Monitoring Client Outcomes of Clean Energy Loans for SOLAR & BIOGAS Renewable Energy in Nepal

Final report May 2018

UNCDF CLEANSTART

rooster logic

About

CleanStart

The UNCDF CleanStart Programme aims to drastically grow the access to clean energy finance for poor and low-income people. By partnering with energy and financial service providers and offering capital, data analytics, capacity building and policy advocacy services in the off-grid energy finance markets, CleanStart has scaled energy business models for microfinance institutions for cleaner, efficient and more effective sources of energy for poor people. Under CleanStart's activities in Nepal, as of 2017, over 130,000 low-income families and small-scale businesses have received access to Renewable Energy Technologies (RETs) through micro credit. This study was conducted by Rooster Logic to gain deeper insights into their energy usage and livelihood effects and tracks 2,564 energy customers over the period 2016-2017, conducting three rounds of interviews.

CleanStart is a UNCDF programme jointly co-funded by the Austrian Development Cooperation, the Government of Lichtenstein, the Norwegian Agency for Development Cooperation (Norad) and the Swedish International Development Cooperation Agency (Sida).

Rooster Logic

This action study was conducted by Rooster Logic Pvt. Ltd., a technology company that aims to increase transparency and evidence-based decision making in Nepal based on real-time data sources and analytics. The study examines energy behaviour of microfinance clients of four leading Finance Service Providers (FSPs) in Nepal, looking at customer uptake of energy loans and solar and biogas energy usage, reliability and costs over time.

Abbreviations and Acronyms

AEPC	Alternative Energy Promotion Centre
BI	Baseline Interview
EMI	Equated Monthly Instalment
FI1	Follow-up Interview 1
FI2	Follow-up Interview 2
FSP	Financial Service Provider
HH	Household
JBS	Jeevan Bikas Samaj
NIBL	Nepal Investment Bank Limited
NMB	Nepal Merchant Bank
REMO	Research and Monitoring
RET	Renewable Energy Technology
SHS	Solar Home System
SKBBL	Sana Kisan Bikas Bank Limited
SLC	School Leaving Certificate
UNCDF	United Nations Capital Development Fund

Acknowledgement

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We heartily thank the financial service providers Nepal Investment Bank Limited (NIBL) (Formerly ACE Development Bank), Jeevan Bikas Samaj (JBS), NMB Bank Limited (NMB), and Sana Kisan Bikas Bank Limited (SKBBL) and their partner microfinance institutions (MFIs) for their commendable work in interviewing microfinance customers. We greatly acknowledge the clients of the FSPs for providing their valuable time and feedback. We thank UNCDF for its continuous support with special acknowledgement given to Prem Sagar Subedi, along with all the Nepali and international team members of UNCDF.

Objective

This action study examines the energy behaviour of microfinance clients of four leading FSPs in Nepal, looking at customer uptake of energy loans as well as solar and biogas energy usage, reliability and costs over the period 2016-2017. The FSPs offered micro credit for installing solar and biogas cookstoves to their respective clients. The study closely monitors client outcomes before and after the clean energy interventions, in terms of energy usage, financial management, product satisfaction and changes in livelihood in terms of time and economic savings. Interviews were conducted by the FSP staffs in close collaboration and under the supervision of Rooster Logic. The report offers insights for energy and financial service providers as well as policy makers that can improve product and policy decision making on clean energy loans for off-and on-grid renewable energy.

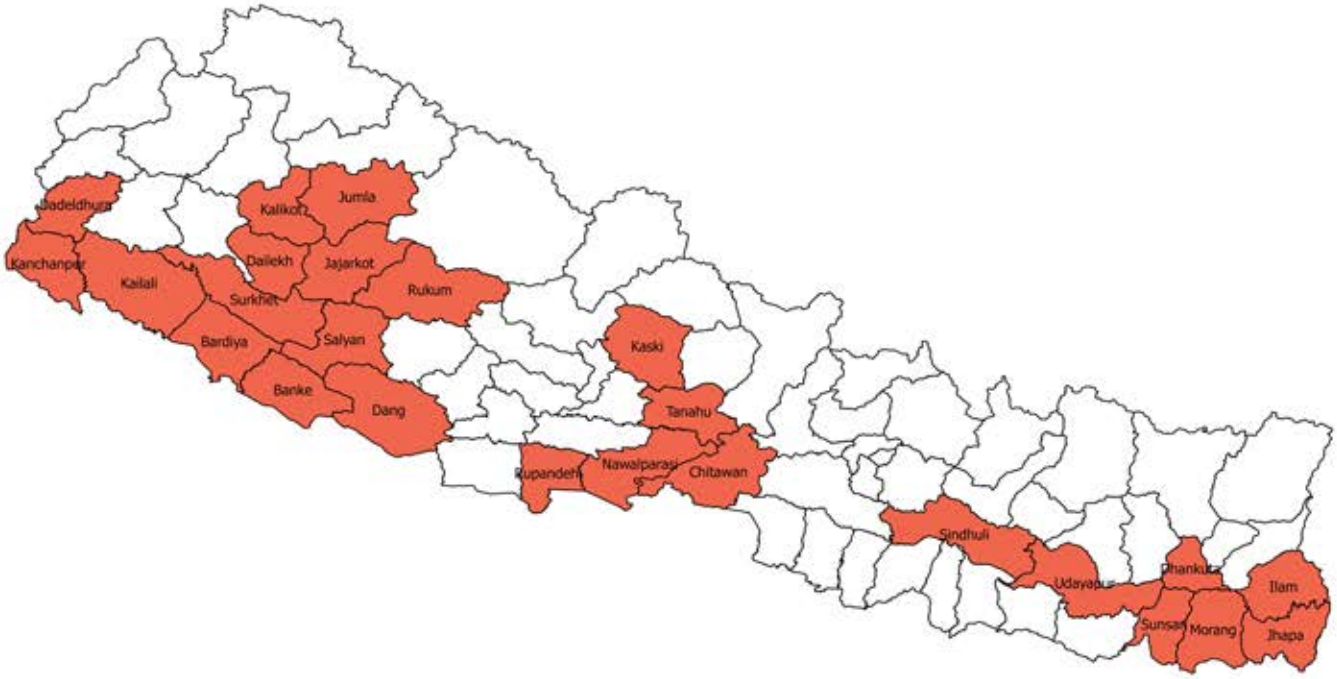
Study Design

All interviews were conducted with microfinance customers who have taken loans for the installation of Solar Home Systems (SHSs) and Biogas Systems from four leading Nepali FSPs and their partner MFIs: NIBL (Former ACE), JBS, NMB, and SKBBL. The interviews were conducted by branch managers and loan officers of the four partner FSPs by using REMO, an innovative smart phone-based survey research and monitoring platform developed by Rooster Logic. Two separate surveys were designed and the SHS loans customers (n=1,739) were significantly higher compared to biogas systems loans customers (n=87).

Since the start of the study the client outcome study has been revised in its methodology on several occasions and, partly because of the aftermath of the 2015 earthquake, the study experienced significant delays in its implementation. Although the initial set-up aimed to estimate energy loan impacts (with control and treatment group design), the current study allows only to monitor active loan customers over time, before and after energy loans were taken (no control group). A panel dataset was constructed with a baseline interview and two follow up interviews. For solar products 65% of the baseline customers for SHS systems were interviewed at FI2, while for bio digesters only 50% of the baseline customers were interviewed at FI2. This is likely to lure attrition bias in the study results, for example because attrition was different across FSPs. To mitigate data gaps, the analysis presented in this paper is based only on the customers who had participated in all three interviews.

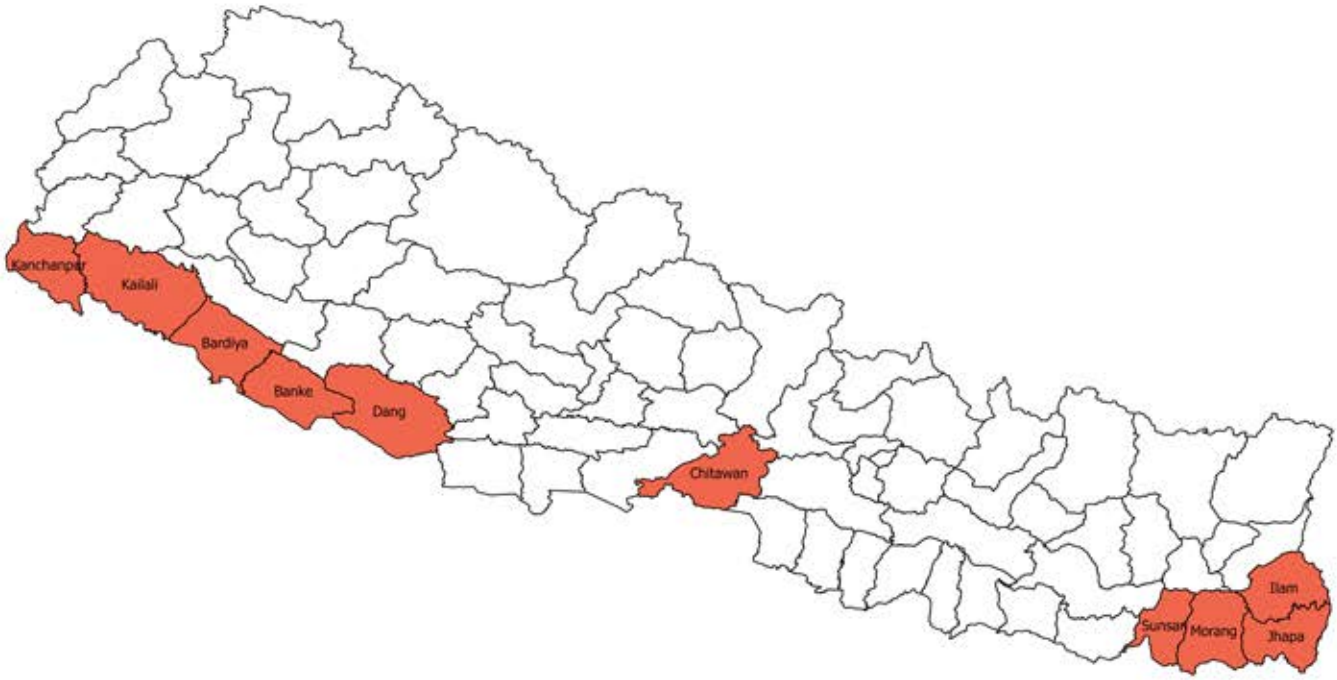
For solar home systems; 2,564 customers were interviewed at baseline before they took new energy loans, covering over 25 districts during the period February to December 2016. The first follow-up interview (FI1) took place three months after the baseline (from June to November 2016) and captured data on 2,156 customers (16% attrition rate since BI), while the second follow-up interview captured data for 1,845 customers over the period March to December 2017. The SHS analysis in this paper is based on the 1,739 customers who participated in all three interviews and had installed the SHS (35% attrition rate since baseline).

Figure 1: Map of Nepal showing districts where Solar Home Systems interviews were conducted



The biogas system loans were in much lower customer demand and only 175 customers were interviewed in February 2016 at the baseline (BI), covering 10 districts. The sample experienced strong attrition and the below analysis is only done for the 87 customers (50% of the total sample) who had participated on all three interviews and continued using biodigester.

Figure 2: Map of Nepal showing districts where Biogas system interviews were conducted

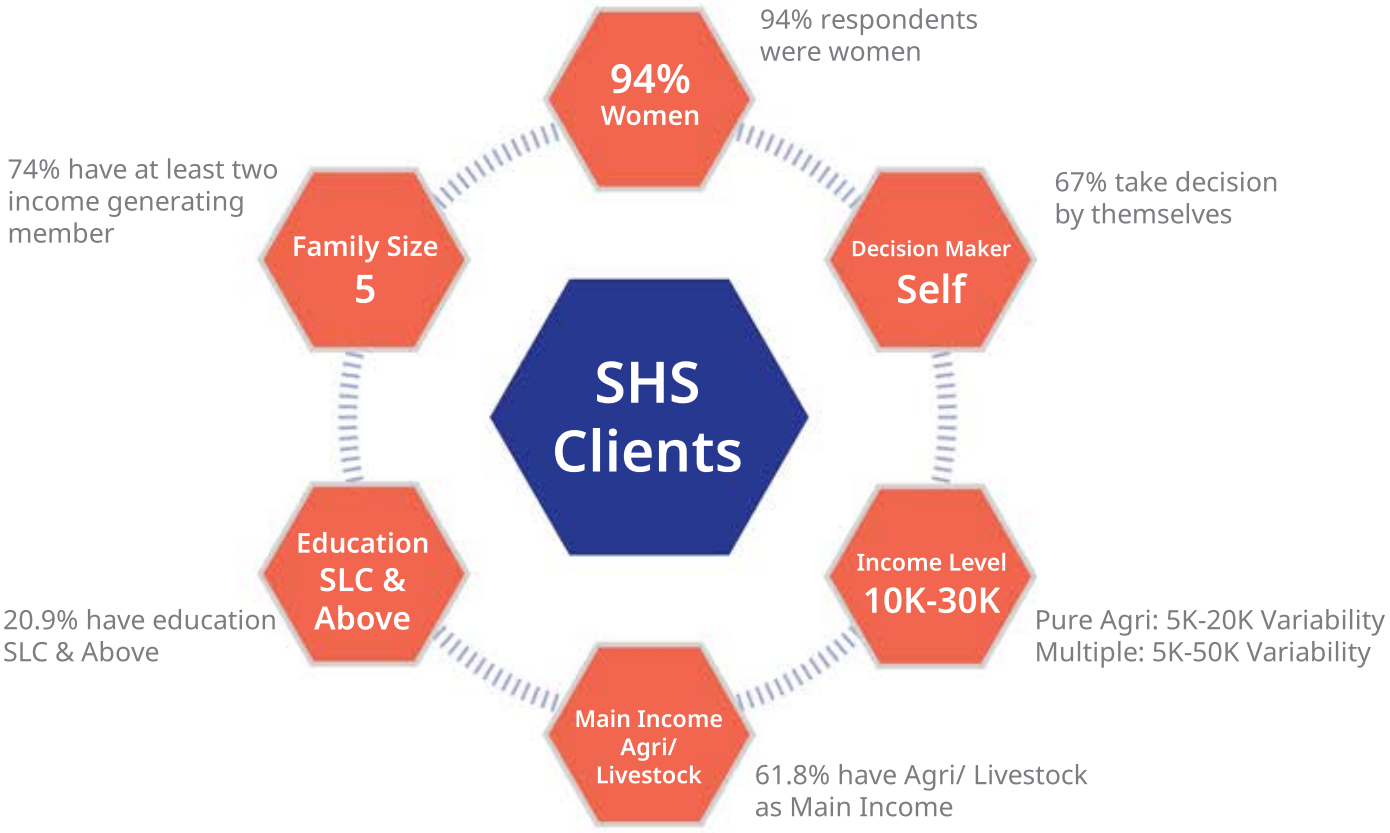


Solar Home System Findings

Profile of Customers

The majority of customers were women from low income families working in agriculture. The average family size of the FSP customers was five with 74% having at least two income generating family members. 67% of loan customers were the main decision makers in terms of purchasing the solar system within the family, 94% of customers receiving SHSs were women, the majority of whom decided to make the purchase for themselves (71%). Only 20.9% of customers had a school leaving certificate (SLC) or higher education, with a majority of low-income families earning between NPR 10,000 and 30,000 per annum. 61% of customers had their livelihood primarily dependent on agriculture and livestock rearing.

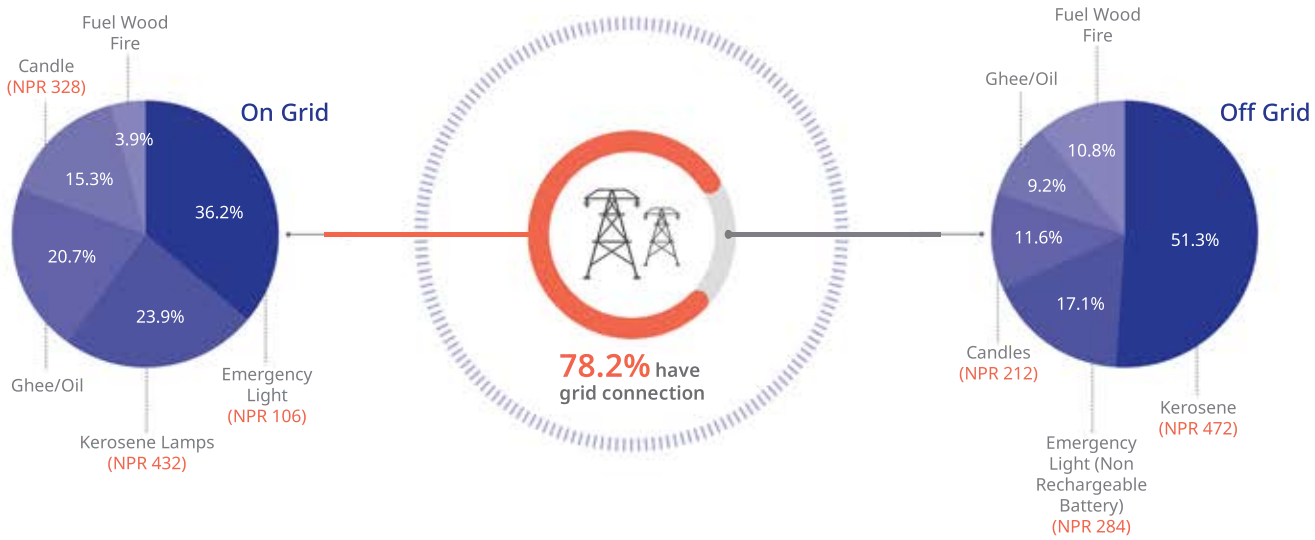
Figure 3: Profile of energy loan customers



Source of lighting (BI)

At the baseline, households of customers applying for energy loans were of two types - with access to grid electricity supply (on-grid – 78.2%) and without access to grid supply (off-grid – 21.8%). The purpose of SHS installations was to serve as primary lighting source for off-grid households and backup lighting source for on-grid households. Figure 4 shows the share of each source of energy among off and on-grid customers. Before acquiring a SHS, off-grid household mainly used kerosene (51.3%); whereas, on-grid household mostly used emergency lights (36.2%), due to charging facilities. Figure 4 also displays the cost of each lighting source per household per month in Nepalese Rupee. The cost of Ghee/Oil and Fuel Wood Fire could not be calculated because they are not purchased but self-produced or collected.

Figure 4: Main fuel/source for light and monthly costs for both on-grid and off-grid households at Baseline

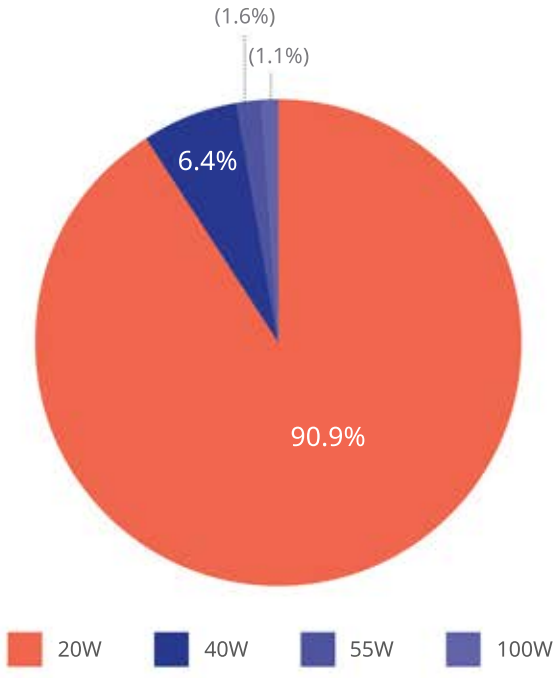


Size of the System

A strong majority of clients (91%) purchased small solar systems of 20 Watts, installed for lighting purposes in their homes and mainly consist of five low wattage bulbs with a 4-hour lighting capacity. These systems can be upgraded for more extensive electricity loads.

Only 1.1% of clients purchased 100-Watt systems, which are usable for other purposes beyond lighting. The average loan for 20-Watt SHSs was NPR 10,000 with NPR 417 monthly instalments for a period of 24 months. 72% of clients had a monthly income in the range of NPR 10,000 – 40,000, making instalments easily payable.

Figure 5: Size of the SHS ordered



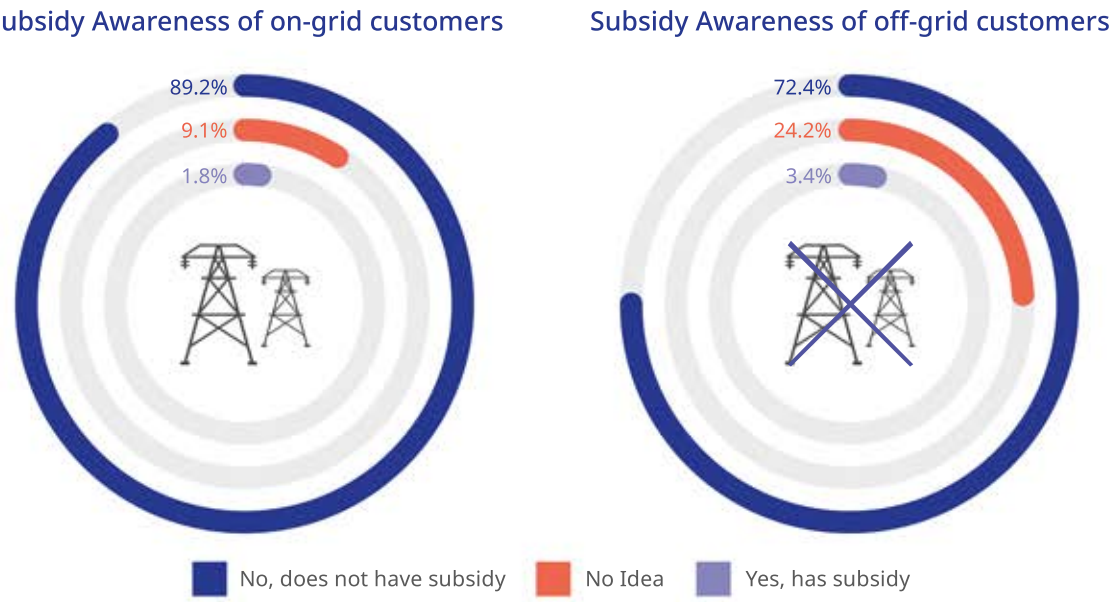
Subsidies

In a global context, subsidies often target the off-grid population in order to gain first-hand access to electricity and substitute traditional energy sources for lighting and fuel usage. Households living without grid connections typically have lower incomes and lower power consumption needs. Therefore, a tendency to promote smaller SHSs rather than larger systems was observed.

Yet in Nepal, there is a limited awareness of subsidy schemes. Of the total interviews conducted with off-grid clients, 72.4% thought SHSs were not subsidised, 24.2% had no knowledge of the availability of a subsidy and only 3.4% thought that SHS was already subsidised. Among on-grid clients, 89% perceived that SHSs were not subsidised, 9.1% lacked clarity on the availability of the subsidy and only 1.8% thought that their SHS was subsidised.

Thus, microfinance clients purchased the (smaller) SHS irrespective of the subsidy, but because they considered the product as useful. Hence, the subsidy policy needs to be better tailored at the off-grid population and encourage the scaling towards larger SHS.

Figure 6: Awareness of on-grid and off-grid clients on Subsidy



Insight: People will buy and use SHSs irrespective of the subsidy, if deemed useful. The promotion of smaller systems seems to inhibit the potential purchase of larger system due to lack of appropriate subsidy.

Usage & Savings

Table 1: Change in alternative fuel user pattern of SHS

Users	Off Grid			On Grid		
	BI	FI1	FI2	BI	FI1	FI2
Kerosene	51.3%	2.9%	2.1%	23.9%	0.4%	0.9%
Candle	11.6%	1.1%	0.5%	15.3%	0.5%	1.1%
Non Rechargeable Battery	17.1%	0.5%	0.3%	36.2%	0.2%	0.1%
Ghee/Oil	9.2%	0.5%	0.5%	20.7%	0.1%	0.1%

Table 1 shows the strong drop in usage of kerosene, candle, non-rechargeable battery and ghee/oil after the installation of a SHS. Kerosene users have dropped by 48percentage points for off-grid clients (from 51.3% to 2.1% of the users from the BI to FI2) and by 23 percentage points for on-grid clients (from 23.9% to 0.9% from the BI to FI2).

Insight: The users of alternative fuels have switched to SHS. This shows substantial change in energy usage.

Table 2: Money and time saved after installation of SHS

Saving Per Month	Off Grid		On Grid	
	NPR	Time (Minutes)	NPR	Time (Minutes)
Kerosene	472	149	432	76
Candle	212	74	328	36
Non Rechargeable Battery	284	93	424	120
Ghee/Oil	-	-	-	-

Table 2 shows that after installing a SHS, off-grid users of kerosene saved 149 minutes per month on the purchasing and transportation of kerosene fuels along with an accompanied average saving of NPR 472 per month after they stopped buying kerosene. Savings were also made by replacing candles and non-rechargeable batteries with SHSs. Clients also stopped using ghee/oil for lighting after the installation of a SHS.[1]

Insight: Usage of clean energy provided financial as well as time savings. For example the average financial saving for off-grid customers was NPR 472 per month for kerosene, while the Equated Monthly Instalment (EMI)[2] for SHS was around NPR 417 per month, resulting in an approximate net saving of NPR 55 per month.

NPR 25/month saved from electricity bill by on-grid clients.

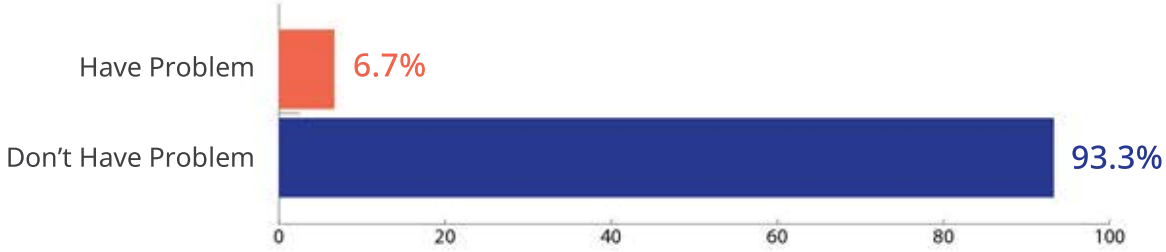
[1]Note: This cost calculation was done based on the average monthly cost per household. Similarly, time calculation was done based on the average time taken for per household in monthly basis.

[2]Note: Equated Monthly Instalment (EMI) is the term used by the MFIs in Nepal for the average monthly instalment.

Customer Satisfaction

Only 6.7% clients faced issues with their solar home system. The issues faced were: electricity related (61%), battery related (16%), parts related (5%), electrical wiring related (11%) and 7% had their solar panel stolen.

Figure 7: Percentage of customers who encountered issues with their SHS



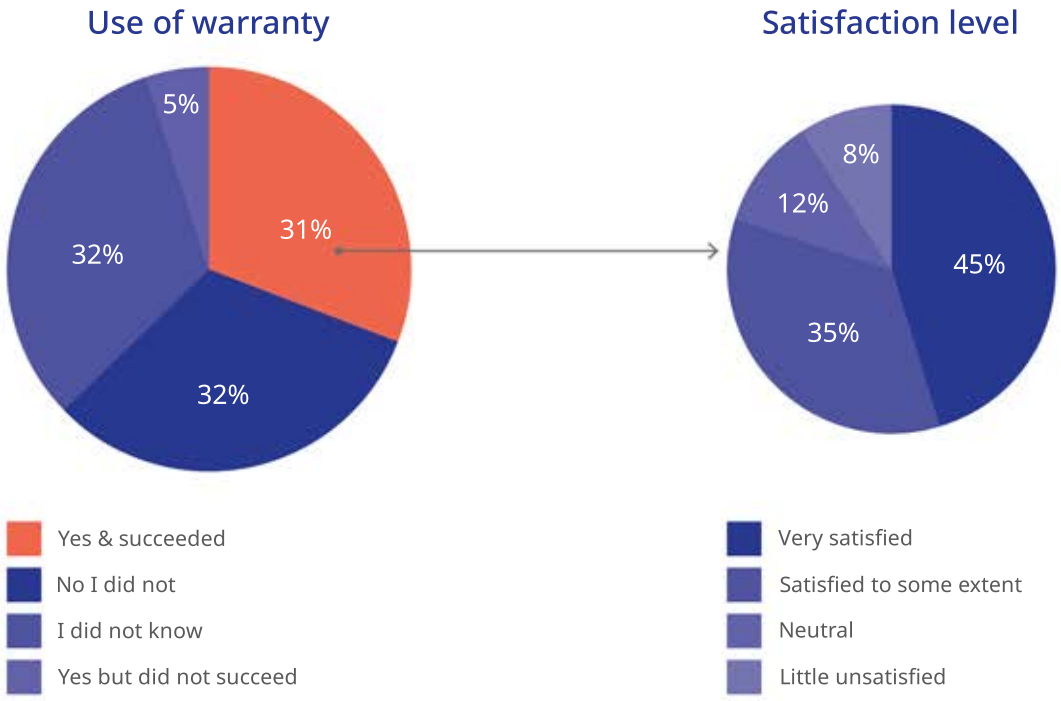
The prime reason for encountering issues was due to the utilisation of the system beyond its capacity or optimal use through self-made modifications. Indeed 91% of clients had a 20 Watt SHS installed in their houses and often had a higher demand for solar energy.

Insight: There is significant demand for existing clients to upgrade their smaller SHSs (<20 Watt) to larger SHSs.

'Use and satisfaction level' on warranty

Out of the 6.7% of clients who encountered an issue with their SHS, 64% did not utilise the warranty (32% had not used it and 32% had no knowledge of it). This indicates a lack of awareness in the use of the warranty. 31% of clients successfully utilised the warranty, of which 80% were satisfied by its usage.

Figure 8: Awareness on warranty and its usage satisfaction among 116 customers having encountered an issue with their product



Insight: Educate clients about the warranty services and develop a support system for rapid dispatch.

Customers were satisfied with the products overall,
and **98.1%** said they would recommend SHSs to others

Advantages

With the installation of a SHS, the energy usage pattern of clients shifted from using traditional fuel such as kerosene and candle to renewable solar energy. The adoption of a SHS saved clients time and money, as well as reduced the risks of experiencing fire hazards. More than 50% of users stated that SHSs were cost-effective, of good quality, coming with a warranty and around 33% consider it to be environment friendly.

Saves Money (67.7%)

Two years of installment amount (EMI of NPR 417 per month) for SHS can be covered with the savings (NPR 472 to off-grid and NPR 432 to on-grid users) in the usage of kerosene alone.

Good Quality (62.3%)

The SHS were reliable as 93.3% respondents didn't face any problem with the SHS (Figure 8).

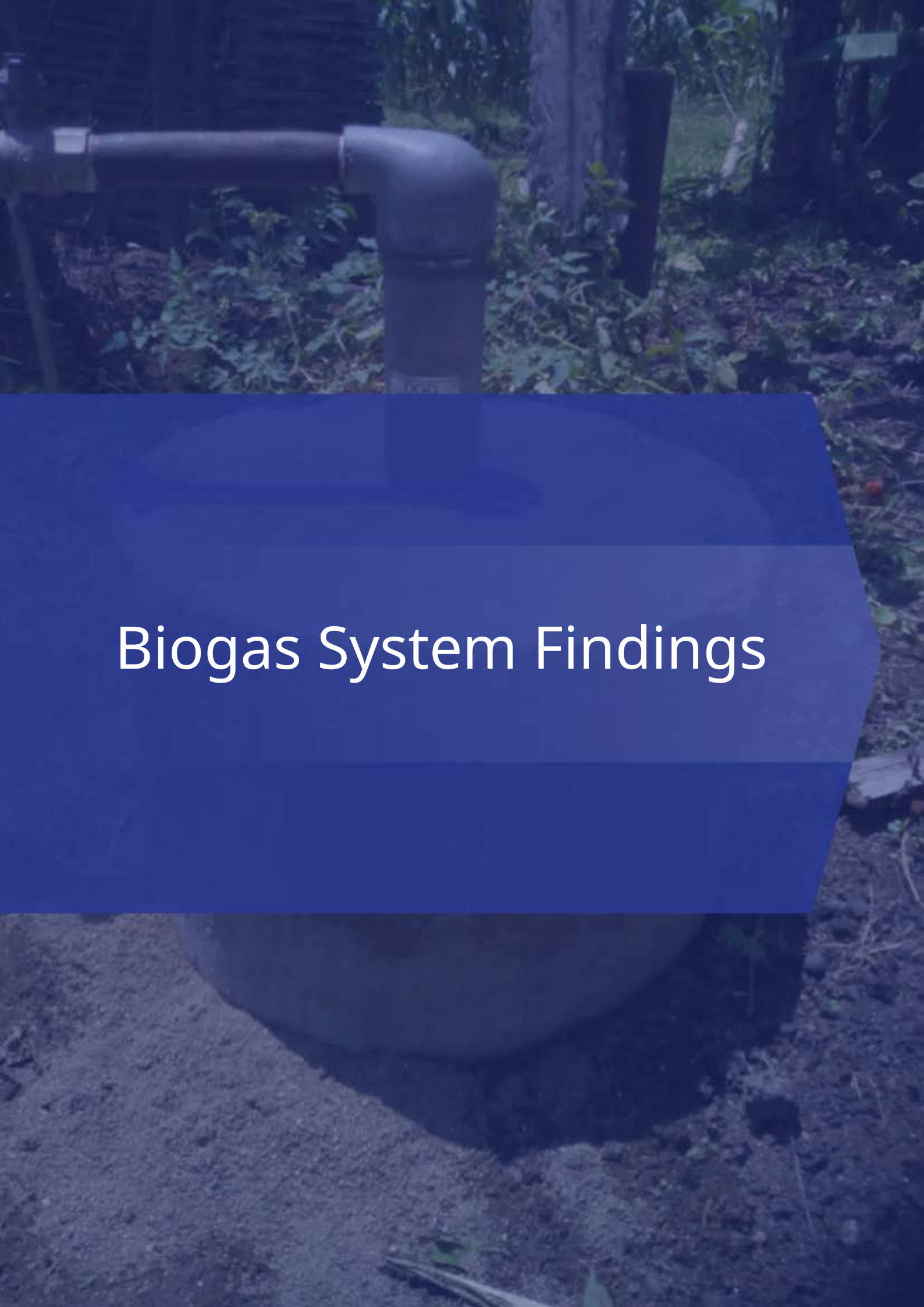
Has Warranty (54.9%)

There is warranty on the components of the SHS: 20 years in panel, two years in battery & bulb and one year in controller. 80% of the respondents who used the warranty were satisfied.

Environment Friendly (34.3%)

As Solar Home System is renewable and clean source of energy, it is environment friendly.

Insight: The savings from kerosene and candle could be utilised towards payment of instalment charges to FSPs.

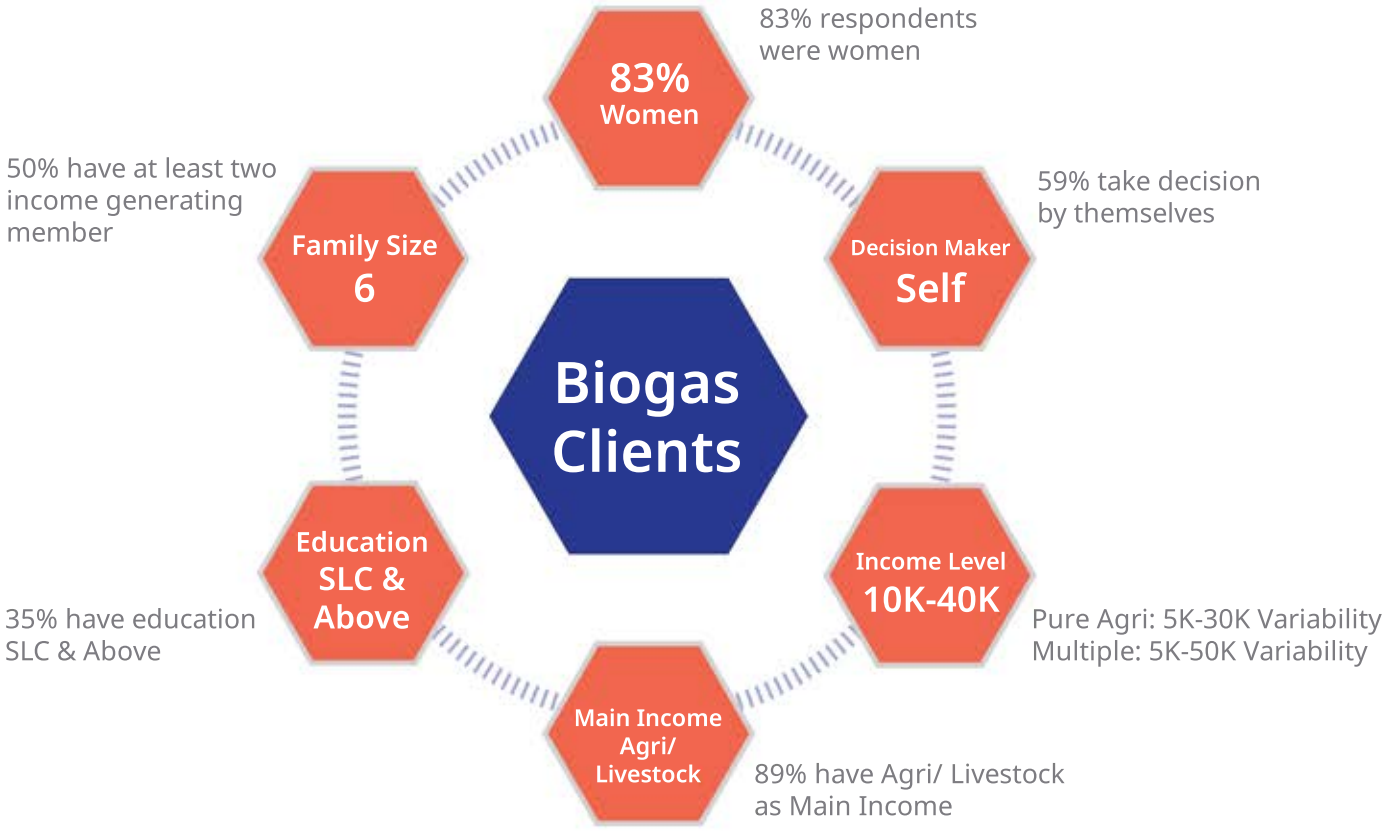


Biogas System Findings

Profile of Clients

A total of 87 clients had participated in all three interview rounds and received a biogas cook-stove in combination with a microloan. The majority of them were women (83%), had an average of six household members and with at least two income generating family members (50%). 59% of clients were the main decision makers in terms of purchasing the biogas system within the family. 35% of customers had an education level of SLC and above, and 89% of customers had agriculture and livestock as their main source of income.

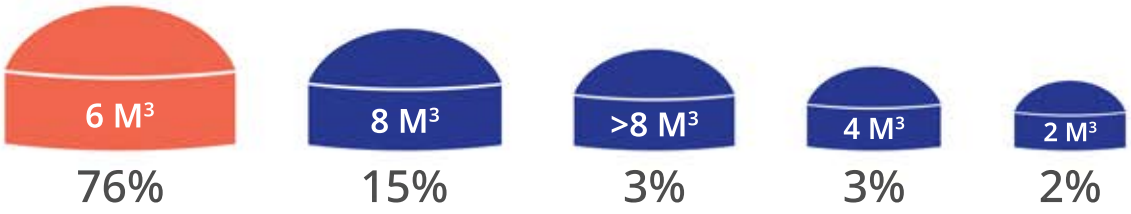
Figure 9: Profile of Biogas customers



Size of Biodigester ordered

76% of clients had biodigester of a 6 M^3 size, 15% had 8 M^3, 3% had above 8 M^3, 3% had 4 M^3 and 2% had 2 M^3 installed, indicating that the larger cook-stoves were in higher demand.

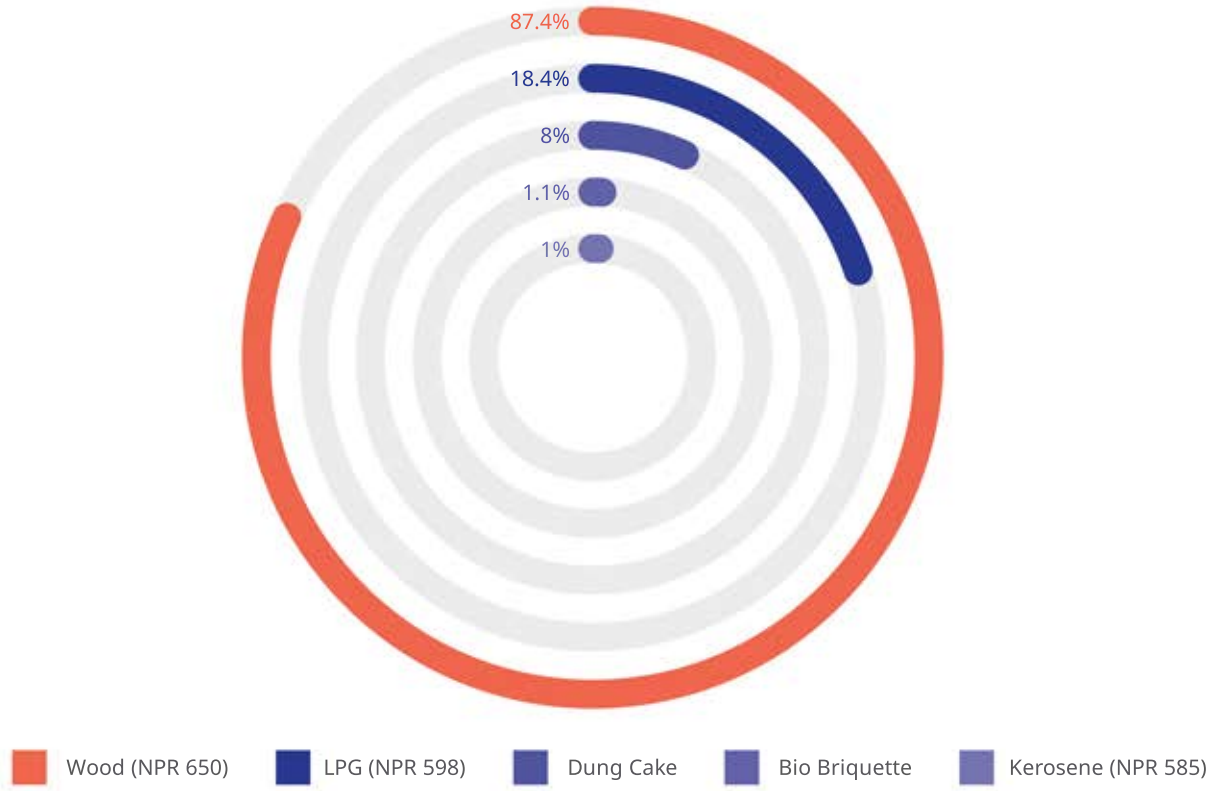
Figure 10: Size of Biodigester



Cooking Source Fuel (BI)

The baseline revealed that prior to purchasing a Biogas System, 87.4% of clients used firewood for cooking purposes, followed by LPG (18.4%) and dung cake (8%). As 99% of clients interviewed in the baseline owned cattle, they could potentially use manure for Biogas System.

Figure 11: Baseline Cooking Source Fuel



Reason to order a Biodigester

39.6% Consumes Less Energy

44.6% Fumes Less

50.5% Saves Cost

34.7% Environment Friendly

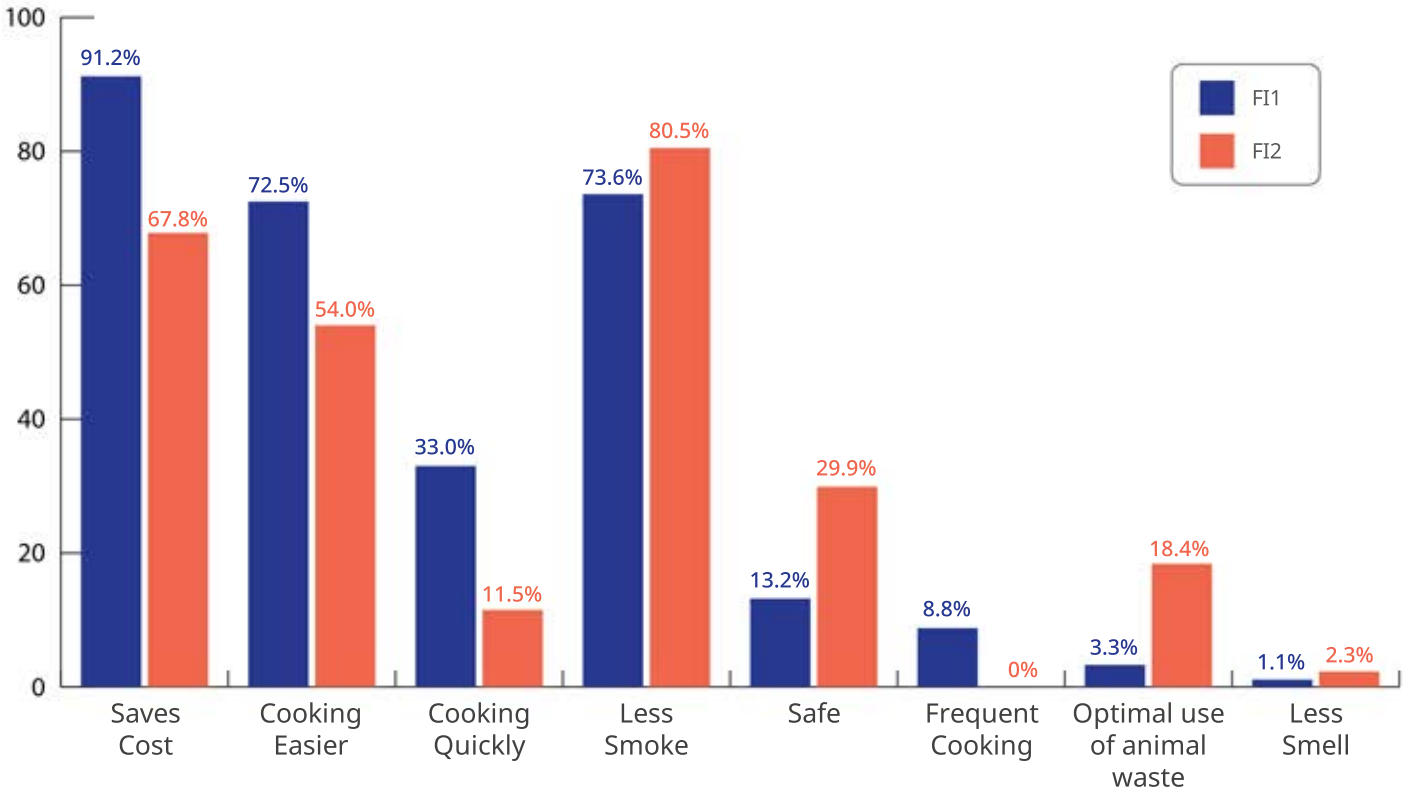
50.5% of clients perceived Biogas Systems as being cost-effective and environment friendly (34.7%) with less fumes (44.6%) as well as efficient in terms of energy consumption (39.6%).

Advantages (FI1 & FI2)

Perceived advantages of Biogas Systems shifted between the installation of the system (FI1) and its usage (FI2). During FI1, more than 70% of customers perceived that Biogas Systems were cost saving, made cooking easier and caused less smoke pollution, whereas there was a decrease in these perceptions in FI2 by at least 18%. This change in perceived benefits in the longer term regarding cost saving and product user-friendliness can inform energy service providers on product quality aspects to tackle through appropriate after sales services.

Optimal use of animal waste was increased by 15.1%, suggesting a shift in practices of animal waste management. Clients increasingly felt that Biogas Systems were safer (increase in perception of safety by 16.7%) and emitted less smoke. Health and security benefits therefore represent potential viable and convincing marketing narratives for prospective customers.

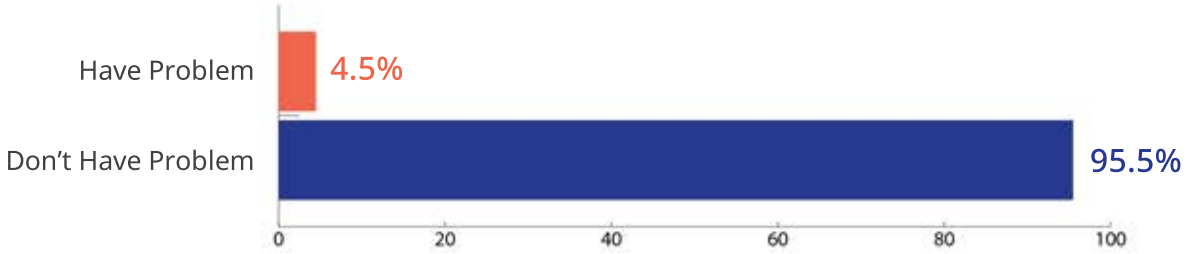
Figure 12: Perceived Advantages of Biogas Systems



Common Problems

The majority of clients (95.5%) did not experience any problem with their Biogas System. Of the four clients who did encountered problems, it was highlighted that there was insufficient gas production for cooking, problems with pressure meters, and complaints about the smell coming from the system.

Figure 13: Percentage of clients who encountered problems



Savings

Users of Biogas Systems were using multiple types of fuels for cooking during the baseline, FI1 and FI2, some of which being considered fuels of major importance and others supplementary. Figure 14 shows the changes in usage of the major sources of energy after using Biogas System. We observe a strong drop by 82 percentage points in the use of firewood as a major fuel source, and 22 percentage points drop in LPG as the main fuel source, after the installation of a Biogas System.

Insight: Clients have switched to Biogas Systems, reducing the use of alternative fuels such as wood and LPG.

Figure 14: Usage pattern of major fuel sources

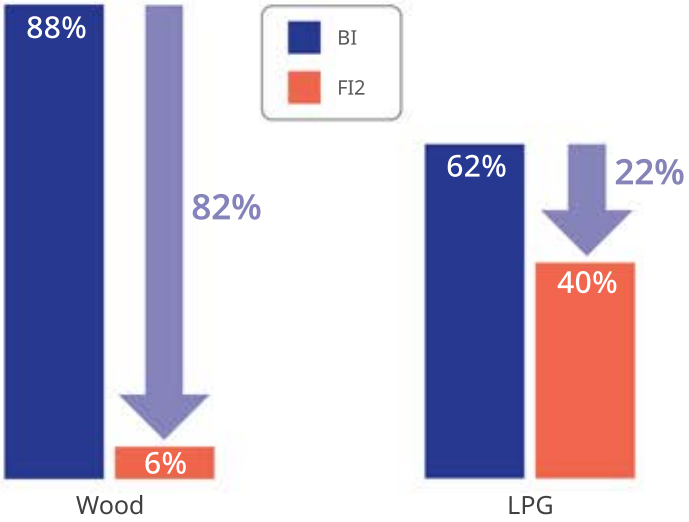


Table 3 presents the average time saving per month after the installation of a Biogas System for each alternative source of fuel.

Table 3: Time saved after the installation of a Biogas System

Time Saving per month	Hours
Wood	46
LPG	1.5
Kerosene	6

Note: Time calculation was conducted based on the average time taken per household on a monthly basis.




Recommendations for Solar Home System improvement

For Product Distributors:

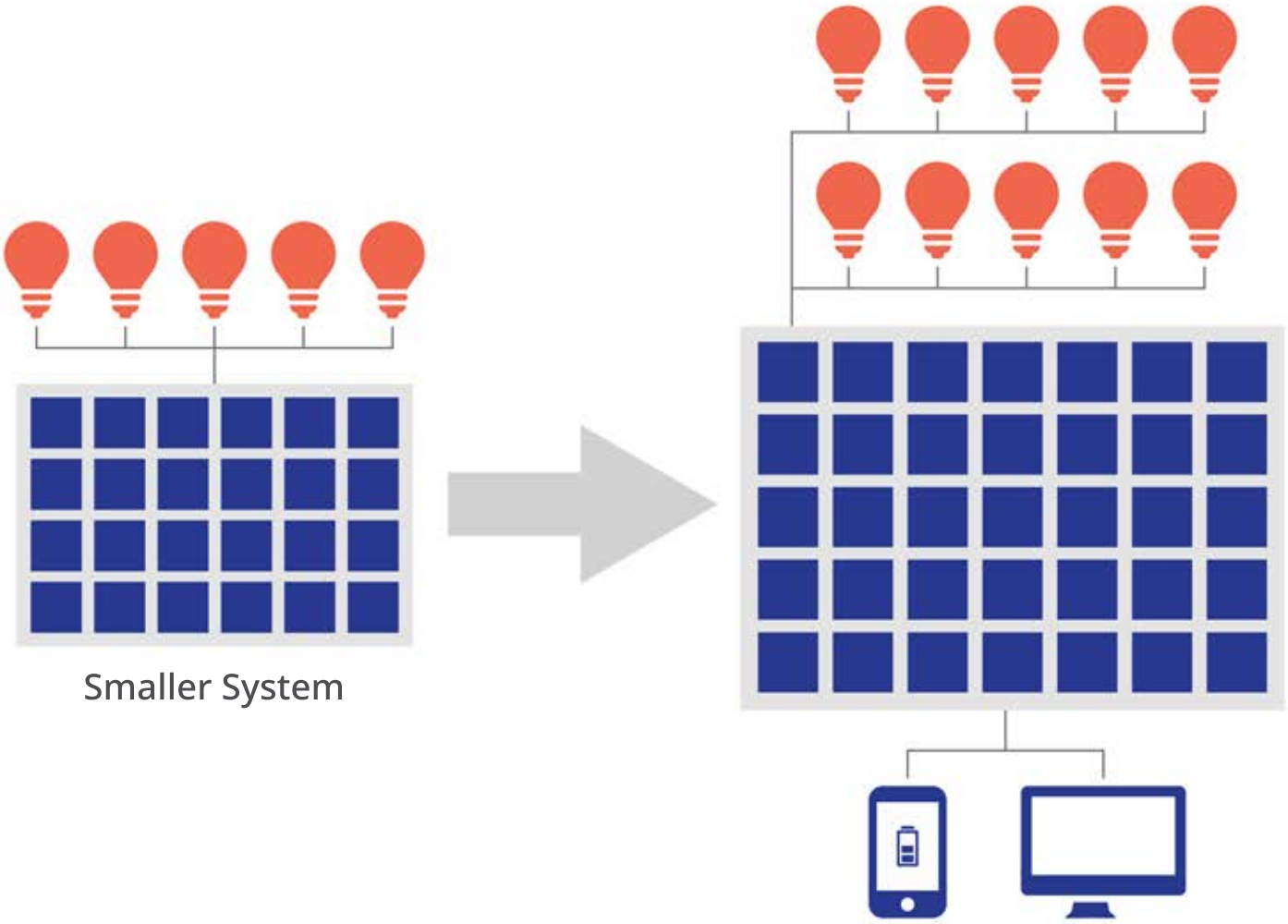
- ✓ There is a strong potential for demand of larger solar systems or upgrades of existing systems, as small SHS do not meet energy needs. Distributors should increase efforts on promoting larger systems and offering adequate payment solutions to foster their uptake.
- ✓ Distributors should provide sufficient knowledge and skills on SHS usage and warranty services. Proper channels for maintenance services need to be in place for adequate and timely solutions for SHS defects. Both measures can contribute to increasing the benefits of SHS and incentivise their uptake by prospective customers.
- ✓ Distribution channels could be branched further towards the untapped mountainous region supplying them with the opportunity of Solar Home System for electrification.
- ✓ Most solar system users faced challenges linked to the low wattage of systems. Distributors are strongly recommended to raise awareness among consumers on the high risk of malfunction of solar systems in case of overuse of their wattage or tampering.

For Financial Service Providers:

- ✓ Energy needs of customers must be properly assessed and product distributors should be informed for the better marketing and sales of systems. There is a potential for up-selling, by offering larger products. FSPs can offer a wider variety of loan products to be provided to match client energy requirements and ability to pay and offer larger systems.
- ✓ One flexible finance solution is to implement Pay-as-you Go leasing- or lending models. The Paygo model uses a chip embedded in the solar system that can be switched off remotely by the service provider in case of non-repayment, thereby lowering FSPs collateral requirements. Paygo further allows the SHS to be paid back with flexible instalments through mobile money or cash payments at agent networks and in East Africa allowed low-income families to access larger SHS systems. UNCDF CleanStart is currently piloting the first Paygo product in Nepal.
- ✓ FSPs and loan officers should demonstrate the multiple benefits and long-term impacts of SHSs to prospective clients to showcase the range of return on investments after the purchase of a SHS in terms of savings on fuel expenses, time savings and health benefits.

For Policy Makers:

- ✓ This study suggests that subsidies are not the driving factor for acquiring a SHS, under the condition that solar products or services fit the expectations and energy needs of customers. Reforming energy subsidies towards larger SHSs can contribute to improving energy access among low income people through uptake of larger off-grid solar home systems. The current study also finds multi-faceted benefits derived from the use of adequate SHSs, such as time and financial savings for users, which can be redirected towards productive economic activities, or the resulting reduced load on the national grid.
- ✓ Timely delivery of subsidies should be ensured to avoid creating a loan burden on consumers that directly affects their loan repayment capacity to FSPs.


Smaller System
Bigger System

Recommendations for Biogas System improvement

For Product Distributors:

- ✓ Distributors should raise awareness among customers about the multiple benefits derived from Biogas System usage. A stronger focus on the efficiency of products will contribute to further decreasing reliance on substitute sources of energy, such as LPG and wood, and increase savings for Biogas system users. It is strongly recommended to implement sound systems for better maintenance and service delivery, as the study showed a decrease in the perceptions of Biogas Systems being more efficient for cooking after a year of usage.
- ✓ Sensitizing clients to effectively use the systems could contribute to more efficient cooking-related usages. Distributors should regularly engage with customers to maintain their product in optimal condition in order to more effectively remove or decrease the use of LPG.

For FSPs:

- ✓ FSPs have a key role in raising awareness on the multiple benefits derived from Biogas System usage, such as the production of organic fertiliser. FSPs should sensitize customers to the savingsbenefits derived from Biogas System usagereducing client's expenses on other energy sources such as wood and kerosene. Safety and health benefits should particularly be showcased to prospective clients as the study demonstrated that customers increasingly perceived Biogas Systems are less polluting and safer.

For Policy Makers:

- ✓ Along with Product Distributors and FSPs, Policy makers can contribute to playing a role in raising awareness on the multiple benefits of Biogas Systems for clean cooking. The current study is done on only 87 bio-gas customer and more rigorous studies are needed on the population'sbio-energy needs. The current study demonstrated a potential demand for bio-gas systems among these customers for the private sector to intervene in.