. People expressed concerns about the durability of the stove when it comes to the electronic parts of the stove.

User acceptability

1. 14 cooks reported using the Philips stove on a daily basis (mornings and evenings).
2. 100% of respondents allocated a score of 5 (highest) or 4 when assessing satisfaction the stoves’ fuel consumption, ease of use, ease in kindling and cooking time associated with using the stove.
3. It was observed that in two households the adoption of the Philips stove took place in week 2 as it took time to gain confidence in using the stove.
4. Only 35% of households used the stove for grilling and simmering. The users felt that drippings could damage the stove. They did not like the batch feeding character of the Philips stove, especially when cooking for longer periods.
5. According to their verbal reports, fuel wood consumption was reduced by 70% (reduced from 3.7kg to 1.2kg per day per household).

Willingness to pay

1. When assessed individually, users expected to pay an average retail price of an average of 211,000 LAK (USD $26.36) per stove and users were willing to pay on average 188,823 (USD $23.60) per stove.
2. There was a high variation around these averages, indicating significant differences among the households on the willingness to pay.
Conclusions

1. One can conclude that the Philips stove is accepted, 14 cooks reported daily use while four used it intermittently throughout the trial period.
2. The analysis excludes thus far those who refused to partake in this test, however they could represent a group that will not adopt the use of the stove at all.
3. Of the 14 cooks that reported daily use Philips stove, four said they still cook on traditional stoves on a daily basis. This could compromise possible health impacts.
4. Although users perceived the body of the stove to be durable, cooks questioned whether maintenance and spare parts would be easily obtained. During the study it was reported that two stove had problems with the fan.

Recommendations

1. To gain more evidence the sample size needs to be increased and locations diversified.
2. It is recommended that the stoves remain in the household longer to observe changes over time.
3. A continuous feeding wood stove (rocket type) may serve better for long term cooking demands, like sticky rice preparations.
4. To fully observe the changes in fuel expenditure and collection/buying habits, the monitoring methods need to be intensified such as methods followed under Kitchen Performance Tests.
5. It needs to be determined whether or not using charcoal and grilling wet foods will damage the stove.
6. Stove Use Monitor devices may provide better proof of the extent of a stove switch, rather than relying on anecdotal feedback.
7. Some households require more training time to gain confidence in operating stoves than others; this can be incorporated in future studies.
1 **Background**

Over 90% of households in Lao PDR use either wood or other biomass such as charcoal in their daily preparation of meals. Some households, especially those in the North, also burn wood inside the house for heating and mosquito repelling purposes.

Heating and cooking inside the household contributes to poor air quality which is linked to respiratory illness impacting heavily on women and children. ¹

Census data confirm that a sizeable portion of households have moved from firewood to charcoal. However, these changes have occurred mostly among urban households especially in more economically and financially well-off areas within Vientiane Capital, Savannakhet and Champasak Provinces.

The use of modern cooking energy sources such as liquefied petroleum gas (LPG) and electricity remain very limited. The prospect for moving to modern cooking fuels is still a long way off because of the relatively high prices of LPG and electricity, and the entrenched habit of cooking with wood and charcoal. Thus, solid fuels, which include firewood and charcoal, will remain the most important cooking fuel in Lao PDR for some time to come, particularly in remote rural areas and in upland and highland communities.

The purpose of this study draws from the reality that most households still use firewood for heating and cooking in homes which contributes to poor health. In an attempt to mitigate the effects of harmful smoke to respiratory health, SNV tested the adoption of clean cook stoves such as the Philips Stove into Lao kitchens.

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² Legros, G., Havet, I., Bruce, N. and Bonjour, S., 2009, *The Energy Access Situation in Developing Countries*:
2  Rationale
The purpose of the study is to assess the acceptance of the Philips Stove amongst households in low-land Lao PDR who use predominantly wood on a daily basis. It aims to gather qualitative information relating to the appreciation of using the Philips stove in the Lao cooking context. The study also aims to gain insights into users’ views on changes in air quality and fuel consumption.

This study can be used in subsequent studies that may include more (type of) clean stoves and health impact research, conducted in consortium with other partners and consultants in the course of 2014.

3  Methodology
The study monitored the kitchen settings of 19 participant households over a 4-week period to observe the adoption and use of the Philips stove. Baseline and endline surveys were conducted by the SNV team to monitor the stoves’ use and suitability within the local context. In the end, the study also assessed the Willingness-to-Pay.

It is important to note that due to different ethnic groups and locations, Vientiane Capital is not representative of cooking and heating habits nationally.

4  Household selection
Using local knowledge, three areas within Vientiane Capital were initially selected as potential survey areas due to their close proximity to the Capital with high incidence of fuel wood users. Nongsavang was randomly selected from the three areas (whereas including more areas would increase logistical challenges).
Participants in Nongsavang village were selected in clusters. The rationale behind this was that new product adoption and usage can be difficult in early stages, and selecting households in close proximity to each other allows for discussion among participants and can reduce intimidation of using the new stove. Households using predominantly fuel wood were selected, however especially poorer households approached were not much willing to participate. In this case the next suitable house was approached. Households using other fuel sources who were willing to participate were also included in the trials to observe adoption.

Figure 2 Mrs Hin, participant of the Philips stove trial
5 Workplan

The workplan included all steps and timing to ensure the study was implemented in an orderly manner. The household trials followed the planning matrix below. Monitoring of stove use was limited to the beginning and end of the trial, in order to minimise interference.
6 Baseline status
A baseline survey was conducted to assess the current status within participating households, which was later used to evaluate changes in stove usage, fuel consumption and expenditure as well as time allocated to fuel collection.

Stove and fuel types most used
A majority of households that participated in the trial owned a traditional stove that can be used with either wood or charcoal, or both. The breakdown on stove types and fuel types are as follows:

<table>
<thead>
<tr>
<th>Stove Types</th>
<th>Number of Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional</td>
<td>14</td>
</tr>
<tr>
<td>Tripod</td>
<td>1</td>
</tr>
<tr>
<td>LPG</td>
<td>2</td>
</tr>
<tr>
<td>Electricity Pot</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

Figure 4 Fuel use per household
**Stove usage**

Meals in participant households are usually prepared in the morning and evenings; meals at midday usually consist of food prepared in the mornings. 74% of households have a rice cooker in their home however most popular is to prepare sticky rice, which is cooked on traditional stoves.

**Figure 5 Usage of stoves in week 1**

![Bar chart showing usage of stoves in week 1](chart.png)

**Cooking location**

The World Health Organisation estimates that 2,600 people die annually from respiratory diseases caused by smoke inhalation associated with the use of biomass fuels for cooking\(^2\). The survey team assessed the cooking location to determine the extent of exposure of cooks and family members to air pollution.

It was found that it is very difficult to ascertain whether current cooking locations impact on air pollution within this study group without further in-depth investigation.

- 32% (8) cook in a kitchen inside the house. It was noted that most kitchens inside the house are well ventilated
- 40% (10) households cook in a separate kitchen outside the house
- 28% (7) cook outside, close by the house

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\(^2\) Legros, G., Havet, I., Bruce, N. and Bonjour, S., 2009, *The Energy Access Situation in Developing Countries: Review of Least Developed Countries and Sub-Saharan Africa*, UNDP / WHO.
Figure 6 Cooking location using baseline stoves

Figure 7 Mrs Khamla preparing lunch in her kitchen located outside her house
Figure 8 Mrs Chandee’s separate kitchen outside the house
Fuel expenditure and use
Households were asked about fuel wood consumption and expenditure. Of the households that reported fuel wood use, the average reported usage per day is 3.7kg, which is lower than other baseline data showing 7.5 Kg. The average expenditure on fuel wood is 50,000 LAK (USD $6.25) per month\(^3\). Out of 10 households that reported they use a traditional wood stove, five households reported they purchase fuel wood, while the other five collect wood from nearby areas.

The average amount of time used to collect firewood is 1.5 hours per week. Wood is usually collected from vacant land or construction sites where wood is used as support beams.

![Image of construction site](image-link)

Figure 9 An example of support beams at construction sites that are used as fuel wood

\(^3\) At the time of the study USD $1 is the equivalent of 8,000 LAK
Awareness of harmfulness of smoke
Participants were asked whether or not they were aware that smoke is harmful to health. Many users associate smoke and negative impacts on health with the inhalation of burning non-organic matter such as burning plastic or packaging containing chemicals. Only one respondent mentioned that smoking is harmful to ones’ health. Burning of biomass is considered normal, a part of daily life and is not harmful.

Figure 10 Awareness on health implications of smoke

Ignition material
Participants were asked what types of materials they use to kindle their stoves. Six respondents reported they used two types of ignition materials depending on availability. Materials that were most commonly used to kindle stoves were:

- 44% reported they use plastic (8 respondents)
- 39% use resin wood (7 respondents)
- 33% use rubber (6 respondents).

Some households reported that in the absence of resin wood, which is purchased, they use plastic or rubber.
7 ENDLINE STATUS

Households were left with the Philips stove for a 4-week period. Monitoring visits were kept to a minimum to avoid interference with adoption of the stove.

Philips stove usage

Interviews were conducted after 4 weeks to assess the adoption rate and usage patterns of the Philips stove.

- 82% of interviewees reported daily use of the Philips stove (14 respondents)
- 4 households said they still used their traditional stoves daily to supplement the use of the Philips stove to reduce the time to prepare meals
- 2 households reverted back to using previous stoves due to the additional work associated with the preparation of fuel.

It was noted that some households took more time to adopt the stove due to low confidence in using the stove. In this instance adoption occurred in the second week of the trial.
Cooking location of the Philips stove
A majority of the household kitchens are located in a separate room outside the house. This is predominantly where the Philips stove is used. Respondents who have separate kitchens outside the house reported they move the Philips stove into the house or to a more secure area after use for fear of theft and dust accumulation.

Users reported they like the mobility and convenience of the Philips stove as they are able to use it in many areas. For example two respondents reported they used it outside the house when they had visitors over for meals.
Types of cooking using the Philips stove
Participants were asked what types of cooking they used the Philips stove for:

- 35% used the stove to prepare dishes that required a long boiling period (6 respondents). Users preferred to use traditional stoves when boiling for long periods as they did not want to feed additional fuel into the Philips stove
- 100% used to prepare soups (17 respondents)
- 35% used to grill food (6 respondents). Participants reported that they worried that drippings from the food may damage the stove
- 100% used to fry food (17 respondents)
- 88% used to prepare sticky rice (15 respondents) some households reported they used their traditional stove to cook sticky rice.
It was noted that five participants (30%) reported they added 1-2 small pieces of charcoal, no more than 50g into the burning chamber when fuel wood has turned into embers. They advised that this extends the cooking time and generates enough heat to grill. The addition of charcoal did not make the stove surface overly hot as only 1-2 pieces are added at a time.

**User satisfaction**

Participants were asked to rate their satisfaction levels of the Philips stove by scoring each characteristic on a scale of 1 (lowest) - 5 (highest). These characteristics were durability, appearance, fuel consumption, smoke production, ease of use, kindling, time spent cooking, stove cooking capacity time, fuel feeding, accommodation of different pot sizes and accommodation of different cooking styles.

Philips stove users were most satisfied with the stoves’ fuel consumption, ease of use, ease in kindling and cooking time associated with using the stove. 100% (17 respondents) allocated a score of 5 or 4 when assessing these characteristics.
Categories that users allocated lower scores to include fuel preparation, the stove cooking time capacity (the operational time of the stove without feeding) and the aspect of feeding fuel to extend cooking time. It is noted that these three characteristics were given scores which indicate that users were neither highly satisfied nor highly dissatisfied.

Participants were asked what they liked and disliked and what improvements they would like to see made to the Philips stove.

What they liked about the Philips stove:

1. Fast cooking time
2. Fuel savings
3. Fan function.

Users said they like how fast they can prepare meals using the stove. They liked the fan function, specifically how it shortens kindling time and can accelerate burning. Respondents also said they like the fuel saving associated with the stoves’ use. Three users responded that they liked how mobile the stoves are.

What they disliked about the stove:

1. Combustion chamber is too small.

Participants reported that fuel preparation, cooking time capacity and feeding fuel into the combustion chamber is not highly desirable but it is something they are willing to accept to receive other benefits associated with using the Philips stove. According to users, wood is prepared for traditional stoves and chopping wood to smaller sizes does not take much additional time.
What improvements users want to the Philips stove:

1. Larger combustion chamber
2. Stainless steel base or tripod legs
3. Ash/charcoal removal system
4. Different sizes
5. Even pot rests.

When asked what could be improved, 10 respondents wanted a larger combustion chamber allowing a longer cooking time. During focus group discussions many voiced the opinion that a bigger combustion chamber may make the stove less fuel-efficient.

Some users wanted to see a sturdier base on the Philips stove. Participants reported they did not load pots with more than 3L of water in fear that the stove may not be able to take the weight. Stainless steel or stainless steel tripod legs were suggested.

Three users reported their pot rests were not even and had to hold their pots whilst stirring. This was confirmed when the stoves were collected for cleaning.

Fuel collection
Due to the length of the trial, no significant changes were observed in the time spent on fuel collection, which expected with 1.5 hours per week only. Only two respondents reported they felt that they spent less time collecting wood. The remainder reported no changes in time spent.

Users were asked whether they had observed any changes to the collection of fuel wood.

- 35% (6 respondents) reported they had changed the way the collected fuel.
- Three users previously who used charcoal or charcoal mixed with wood said they started to collect firewood on vacant land and smaller pieces of wood around the property.
- One user said she started to collect coconut shell from the market she works at and small saw mill off cuts that are given away for free.
- Only one user reported they started to purchase wood for 15,000 LAK (USD$1.88) per bag.

All users reported a reduction in the consumption of firewood. At the time of the endline survey the average amount of wood used per household per day was 1.2kg, which is a reduction of over 70%.

Fuel preparation
Although the Philips stove requires fuel to be prepared into smaller pieces, most users advised that fuel wood needs to be prepared anyway and chopping them into smaller pieces isn’t much additional work and didn’t see it as taking up more time.

- 6% (1 respondent) reported fuel preparation took less time
- 35% (6 respondents) reported it took more time
- 59% (10 respondents) reported no changes in time.
Ignition material

Households were asked what ignition material was used with the Philips stove to assess any changes. Users were informed not to use paraffin, rubber or plastic with the Philips stove. A significant change in ignition material used was observed, many users who previously used plastic and rubber used smaller pieces of wood.

- 41% use resin wood (7 respondents)
- 35% use wood (6 respondents)
- 18% reported they use plastic or rubber (3 respondents each).

Figure 17 Ignition material used with the Philips stove
8 Willingness to pay

One of the objectives of the study was to determine the users willingness-to-pay for a Philips stove. Participants were asked individually during the endline survey and in group discussions two questions:

The first, what they expected the retail price would be at store level;

- After individually administered surveys, users quoted an average retail price of 211,000 LAK (USD $26.36)
- During the focal group discussions, one group quoted a retail price of 150,000 LAK (USD $18.75) while the second group quoted in the range between 250,000 – 400,000 LAK (USD $31.25 - $50.00) would be an expected retail price.

The second, what price they would be willing to pay for the Philips stove.

- After individual interviews, the average willingness to pay is 188,823 (USD $23.60).

The survey team also asked if there were to be a payment plan, what would they would be able to pay per month. Most respondents reported they did not like to be in debt and would rather pay outright than pay interest. Only five users said they would like a payment plan.

- A monthly payment plan of 50,000 LAK per month ($6.25).

9 Observations from focus group discussions

- Although the Philips stove requires fuel to be prepared into smaller pieces, most users advise that fuel wood needs to be prepared anyway and cutting them into smaller pieces didn’t seem to bother them. A longer trial period may see changes in this opinion.
- Many users did not use the stove to grill food fearing that the drippings would cause corrosion at the base of the burning chamber. It has been observed that there is what appears to be rust at the bottom of the burning chamber. There does not appear to be a link between grilling and rust. The incidence of rust in the stoves that were used to grill does not seem to be higher than in stoves that were not used for grilling. Other factors such as frequency of use, spillage of liquids or the use of ignition materials such as rubber or plastic could be the cause but cannot be confirmed. 4

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4 The stove manufacturer ACE, advised that the base is made of SS430, which does not rust. Without inspection, it is most likely a build up of residues that have been left behind after burning. Materials such as plastics can cause the rust-like appearance. The build up of salt deposits from Eucalypt can become corrosive over a long time, however in this short trial period it is not likely.
Figure 18 Stoves with what appears to be rust at the bottom of the burning chamber. From upper left clockwise: Stove 1 used wood as ignition material and grilled with, Stove 2 used with wood as ignition material and not grilled with, Stove 3 used rubber for ignition but not grilled with.

- Philips Stove users liked how fast meals can be prepared and compared the heat to gas stoves. Only three users stated that they like the Philips stove as it produces less smoke than traditional stoves.
- During focus group discussions, users expressed concerns if the Philips stove once it breaks down need to be replaced or can be repaired?
- Two users complained about flames engulfing the pot and burning the pot handles, however both made the connection that this was due to overloading the combustion chamber.
- Participants discussed the use of different types of fuel wood, its sizes and how it affects cooking times. Users agreed that using dry hardwoods burned the best, whilst wet wood and wood with higher amounts of oil produced more smoke.
SNV Advisor demonstrating how to use the Philips stove

Demonstrations of the Philips stove

Kitchen located inside the house

Mrs Duan preparing fuel wood for the Philips stove
Mrs La’s kitchen located outside the house

Fuel wood prepared for the Philips stove

Mrs Duan’s husband preparing a meal using the Philips stove

Mrs Khaositharn
Mrs Mountha’s daughter and granddaughter

Mr Moukla’s tripod located outside the house
Mrs Oukham uses her Philips stove outside the house

Mrs Khaositharn uses her stove inside the house