Solar Household Energy

Solar cooking for Human Development and Environmental Relief

2015-2016 Solar Stove Adoption Project in Tilori, Haiti
Evaluation Report

February 2017

Evaluation report prepared for the Solar Electric Light Fund
by Solar Household Energy, Inc.
Sophie Brock Lyman
Executive Director
Sophie@she-inc.org

With input from reports by Onel Joseph
SHE consultant
Project field manager
jonel25@hotmail.com

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Acknowledgements:

Solar Household Energy (SHE) would like to acknowledge the many people and organizations without whom this project could not have taken place. Our thanks go to the Agua Fund for their generous funding of this project allowing the people of Tilori to benefit from solar cooking.
We are also grateful to the Solar Electric Light Fund (SELF) for sharing our vision and working tirelessly to develop solar energy systems worldwide. In particular, SHE would like to thank Executive Director Robert A. Freling, Project Director Jeff Lahl, and Haiti Project Manager Jean-Baptiste Certain for in-country support.
SHE would like to recognize the efforts of trainer Onel Joseph, whose expertise and effort made this project possible. He implemented the second phase of the integrated cooking project in Tilori in 2014 with 78 “Sun and Ice” parabolic solar cooker and 177 “StoveTec” fuel-efficient stoves, and continues to be a vital partner in our work in Tilori. From creating surveys, selecting participants, leading training sessions, and ensuring follow-up communication, Onel continues to be dedicated to SHE’s work.
Further thanks go to The Nature Conservancy (TNC), whose partnership with SHE in 2011 introduced solar cooking, integrated cooking, and tree-planting efforts in Tilori in an innovative project that lead to the discovery that parabolic cooking is a popular solar cooking solution for the people of Tilori.
Finally, SHE would like to thank local leaders Idamane Supreme and Marc Breus for their continued, tireless effort to improve their community, as well as their support for solar cooking and other sustainable initiatives. Our gratitude extends to the people of Tilori, for their willingness to work with us in learning to become solar cooks.

EXECUTIVE SUMMARY

In September 2015, Solar Household Energy (SHE) entered into a partnership with Solar Electric Light Fund (SELF) to introduce 25 SolSource parabolic solar cookers in Tilori, Haiti, expanding the existing clean cooking efforts. SHE managed the project, contracting solar cooker expert Onel Joseph to carry out the project training and assessment mission in Tilori in October 2015 and to collaborate with SHE in supporting local leaders to carry out monthly follow-up surveys and quarterly focus group meetings for one year. This end-of-year evaluation report has two areas of study: adoption, impacts and outcomes evaluation, and management and implementation process evaluation. Adoption, impacts and outcomes evaluation covers baseline demographics, stove usage and adoption levels, health and fuel impacts, foods cooked, satisfaction levels, and comments from surveys and focus group meetings. Management and implementation evaluation covers methods, materials, staff performance, schedule and budget.

According to the scoring system promoted by the Global Alliance for Clean Cookstoves, the SolSources had “Very High Adoption” and “High Impact.” The adoption value stems from average SolSource usage frequency (10.4 times a week), average SolSource condition (most were in good condition but dirty), average SolSource satisfaction levels (4.9 out of 5), and the interest in replacing the SolSource at the end of its lifetime (overwhelming demand for more solar stoves, and 98% who would recommend it to a friend). The impact level value stems from average stove usage frequencies and stacking (SolSource 10.4 times a week, fuel-efficient stove 17.9 times a week), the traditional stove usage and its location (the three-stone fire was virtually no longer used), perceived health improvements (98% reporting “three or more” signs of improved health), and perceived fuel savings (97% reporting “some savings”).

In-depth analysis gave us additional information and suggested some trends. Participants were well suited for the project, having a sunny space in their yard and willingness to buy appropriate thick black pots. Most of them were single or divorced women farmers between the ages of 36-50 years old. They cooked for families of 5-12 people.

At baseline, 75% of participants had three-stone fires inside their houses, 25% had them outside under a roof, and 4% had them outside. At baseline, excluding incomplete reporting, three-stone fires and fuel-efficient stoves were used about equally (rough estimates of 10 or 15 times a week were given). This is comparable to average total weekly stove usage with the SolSource at follow-up (SolSource: 10.4 times/week, fuel-efficient stove: 17.9 times/week). The three-stone fire was hardly ever used after SolSource introduction. Follow-up reported average monthly SolSource usage rates were 33%-40% of total stove rates, but occasionally went as high as 52%. Observed SolSource usage (at the time of the survey) increased in the first three months then stayed high thereafter (by more than 21 of 25 participants, except in July due to cloudy weather).

At baseline, for their non-solar stove cooking fuel, participants predominantly used wood, with two also using some charcoal, and none using propane or kerosene. They collected around half of their fuel and purchased around half. Mothers, sons and daughters gathered combustible fuel most often, spending an average of 3.73 hours per week. Almost all participants rated the cost and difficulty of buying and collecting wood as a 1 out of 5 (“do not like at all”). Their monthly income ranged from 0-6000 Gourdes (97.69 USD), averaging 1370 Gourdes (22.31

USD). Expenses ranged from 0-7000 Gourdes (113.98), averaging 2832 Gourdes (46.11 USD). They reported spending between 25% and 50% of their income on fuel. At follow-up, they reported “some savings” on average.

At baseline, the most common health symptoms from three-stone fire and fuel-efficient cookstove use were sickness in children, sore eyes, coughing/flu, and stomach pain. At follow-up, virtually all participants reported three or more signs of improved health.

Foods reported as most commonly cooked on the SolSource were beans (78% of participants), followed by vegetables, meat, rice, and sauce. Most of the same staple foods were observed being cooked as well, with an increasing diversity of foods cooked as the year progressed.

SolSources were all functional throughout the year, except for one case where a part was stolen. Otherwise, most missing parts were redundant QR pins and screws, which were replaced usually within a month by local leaders. Some stolen small black mirrors and broken adjustment poles were also reported. Fuel-efficient stoves were more prone to breaking down, with up to 5 known broken stoves in May (and 4 not reporting for unknown reasons).

At baseline, satisfaction with the three-stone fire was low at 1.8 out of 5, and satisfaction with the fuel-efficient stove was a 2 out of 5. At follow-up, satisfaction with the improved stove and SolSource were virtually always rated 5 out of 5. All participants would recommend the SolSource to a friend if available.

Open feedback from survey comments and focus group meetings revealed that participants were deeply appreciative of the SolSources and their many benefits including absence of smoke, improved health, and fuel savings. Many said that they shared the SolSources with the whole neighborhood (one specified 5 people), and that there was high demand for more SolSources from Tilori and beyond.

The main issues were a few missing or broken SolSource parts (though only one participant reported decreases in usage); and that of the SolSource damaging thin pots, due to participants not buying more appropriate pots because of their expectations and demands that they should receive free pots, since others had received them in previous clean cookstove projects.

There seems to have been a learning curve in the first 2 or 3 months, as SolSource usage (both reported and observed) increased, the number of reported signs of improved health increased, the reported fuel savings increased, observed SolSource usage on partly cloudy days increased, and the number of people not commenting decreased (virtually all comments were positive). The diversity of foods cooked on the SolSource, both reported and observed, increased throughout the year, with 14 different foods (not to mention recipes/dishes) observed being cooked on the SolSource during the survey by the end of the year.

The true level of adoption and impact of the SolSource is probably greater than reported (33%-40% of total stove usage), as SolSource usage was not included in average calculations when fuel-efficient stove data was lacking (where it may have been higher if the fuel-efficient stove was broken); as foods most often cooked on the SolSource were slow-cooking foods such as beans, vegetables, and meats that require more energy/fuel to cook; and since many participants shared their SolSource with their neighbors.

Project management and implementation was successful and mostly as planned in the proposal and contracts. Despite losing two days of the training and assessment trip in Tilori due

to border issues, trainer Onel Joseph managed to carry out all planned activities, though he did not visit as many individual homes as hoped for. The participant selection process was mostly based on Onel laying out the selection criteria to everyone during the workshop with help from the local leader, rather than the participant selection survey, but this was just as effective and saved time compared to surveying a large pool of Tilori residents. The first follow-up survey and all others were postponed by half a month, as the local leader felt that the participants should familiarize themselves with the SolSources. Submission of quarterly reports to SELF was delayed by communication issues in Tilori and SHE's unexpectedly small staff. In terms of materials, they accomplished their purposes well, although a high-quality camera would have been helpful in resolving technical SolSource issues.

The SolSource assembly manual's lack of clear labels led to some parts' translation confusion. The participant selection survey was a bit too long, and with different methods, could feasibly be eliminated. The baseline survey and follow-up surveys were appropriate, save for a couple poorly translated questions. In terms of staff performance, the SHE management team (Sophie Brock Lyman, Kate McGarrity, and Richard Stolz), contractor Onel Joseph, and local leaders Idamane Supreme and Marc Breus excelled at their role, volunteering extra hours to get the job done. SHE was short-staffed due to Sophie's extended maternity leave, contributing to delays in reporting. In terms of schedule, events followed the planned timeline, save for the first follow-up survey taking place in December, and the November 2016 surveys being very delayed due to communication and travel issues from Tilori. The budget was also appropriate, although the team members worked more hours than budgeted for, and the local leader was given an extra $50 for additional data clarification work for the end-of-year evaluation.

To conclude, this project can be considered a success. Project objectives were met regarding disseminating 25 SolSources in Tilori, measuring adoption, impact and outcomes, and drawing lessons concerning technology adoption. The end-of-year evaluation confirmed that the SolSources achieved very high adoption and high impact, among other findings, and that management and implementation were carried out generally as planned, with expected favorable outcomes.

To protect gains already achieved, minimal funding would be needed to support the 25 participants in their continued SolSource usage over the next 10 years. Next steps would include expanding the SolSource project to other Tilori residents, or setting up a shop to locally manufacture parabolic solar stoves, so that solar cooking could scale up considerably, spreading to the rest of Haiti with minimal international funding or intervention, and perhaps even achieving carbon finance.

I. INTRODUCTION

Hispaniola is an island of 78,000 km^2 shared by two countries: Dominican Republic and Haiti. The Central Mountain Range of the island is very important for the economy of both countries as all major rivers originate there, including the bi-national watershed of the Artibonite river. Unfortunately, this region is under severe environmental degradation because of the high deforestation rate and water contamination. Particularly, the border zones of the Dominican Republic and Haiti have been historically affected by human activity, reaching in many places total loss of vegetation coverage due to the rapid rates of expansion of hillside agriculture and unsustainable crops production.

Project location and community

Tilori, a small Haitian town with a population of less than 5,000 on the border of Haiti and the Dominican Republic, was selected as a pilot project location as its inhabitants are some of the main users of the forest of Sabana Clara, a mix of pine and broadleaf forest with an important biodiversity value for restoration of Haiti's degraded ecosystems.

Tilori is a locality pertaining to the third communal district of LaMiel, located in the Haut Plateau in the Centre Department, more particularly in the municipality of Cerca-La-Source in the State of Hinche (Chef-Lieu). TiLori also shares borders with the Dominican Republic (DR) along "Route 45" about two kilometers from the town of Anacaona in DR.

Location of Sabana Clara forest, under deforestation threat from Tilori residents on Haiti-DR border

Climate

Haiti's climate is tropical, with two rainy seasons from April-June and October-November.[1] Specific weather data (22-year averages) for Tilori, latitude 19.5, longitude -71.5, obtained from the NASA Atmospheric Science Data Center, tells us that:

- monthly averaged insolation incident on a horizontal surface at from 10 am to 1 pm stays between 0.6 and 0.8 kW/m2 from February through October, dipping slightly below from November to January.
- precipitation peaks in May and September, but stays above 2.5 mm/day from May through

November.
- the frequency of near-overcast skies increases as the day goes by. Afternoons are quite cloudy April through October, in line with the precipitation data. (See appendix 1: Weather and solar cooking)

These weather patterns do not give us very clear answers when it comes to solar cooking potential. Weaker insolation slows down parabolic solar cooking, but mostly insignificantly. Cloud cover and rain, however, halts parabolic solar cooking. This weather data is not precise and can be interpreted in different ways, and there are many factors at play for solar cooking, but it suggests the following:
Mornings throughout the year seem like a better time to solar cook, since afternoons tend to be cloudy (this was also a comment from local leaders). February, March and April may be a better time for solar cooking, as insolation is relatively high and precipitation relatively low. From May through November, both insolation and precipitation are higher. In December (month of first follow-up survey) and January, both insolation and precipitation are lower.

Background and history

In 2011, The Nature Conservancy (TNC) joined efforts with The Ministry of Environment and Natural Resources of the Dominican Republic, Solar Household Energy (SHE), Fondo ProNaturaleza (PRONATURA) and Servicio Social de Iglesias (Protestant Church's Social Services) in DR to conduct actions with the intention of reducing the pressure on the remaining forest and to improve the economic conditions and quality of life, and thus provide a showcase for best management practices and livelihood improvement.

SHE and TNC partnered to introduce Sun Oven solar ovens (a box cooker design) as a sustainable way to promote a healthy and clean environmentally-friendly practice. However, due to the number of cloudy and rainy days in this region the use of the solar oven was combined with "StoveTec" energy efficient stoves in order to provide a cooking system that uses less wood than the method this Haitian community traditionally uses. A group of 30 women received training in the use of the combined cooking system of solar ovens and energy efficient stoves.

After a year of the introduction of solar ovens and fuel-efficient stoves in Tilori, SHE and TNC evaluated usage by community participants in the program and found that not only were all women regularly using the combined cooking system, but there was also a list of more women requesting to be integrated in the clean energy program.

SHE recommended, however, that more powerful parabolic solar cookers be introduced for faster cooking and larger meals. In 2013, TNC introduced 85 "Sun and Ice" parabolic stove solar cookers along with an additional 177 StoveTec fuel-efficient stoves and 30 pots to 177 families in Tilori. Beneficiaries were selected based on need (favoring single mothers and lower-income households) and level of expressed interest. A special team of twelve local community members assisted in the distribution and assembling of the solar stoves. The local leader, Idamane Supreme, and three assistants also supported those activities. Beneficiaries have been receiving and will continue to receive training on alternative cooking education, solar usage, maintenance, and safety. They have also participated in several focus groups and workshops on environmental protection and awareness.

With a high demand for parabolic solar cookers, experienced solar cooking leaders and trainers, training and monitoring and evaluation materials in place, Tilori was ready to welcome 25 SolSource parabolic solar cookers.

II. PROJECT CONTEXT

A. Problem statement

Haiti suffers from severe deforestation due in large part to harvest wood for cooking fuel, particularly in Tilori, a small town near the Dominican Republic border. Tilori residents suffer from the effects dirty cookstoves. Women in particular carry the burden of collecting woodfuel, and cooking over a smoky fire or stove which cause respiratory and other health problems. Purchasing fuelwood can be a large financial burden as well for the whole family.

In 2014, Tilori residents were surveyed as part of the participant selection and baseline surveys for the integrated clean cooking project introducing 85 Sun and Ice solar stoves and 177 StoveTec fuel-efficient stoves. Residents were surveyed on a first-serve, first-come basis, knowing that low-income, female heads of households would be given preference for participation in the project. These participant selection and baseline survey results give us insights into the population most interested and in need of alternative cooking technologies.

The graphs and tables below taken from the October 2014 Summary Report of the Alternative Cooking Project in Tilori, Haiti, by Onel Joseph tell us that the typical person interested in clean cooking:
- is a woman (91% of applicants)
- is married (84% of applicants)
- lives with a spouse (62% of applicants)
- often lives with parents (18% of the time)
- has several children (5.4 on average)
- is most likely between 36 and 50 years of age (41% of applicants)
- is illiterate (72% of applicants)
- is most likely a farmer/laborer (58%) or merchant/businessman (17%)
- collects wood almost daily (around 45% of applicants) or twice a week (around 25% of applicants)
- predominantly uses wood, twigs, leaves and grass as cooking fuel, followed by charcoal, with virtually no LPG or propane use
- purchases one bundle of wood per week
- pays 88 goudes, or $2.20 for fuel twice per week (700 Goudes / $18 per month)
- has a monthly income under $20 (1300 Goudes on average)
- has monthly expenses over $40 (3000 Goudes on average)
- suffers from the effects of dirty cookstoves, especially children, mostly eye problems, followed by cough, chest pain, and headaches.

The survey results confirm that the typical Tilori resident showing interest in alternative cooking methods spends a large proportion of their time and income on fuel, and can barely, or cannot, make ends meet. This typical person, usually a woman, and his/her children, suffer from the health effects of smoke exposure from cooking. Reducing the need and use of cooking fuel by using alternative cooking technologies would reduce the burden on women and families in terms of money, time, labor and negative health impacts.

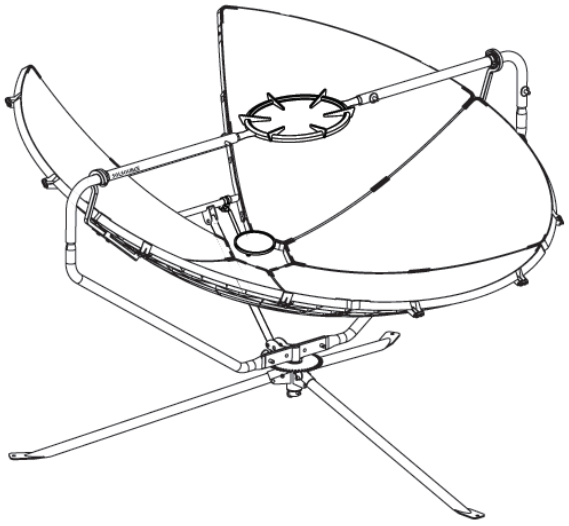
(See appendix 2: Demographic data from the October 2014 Summary Report of the Alternative Cooking Project in Tilori, Haiti, by Onel Joseph)

B. Theory of the intervention

Clean cookstoves are one solution towards reducing the financial and health burden on women and children in Tilori caused by dirty cookstoves, and towards reducing deforestation, land erosion, smoke pollution, etc…

1. Technology

The SolSource is a parabolic solar stove, a zero-emission clean cookstove that transforms sunlight into heat for cooking. Given Haiti's sunny climate, and Tilori's previous successful solar cooker projects, the SolSource is an appropriate technology to reduce deforestation and improve quality of life for Tilori residents.



	Metal Frame	Reflective Dish
Dimensions	1.5m (W) x 1.2m (D) x 0.94m (H)	Diameter 1.3m x 0.28m (Height)
Weights	14kg	4.5kg
Materials	Carbon steel with ED coating Pod Stand with Enamel coating Stainless steel accessories	Outdoor endurance plastic
Color	Black	Grey plastic base with reflective mirror

Product Features

- Reflective dish with 360° rotation for sun tracking
- Adjustment pole with 5°-60° elevation angle (summer and winter settings available)
- Foldable tripod legs
- Easy set up and tool free disassembly for storage
- 1 year limited warranty

The SolSource is being used in 18 countries on 6 continents. The manufacturer, One Earth Designs, asserts that the design addresses major flaws of existing parabolic solar cookers, and that it is 90% energy efficient, at least 10 years durable, wind-sturdy, and comes with a safe and convenient user interface .
(See appendix 3: SolSource Technical Issues)

2. Partners

Solar Electric Light Fund (SELF)'s mission is "to design and implement solar energy solutions to assist the 1.2 billion people living in energy poverty with their economic, educational, health care and agricultural development."

Solar Household Energy (SHE) leverages the power of solar cooking to improve social, economic and environmental conditions in sun-rich areas around the world. Since 1998, Solar Household Energy has worked with non-governmental organizations, entrepreneurs and public sector entities to promote solar cooking with modern solar cookers, including the "HotPot" developed by SHE. SHE helps to introduce the technology in developing countries through making suitable devices available within the context of comprehensive training initiatives, including progress monitoring and project evaluation.

One Earth Designs, creator of the SolSource parabolic solar cooker, is committed to bringing affordable and sustainable home energy solutions to the emerging markets through collaborative design, engineering, and entrepreneurship initiatives. Its expertise is in combining valuable local knowledge with modern design thinking to create convenient and accessible products that are in harmony with people and nature.

3. Project Design and Implementation

a) Objectives:

- To disseminate, promote and encourage long-term adoption of 25 SolSource parabolic solar stoves in the rural community of Tilori, Haiti, to empower women and generate economic self-sufficiency, while helping to reduce the levels of deforestation, land erosion, and household air pollution.

- To measure SolSource impacts on fuel use and expenditures, health, social and other impacts qualitatively, comparing baseline measurements with monthly evaluation measurements.

- To draw lessons learned concerning new technology adoption, in particular in relation to the two other types of solar cookers and the fuel-efficient stoves already introduced.

b) Planned timeline and deliverables

Timeline	Milestone	Deliverables
January-August 2015	**Project planning:** Plan project implementation, drawing lessons learned from clean cooking program in Tilori.	**Agreement**: All Parties to confirm an agreement specifying budget breakdown, timeline, implementation and training plan, and deliverables. **Funds disbursement**: to SELF, OED, and SHE.
September 2015	**SolSource Shipment and transport to Tilori:** OED to arrange shipping of 25 units with accessories and replacement parts to Miami. SELF to arrange shipping from Miami to Port-	**Confirmation of SolSources' arrival at destination:** Shipping, customs clearance, and transportation documents.

	au-Prince, customs clearance in Port-au-Prince, and transportation to Tilori.	
October 2015	**Training of two local project leaders** by Onel Joseph, SHE's consultant. **SolSource distribution and baseline data collection:** Onel Joseph and local leaders distribute SolSources and conduct in-home visits, recording baseline data on fuel use and expenditures, and reinforcing training.	**Training report and baseline assessment report** by Onel Joseph. Field staff to share stories, images, quotes from participants with all Parties.
October 2015 – October 2016	**Ongoing monitoring and evaluation** Local leaders to conduct monthly "adoption and impact" surveys on all 25 SolSource recipients and carry out focus group meetings quarterly. Onel Joseph and SHE staff to oversee efforts and assist by distance communication.	**Quarterly progress reports** SHE reports on surveys and focus group meeting, aggregating data collected by local leaders.
October 2016	**One-year Impact Evaluation and Project Analysis Report**	**Year One project report**: SHE summarizes year-long project with monthly results and quarterly focus group meetings, and lessons learned.

c) Planned Methods

These will be reviewed alongside what actually happened in section V. A. 2 Evaluation of methods (see below).

d) Planned Budget

OED Expenses	Unit cost (US$)	Quantity	Total cost ($US)
SolSource costs			
SolSource units at non-profit rate	264	25	6589
SolSource covers at non-profit rate	26	25	660
Replacement parts/Repair materials	0	25	0
Shipment CA to Miami	1498	1	1498
Total			**8747**

SHE expenses	Unit cost (US$)	Quanti ty	Total cost ($US)
Project management (SHE) (per man-day)			
Desk research, preparation and planning	200	5	1000
Training and M&E materials creation	200	5	1000
Data analysis, report-writing and publicizing	200	5	1000
Total			**3000**
Joseph Onel salary (per man-day)			
Research, preparation, and planning	200	3	600
Field education, training, baseline assessment	200	6	1200
Distance follow-up, monitoring and evaluation	200	4	800
Subtotal Salary			**2600**
Travel (Joseph Onel)			
Flight Miami-Port-au-Prince, Round-trip	500	1	500
Car rental PAP-Tilori, Round-trip	250	1	250
Food, lodging, & Transport (Joseph Onel) per day	100	6	600
Subtotal Travel			**1350**
Field education, training, M&E			
Logistics (e.g. phone, electricity)	100	1	100
Food & beverage, plates for demo	2	25	50
Materials/Printouts per SolSource (12 months)	25	12	300
One local leader (Idamane Supreme)/monthly	100	12	1200
One trainer/assembler/monthly	50	12	600
Communication & transport stipend (local leader)	10	12	120
Communication & transport stipend (asst leader)	10	12	120
Subtotal field education, training, M&E			**2490**
Total			**9440**

SELF and shipping expenses	Unit cost (US$)	Quantit y	Total cost ($US)
SELF oversight	1	3000	3000
Trial SolSource cost and shipment to Onel Joseph and back	290	1	290
SolSource shipment from Miami to Tilori	1	2000	2000
IDB Customs Clearance	1	2000	2000
Total			**7290**

Total project expenses	Total cost ($US)
OED expenses	8747
SHE expenses	9440
SELF expenses	7290
Contingencies	523
Grand total	**26000**

SHE trainer Onel Joseph (center, touching SolSource), with local leader Idamane Supreme to his right (red shirt) carrying out SolSource training.

III. PURPOSE OF THE EVALUATION

The goals of this end-of-year evaluation are to:

- Assess whether project objectives have been met:
    - To disseminate, promote and encourage long-term adoption of 25 SolSource parabolic solar stoves in the rural community of Tilori, Haiti, to empower women and generate economic self-sufficiency, while helping to reduce the levels of deforestation, land erosion, and household air pollution.
    - To measure SolSource impacts on fuel use and expenditures, health, social and other impacts qualitatively, comparing baseline measurements with monthly evaluation measurements.
    - To draw lessons learned concerning new technology adoption, in particular in relation to the two other types of solar cookers and the fuel-efficient stoves already introduced.
- Evaluate project impacts and outcomes (stove usage and adoption levels, health and fuel impacts, foods cooked, satisfaction levels, and other impacts or outcomes obtained from comments from surveys and focus group meetings.)
- Evaluate project management and implementation in terms of planned vs. actual methods, materials, staff performance, schedule and budget.
- Draw lessons concerning project management, impacts and outcomes
- Recommend next steps

IV. RESEARCH DESIGN AND EVALUATION METHODOLOGY

A. Project management and implementation process evaluation methodology

The management and implementation process was evaluated by comparing expected vs. actual team implementation methods, materials, member performances, schedule, and budget. The October 2014 assessment and training report with receipts was very useful for evaluating the logistics and finances of the assessment trip, the training program, the participant selection process and baseline data collection process. Other insights were also drawn from communications between the SHE project manager Sophie, SHE consultant Onel Joseph, and Tilori local leader Idamane Supreme, mostly near the end of the year.

B. Project impact and outcome evaluation methodology

Project impact and outcomes were evaluated using a participant selection survey, a baseline survey, a follow-up survey carried out on a monthly basis, and quarterly focus group meetings, all of which were conducted by the local leaders Idamane Supreme and Marc Breus. SHE Trainer Onel Joseph helped carry out the participant selection and baseline surveys.

The participant selection questionnaire included demographic questions (location, age, marital status, home ownership, employment, income and expenses) to ensure preference for low income, female heads of households; as well as cooking-related questions (number of people cooked for, types of stoves and fuels, satisfaction levels, which household members collect fuel, health issues, whether they have enough sunny space in their yard for a SolSource and a thick black pot for the SolSource), to ensure that they would benefit from solar cooking; and finally, willingness to participate in the project's progress monitoring activities (monthly surveys and quarterly focus group meetings).
The baseline and monthly follow-up surveys used a questionnaire developed by the Global Alliance for Clean Cookstoves, a UN Foundation initiative, to measure stove adoption qualitatively, as well as a few added questions pertinent to solar cooking developed by Solar Household Energy and Solar Cookers International (SCI).

The baseline survey questionnaire also contained quantitative questions on fuel and health in order to get an idea of the participants' conditions before starting the project. The follow-up survey does not contain the same quantitative questions as the baseline survey, for reasons described below. Nevertheless, valuable insights were still gained.

The baseline questionnaire contained questions relating to household (number of people cooked for, which family members collect wood); fuel (amount collected, amount bought, money spent in terms of amount and percent of income, fuel prices, time spent collecting); cooking (which stove, frequency of use, foods; health (which health issues occurred, fire burns, sick children); and satisfaction levels (on stoves, buying and collecting fuel). It also contained a question from the GACC questionnaire on the location of the three-stone fire. This question was omitted from the follow-up questionnaire because solar cookers, unlike other types of stoves, would not in theory affect the location of other stoves, as they must be outside to function. As it turns out, the SolSources virtually displaced the use of three-stone fires altogether, so the question should have been kept in the follow-up questionnaire.

The follow-up questionnaire, taken mostly from the GACC survey, relies on users' perceptions rather than quantitative measurements. It contains questions relating to household size, cooking (which stoves with satisfaction levels, frequency of use, foods cooked including at time of interview), health impact, fuel savings, SolSource appreciation (whether they would buy or recommend to a friend), project support (access to training and repairs), and for the surveyor, condition of the SolSource.
The excerpts below, taken from "A recipe for measuring adoption and impact," a guidebook promoted by the Global Alliance for Clean Cookstoves, explain why obtaining accurate quantitative impact measurements is not a feasible goal for this project (or for any similar project).

"Measuring exactly how many fuels and technologies are being used to cook involves considering the number of technologies in use, for how long they are being used every day, and the variations of these factors over time. For example, some people use liquefied petroleum gas (LPG) in the rainy season when firewood is wet; others use the open fire only to cook in big pots for special occasions."
"The second reason that makes measuring impacts such as the reduction of harmful emissions, the reduction of fuel consumption, or the health improvements of the beneficiaries very difficult is the high cost, complexity, and duration of these measurements."
"One way of addressing the challenges of both the stacking of cooking technologies and the high cost and complexity of impact measurement is to obtain adoption and impact indices that are based only on user perceptions regarding the changes the clean cookstove technology has brought about in their lives."

In the case of introducing 25 SolSource solar cookers in Tilori, Haiti, many factors were at play, including: the use of several stoves with varying performances (three-stone fires of different sizes, fuel-efficient stoves with varying performance due to their one-year lifespan), changing availability and prices of wood, charcoal, agricultural residues and other fuels throughout the year, and changing household sizes.

Therefore, any attempt to accurately measure quantitative reductions in fuel usage, health issues, and other impacts would not pass rigorous statistical standards due to the small sample size with no control group and the very large number of known and unknown variables that could not be measured.

Given this caveat, the baseline and follow-up surveys did include one quantitative question, which was the number of times people use their stoves per week. On top of all the sources of error mentioned above, the number of times people use their stoves per week presents us with many issues. It relies on users' recollections and estimations, for one. Also, it is not a very good proxy for fuel savings for the SolSource, as different dishes take different amounts of fuel/energy to cook (e.g., tea vs. beans).

While project impact was mostly measured qualitatively through baseline and follow-up surveys, project outcomes were mostly gleaned from quarterly focus group meetings, where local leader Idamane Supreme sparked discussions on various topics relating to the project.

V. FINDINGS

A. Process findings about the management and implementation of the program

1. Evaluation of methods

Planned methods and events	Actual methods and events
1. Desk research and planning	Project planning went as planned. Using materials

a) Project planning SHE researches project partners, location, community and conditions best suited for the goal of bringing SolSource solar cooking benefits to Haiti. Tilori, a small town on the DR-Haitian border with past TNC-SHE solar cooking projects, is selected. Onel Joseph, former TNC consultant and field project manager for a previous TNC solar cooking project in Tilori is selected as trainer and field project manager. As a precaution, Onel Joseph first tests out the SolSource in his Florida home to assess its suitability for Tilori. It passes with flying colors. SHE, with help from Onel Joseph, researches past Tilori clean cooking projects to apply lessons learned, availability of resources, and logistics for new project. SHE develops protocols and materials for participant selection, training, follow-up, monitoring and evaluation, among other topics. SHE develops proposal and budget.	shared by TNC, and Onel's knowledge from past clean cooking projects, SHE and Onel Joseph together created a participant selection survey, a baseline survey, a monthly follow-up survey, focus group meeting guidelines, and local leader contracts. SHE wrote a contract and an agreement for Onel Joseph, and a proposal and an agreement for SELF. Thanks to Onel's experience with previous clean cookstove projects in Tilori, he easily prepared for his trip, planning travel and lodging logistics with help from previous project contacts.
b. Arrange SolSource delivery and storage SHE, OED and SELF explore and select suitable shipment and storage options, and make arrangements accordingly. Currently, the most likely scenario is as follows: OED arranges shipment to Miami. SELF arranges shipment from Miami to Port-au-Prince, engaging the IDB to assist with customs, and transportation from Port-au-Prince to Tilori.	SolSource delivery went as planned (SELF can comment on shipment from Miami, customs clearance and transportation to Tilori). Storage was successful, on Mrs. Supreme's premises in her detached storage. Although not stated explicitly in the proposal, Onel Joseph had ensured a safe storage space was available before his training trip. This responsibility was also included in the local leader's contract, which Onel went over with the local leader before his training trip.
2. Field research and preparation	Field staff selection and recruitment went mostly as planned. SHE Consultant Onel Joseph had Idamane

a. Field staff selection and recruitment One local leader is recruited in Tilori with responsibilities to assist in planning, organizing, and coordinating various activities of the project, as well as training and follow-up, as specified by terms of reference. This person will most likely be Idamane Supreme, in charge of past solar cooking projects involving the "Sun Oven" and "Sun and Ice" parabolic solar cookers. An assistant local leader will be recruited to help transport, assemble, and repair SolSources, as well as take pictures.	Supreme and Marc Breus sign their contracts and payed them his first day in Tilori. Although it was not explicitly stated in the proposal or anywhere else, these recruitments were arranged before the training trip. Signing the contracts was a formality, as they had already understood the terms of the job and accepted them over the phone with Onel Joseph before his arrival. There would not have been time to find local leaders once arrived in Tilori, which would involve advertising the job, interviewing candidates, and making a selection. So although this step was under "field research and preparation," this step was mostly completed during the project planning phase. In future projects, this necessary step of recruiting local leaders before the training trip should be made explicit.
b. Participant selection and enrollment Low-income households, especially single mothers, demonstrating a willingness to participate in other TNC initiatives, are favored on a first-come, first serve basis. Those waiting on a parabolic solar cooker from the Sun and Ice initiative will also be favored.	Participant selection and enrollment went as planned. The participant selection survey questionnaire was created to ensure that only suitable candidates would take part in the SolSource project. In theory, a large number of candidates would have taken the survey in order to select the most suitable 25 candidates for the SolSource project out of a large pool (there were 92 people on the waiting list from the last project to receive a solar cooker). In practice, SHE consultant and trainer Onel Joseph first went over some of the criteria (particularly progress monitoring activities) for project participation in the environmental workshop attended by 40 candidates, and then the local Tilori leader, who was very familiar with each candidate from previous projects, selected the SolSource beneficiaries and had them fill out the participant selection forms, to avoid confusion, frustration, and false expectations. Lack of time to fill out more participant selection forms was also an important factor, especially given the long questionnaire form, candidates' illiteracy for the most part, only 2 people to carry out the survey, and so many other activities for the SHE consultant to complete in just 3 days (since he lost 2 days due to border issues). Printing a large number of questionnaires can also be difficult and expensive in a place like Tilori with no print shops. This method seems to have worked well, as the participant selection survey showed they were suitable for the project, they had good results with the SolSource, and they were enthusiastic about participating in progress monitoring throughout the year. The only issue that came up which may (or may not) have been avoided with the

	survey was that of thin pots being damaged by the power of the SolSource. The questionnaire included a question on whether participants had thick black pots appropriate for the SolSource. Most of the participants answered no. However, it is likely that most of the population does not have thick black pots, since these were given to recipients in past projects, so the survey would not have found many people with thick black pots anyway. Furthermore, project participants assured local leaders that they could find suitable pots on the marketplace. Unfortunately, by the end of the year, most participants were still complaining about pot issues, asking for free black pots, probably because others in past projects had been given free black pots. In the future, planning for participant selection will take into consideration these factors. Going over the selection criteria in detail at an environmental education meeting and having a leader familiar with candidates select the final project participants worked well in this case, and would probably work well in similar projects.
3. SolSource training and distribution, baseline data collection *a. Training of trainers* Training will be carried out by Onel Joseph. He will train one local leader to assist in training and follow-up of SolSource users, as well as planning, organizing, and coordinating various activities. Onel will also train an assistant leader to help with assembling, transportation, repair and maintenance, and other duties.	The training of trainers went as planned, except that not only was the assistant leader trained in assembling the SolSource, so were the main leader and 6 volunteer assemblers, who were paid a total stipend of $12. Training the local leader was a necessary step which should have been explicitly stated in the proposal. Having 6 volunteers assemble the SolSources was also necessary to have them ready for distribution the next day, especially given limited time. Onel Joseph went over the pictorial SolSource instruction manual (that comes with each SolSource) with the local leaders. He also used the English SolSource Usage Training guidelines by Sophie Brock Lyman and SolSource Assembly videos by One Earth Designs to help with training.
b. Participant training workshop Onel Joseph, with the local leader and assistant leader, will coordinate one education and training workshop on environmental protection awareness, utilization	As planned, except that two workshops were carried out for different audiences, rather than one. The first was an environmental education workshop attended by around 40 females and some of their children, and the second a smaller SolSource training workshop attended only by the 25 project participants selected during the larger

and maintenance of stoves, and alternative cooking best practices, including the distribution of any necessary materials (e.g. brochures and posters).	workshop. The first workshop was an excellent way to reach more people than having only one workshop as stated in the proposal. Onel Joseph found from past experience that printed training materials were not helpful, even simple graphics, as women did not look at the papers. Instead, women seemed to be impressed by simple allegorical stories – they all remembered a video clip played years ago by Onel Joseph about a father cutting a tree branch while the entire family was sitting on it. Onel Joseph also talked about local tree-planting activities, the need to focus on the long-term, and of course using SolSources as an important part of the solution. The training workshop went as planned, covering cooking practices and safety issues, with Onel answering questions on the black mirror, and also touching upon using heat retention baskets. Participants started filling out the baseline survey, but they were soon stopped by rain.
c. SolSource distribution and individual training Onel Joseph will visit individual homes with the local leader and assistant leader to oversee SolSource distribution, assembling, training, to do the baseline survey, and to take pictures.	SolSource distribution went as planned. The exact distribution and transportation methods to be used were left to Onel's discretion, to what would be most practical and appropriate for the local conditions and culture. The SolSources were assembled by the local leaders and volunteers on the first day, and three were distributed to women as there was not enough space for all 25 fully assembled SolSources. The next day, participants came to take part in a solar cooking demo with chicken and beans, which finished on the fuel-efficient stove due to clouds, and to take home the remaining 22 SolSources. They carried the assembled stoves home with help from family members, with the parabolic dish sometimes unhooked for easier carrying. Onel only had time to visit one home with Idamane and Marc, that of Prestilia Prestanor. Together, they reinforced training as she cooked rice and beans in 20 minutes. The initial thought was to show people how to assemble the SolSources in their homes, but in the end the participants took the SolSources home with them already assembled. Although the participants did not receive much training on SolSource assembly (or disassembly), they could always ask the assistant leader to help them with this. This was probably for the best, as training all participants in assembly would have taken too long and

	participants' errors at home might go unnoticed. Having the assistant leader practice and eventually gain expertise in assembly, repair and maintenance was a better way to ensure project success and documentation than having participants assemble their own SolSources.
Follow-up data collection *Monthly household surveys* The local leader and assistant leader will visit each home at the beginning of every month to carry out a survey on adoption and impact. They will relay the information to Onel Joseph who will relay it to Solar Household Energy for compilation and analysis. Solar Household Energy will present progress reports with analytical summaries on a quarterly basis.	Monthly data collection went mostly as planned, with some delays due to different issues. The training took place in mid-October 2015, but the first follow-up survey took place in December, as Idamane felt that the participants should have more than 2 weeks to familiarize themselves with the SolSource. So this postponed everything by one month. Idamane and Onel then sent the filled-out surveys shortly after completion, except for the October 2016 and November 2016 surveys which were sent to Onel in January 2017 due to technical challenges in Haiti. Solar Household Energy then took longer than expected to submit quarterly reports to SELF including survey data analysis due to multiple unforeseen circumstances. Having Tilori locals perform data entry (entering survey answers in excel) in future projects, if possible, would reduce costs.
b. Focus groups Focus groups will be held by SolSource users at 1 months, 3 months, and 6 months to gather feedback and address any challenges in SolSource usage and adoption. Reports on these focus groups will be relayed to Onel Joseph and Solar Household Energy to incorporate relevant information into the quarterly progress reports and 1-year impact evaluation, and to address any obstacles.	The focus group meetings and the transfer and analysis of their reports went as planned, except for delays in submitting quarterly reports to SELF as explained above. Onel Joseph communicated regularly with SHE management and local leaders to address obstacles and find solutions.
Monitoring and evaluation Basic quantitative data collection is built into the project design using a survey developed by the Global Alliance for Clean Cookstoves, a UN Foundation initiative, and adapted for solar cooking by SHE and SCI. Every new project participant will need to fill out a baseline survey with demographic	Monitoring and evaluation went mostly as planned. Data from monthly surveys, focus group meetings, and communications with Onel and local leaders were aggregated at the end of the year for writing up the end-of-year evaluation report. However, certain issues were explored in more detail once Sophie came on board near the end of the project, using her experience from previous SolSource projects in Haiti to better understand issues and try to find solutions. So some issues were addressed too late in the game to fix by the end of the project, for

and fuel use data. The SolSource trainers are responsible for making at least one customer home visit every month, where follow-up surveys will be taken on SolSource and fuel usage, as well as qualitative feedback on social, health, and other impacts.	example that of the broken or stolen SolSource parts.

Left to right: Idamane Supreme (local leader), SHE Trainer Onel Joseph, and assistant local leader Marc Breus.

2. Evaluation of materials

Contracts and Agreements

The contracts and agreements were thorough, complete and appropriate. As explained above, some of the tasks set out in Onel Joseph's contract could have been more explicit (for example, stating that local leaders had to be recruited *before* Onel had arrived in Tilori), but this did not affect the project, as firstly, the SHE team discussed details with Onel through regular

communications, and secondly, the SHE team was confident that Onel Joseph, thanks to his vast experience, had the good sense to think ahead and improvise appropriately, which he did. A more explicit, detailed contract might be helpful for a less experienced trainer, however.

Training materials

To prepare for training, the English SolSource Usage Training guidelines by Sophie Brock Lyman and SolSource Assembly videos by One Earth Designs were very useful to Onel Joseph. Once in Tilori, Onel went over the pictorial SolSource instruction manual (that comes with each SolSource) with the local leaders. This manual does not include simple labels for each SolSource part, which led to made-up Creole and English labels and translation errors regarding missing or broken parts. (See appendix 3: SolSource Technical Issues) The manual could be improved for Haiti by creating simple labels for each part, either one letter, or with an appropriate Creole name.

For Tilori locals, Onel had found that written materials were mostly ignored, and that oral anecdotes and interactive demonstrations were far more appreciated and effective. The training

Surveys

The participant selection survey was too long, in that the training team only had time to fill out the surveys for the 25 participants, rather than a larger pool of candidates. A simpler way to select participants would be to go over the selection criteria in detail during the educational workshops, and then to later ensure those criteria were met in the baseline survey results. Also, the participant selection and baseline survey had some of the same questions. This redundancy wasted time in the field, though it may have saved a little time in analyzing the data later on. A question regarding preferred stoves was poorly translated in that it was understood as a conditional question rather than a polite one. (see Appendix 4: Translation issues). (See Appendix 4: Translation issues)

The baseline survey helped understand basic baseline conditions for participants, such as fuel usage and health impacts. Satisfaction ratings should have been accompanied by descriptions for each rating (as in the survey promoted by the Global Alliance) to increase objectivity. As is always the case, accurate measurements or even estimates of fuel amounts and expenses are difficult to obtain. Units for fuel amounts were noted down in “pake” (bundles) and other local units, rather than the “20-liter buckets” unit stated in the survey. More research should be done on the most accurate, cost-effective way of measuring or estimating fuels locally, including which units to use. But these inaccuracies were expected, which is why fuel and other measurements/estimates are only supposed to give us a general idea of baseline conditions.

The follow-up survey served its purpose. Two questions, regarding getting another SolSource and getting SolSources repaired, were poorly translated or unclear, which led to confusion, and therefore answers which had to be discounted. (See Appendix 4: Translation issues)

Most of the qualitative Global Alliance survey questions were a bit vague and subjective (for example, rating fuel savings as: “no,” “a little,” “some savings,” “impressed with savings,” or “very impressed with savings”). Although the answers were for the most part uniform, and usually the best possible option for the SolSource, which sounds too good to be true and biased towards the SolSource, there was at least one question which received medium ratings: “some savings” for fuel savings was the most common answer. Also, the same fuel-efficient stoves

received satisfaction ratings of 2 at baseline and 5 at follow-up, shedding some doubt on their validity. Satisfaction ratings should have been accompanied by descriptions for each rating (as in the survey promoted by the Global Alliance) to increase objectivity. It is important to remember that the Global Alliance survey relies on user's perceptions (appreciation measured in satisfaction levels and other subjective means) of the stoves as a measure of adoption. Participants' appreciation of the stove is arguably the most important factor in whether they are likely to use them, fix them, recommend them to friends, buy them, and in general, create a favorable market for them.

The survey was done on a monthly basis to see if seasonal changes affected fuel and stove usage. There were no significant changes that could be attributed to seasonal variation. In the future, quarterly follow-up surveys would probably suffice, as long as local leaders still visit participants frequently to promote SolSource usage.

The quarterly focus group meeting reporting template had good guidelines to spark discussion on the project.

Project participants attending focus group meetings (local leader Idamane Supreme at center table)

As well as written materials, the project would have benefitted from a high-quality camera for the

local leaders to take high-resolution, informative pictures. (They had their own cameras but it was only after seeing how blurry the pictures of missing or broken SolSource parts were, that SHE realized that higher quality cameras were needed.)

3. Team members' performances evaluation

SHE Consultant Onel Joseph - Consultant Onel Joseph has been an outstanding trainer and field project manager, using his fluency in Creole and extensive experience in past clean cooking projects in Tilori to carry out his responsibilities with expertise and efficiency, maintaining high standards, and improvising successfully when necessary. The logistics of traveling to Tilori are quite challenging and risky. Thanks to his contacts and familiarity with DR and Haiti, he was able to take care of all travel logistics at low cost to the project. Despite losing two out of four of his planned days in Tilori due to border issues, he managed to complete all planned activities on his training and assessment trip in October 2014. On top of the doing the training and assessment outlined in his contract, he also obtained biographies for the local leaders, interviewed one of the participants to write up a case study, and wrote down the recipe for a solar cooked local dish (which served as the demo). None of these tasks was requested as part of his training report. He was not able to visit as many homes with the local leaders as he could have given more time, but SHE is confident that the local leaders were so well trained that this had virtually no impact on the project's success. Throughout the rest of the year, Onel communicated with local leaders on a regular basis, pro-actively problem-solving with the local leaders. He responded to requests from the SHE management team quickly and with great insight. His actions show he is invested and cares deeply for the people of Tilori, and does his best to lift them out of poverty. He was an invaluable asset to this project.

Local leader Idamane Supreme (review written by Onel Joseph) - Local leader Idamane Supreme – Ms. Supreme has been instrumental to the overall coordination and success of the project. She demonstrated great leadership skills. She is very reliable and she handled all financial aspects of the project responsibly.

Every month she arranged trip to different towns wherever she would know there was service available to send the monthly surveys and other important documents. Besides, when technical issues occurred during transmission, she always managed to resend them despite the limited resources she had at hand. Also, on a monthly basis, she diligently received and managed funds for project activities and payroll.

Throughout the project, she's been very versatile. During my field visit to Tilori, when she found out that the place I was reserved to spend the night was by all standards inhabitable, she quickly managed to offer me a very comfortable room in her home. Besides, she enjoyed having the beneficiaries gather at her place for necessary meetings. She definitely showed a great sense of hospitality. She connected well with the beneficiaries. Despite logistical challenges, she always carried all her duties diligently. Per Marc Breus, she maintained a very healthy relationship with her assistant. In all, Ms. Supreme has been a great asset to our project and the Tilori community.

Assistant Marc Breus (review written by Onel Joseph) - Marc has been a critical asset for the project working alongside Idamane. Marc has a great personality. Marc displayed superior sense of leadership, authority, and communication skills. Marc was not afraid to go the extra mile to make things happen with great confidence as he managed to get on and off Tilori safely during the border issues between DR and Haiti. Marc was very reliable. He always carried his duties assisting Ms. Supreme with the monthly surveys, taking pictures, home visits either trying to fix a stove or for extra training despite logistical challenges in Tilori. Marc's versatile personality made him easy to work with. His contributions indeed to our project have been invaluable.

SHE management: Sophie Brock Lyman, Kate McGarrity, and Richard Stolz - SHE used its long experience managing solar cooking projects to manage this project with expertise and efficiency at low cost. Specifically, documents (surveys, training materials, and contracts) and knowledge from the 2014 SolSource project in Lebrun, and the Sun Oven and Sun and Ice projects in Tilori were used as starting material to quickly create appropriate materials for this project. SHE is a small non-profit run by part-time staff and some volunteers, including Board members. Sophie, Kate and Richard, the SHE staff, collaborated together to design the project, manage it, and submit reports to SELF. As Chief Operating Officer, Richard mainly supervised and edited reports. Most of the project design work was performed by Sophie in summer/fall 2015. SHE's then-recent hire Kate McGarrity then took over in October, in anticipation of Sophie's maternity leave, around the same time as Onel's training and assessment trip to Tilori. Due to her daughter's health issues, Sophie extended her maternity leave indefinitely, leaving the SHE team short-staffed. Sophie returned to SHE at the end of 2016, in time to take over for Kate McGarrity, who was leaving SHE for a full-time opportunity. The small staff, double turnover, and underestimating the amount of time needed for management, follow-up, data analysis and report-writing, contributed to delays in submitting the training and quarterly reports to SELF. Despite these challenges, SHE ensured all aspects of the project were fully implemented, communicating with Onel Joseph regularly to pro-actively problem-solve and stay on top of project details, and analyzing data for quarterly reports to SELF and this final report.

4. Evaluation of Schedule

Project events occurred for the most part according to the planned timeline. Onel's training and assessment trip took place in October, as planned. One slight deviation was that the first follow-up survey took place in December rather than November, a decision by the local leader as she felt that the participants were still familiarizing themselves with the SolSources. So everything was postponed by one month, with the last survey taking place in November rather than October. Difficulties in communication and the logistics of sending data in Haiti, as well as SHE's unexpected small staff to analyze the data, contributed to delays in sending quarterly reports to SELF. However, overall, this did not impact project success in terms of SolSource adoption and its benefits.

5. Evaluation of Budget

The budget was appropriate. The main issue was underestimating the number of hours needed for management, both for SHE management, and for the SHE consultant. These extra hours were paid by SHE's reserve funds, or donated, particularly by Onel Joseph. Also, the budget was very Spartan and did not include emergency funds. For example, Onel lost two days in Tilori due to border issues. He could have changed his travel plans with emergency funds, but could not. Fortunately, he was able to do all his planned activities anyway, although visiting fewer homes than hoped for. Funds could have also been reserved for any extra replacement parts.

Onel's comments: The travel budget served its purpose despite a few changes in itinerary and transportation. Because of the budget restrictive nature, I made some tough choices trying get out of Tilori to accommodate my planned budget. For instance, as a result of the border issues, I decided to ride in the back of motorcycle for about four hours and then spend another two hours in a leaky van before reaching Cap-Haitien in the middle of the night, and then get back on a motorcycle for my hotel. It was quite risky and I do not recommend it for anyone traveling alone.

Yet, if the budget had provided for emergency I could have simply managed to return to DR and only changed my fly itinerary, but it would have been a bit more costly. In all, everything else went well.

B. Outcome and results findings

1. Survey results

a) Participant suitability for project participation

At the educational workshop attended by 40 people at the start of the project, the trainers went over some of the selection criteria for participation in the project. The participant selection survey included questions to determine their ability to use the parabolic cooker and get involved in the project. The results are below:

21 responded that they have a lot of space in their yard, while 18 participants specifically responded that they had a flat space sufficient for a SolSource.

Reponses to: “How much shade is in your yard?” are summarized below:

A lot of shade -you can only use the SolSource around noon only	Some shade -you can only use the SolSource for half the day	Not a lot of shade -you can use the SolSource all day
2	1	22

Participants were asked if they have a dark colored, thick, and not too big pot to cook with the SolSource. 20 claimed they did not have that type of pot, while 5 said they did. During the training, Onel found that once the participants were told they weren’t being provided pots, “they finally admitted they could find some dark colored pots.”

Every participant said they or someone in their household would be willing to take monthly surveys and quarterly focus group meetings.
At follow-up, participants were asked if they had received training on the SolSource, and whether they could repair the SolSources in their community. All those reporting said yes regarding the training.

Regarding getting the SolSource repaired in the community, participants mostly said no, with some “yes’” and “uncertain’s”. This question was included to ensure that participants knew how to get their SolSources repaired by the project leaders, but they probably thought the question was referring to getting the SolSource repaired in their community outside of the project. The answers to these questions should probably be ignored, and the question modified for future trainings. A clearer, less ambiguous question would be: “Have the local leaders met all your needs regarding the SolSource, including training and repair?”

b) Participant demographics

The participant selection and baseline surveys also asked demographic questions, among others. The results are below:

Gender distribution: 21 of the participants are female, 1 is male, and 3 did not respond.

Age range:

18-25	26-35	36-50	50-65	No Response
1	1	13	6	4

Marital Status:

Single	Married	Divorced
10	10	5

Home Ownership:

Own their own home	Do not own their own home	Did not respond
18	4	3

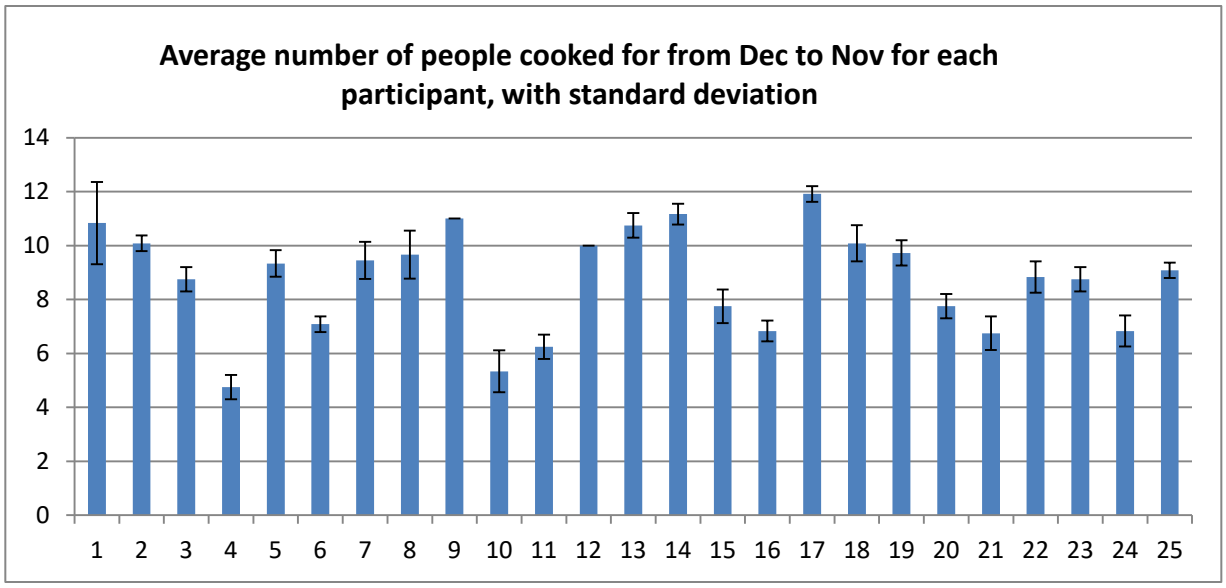
Employment:

Employed	Not-employed	No-response
14	10	1

Farming	Reforestation	Commerce	Unemployed	No Response
15	1	2	2	5

Number of people cooked for:
This was asked at baseline and follow-up. The number of people cooked for did not change significantly throughout the year. Participants cooked for 5-13 people, with up to 5 children

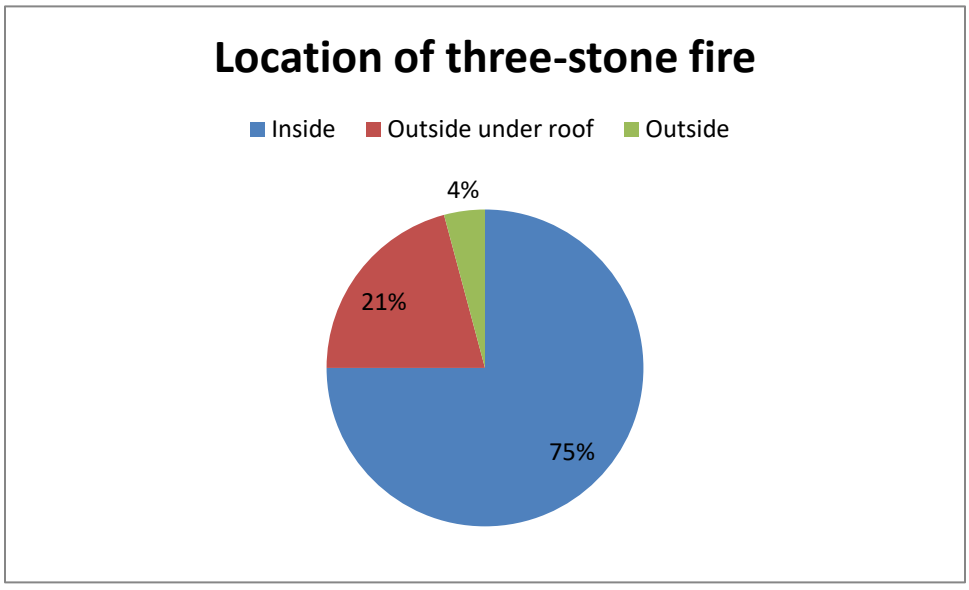
(under 12 years old), 10 adults (between 12 and 50 years old), and 2 seniors (over 50 years old).
In theory, the number of people cooked for correlates with the amount of food cooked, and hence the stove usage frequency. In practice, there is a very low correlation, perhaps because people cook just as often, but using smaller pots, or smaller amounts of food in their pots. (See Appendix 5: Further analysis regarding the number of people cooked for)



This graph shows the average number of people cooked for, over the year, for each one of the 25 participants, with standard deviations. The standard deviation bars show there was not much variation throughout the year for each household.

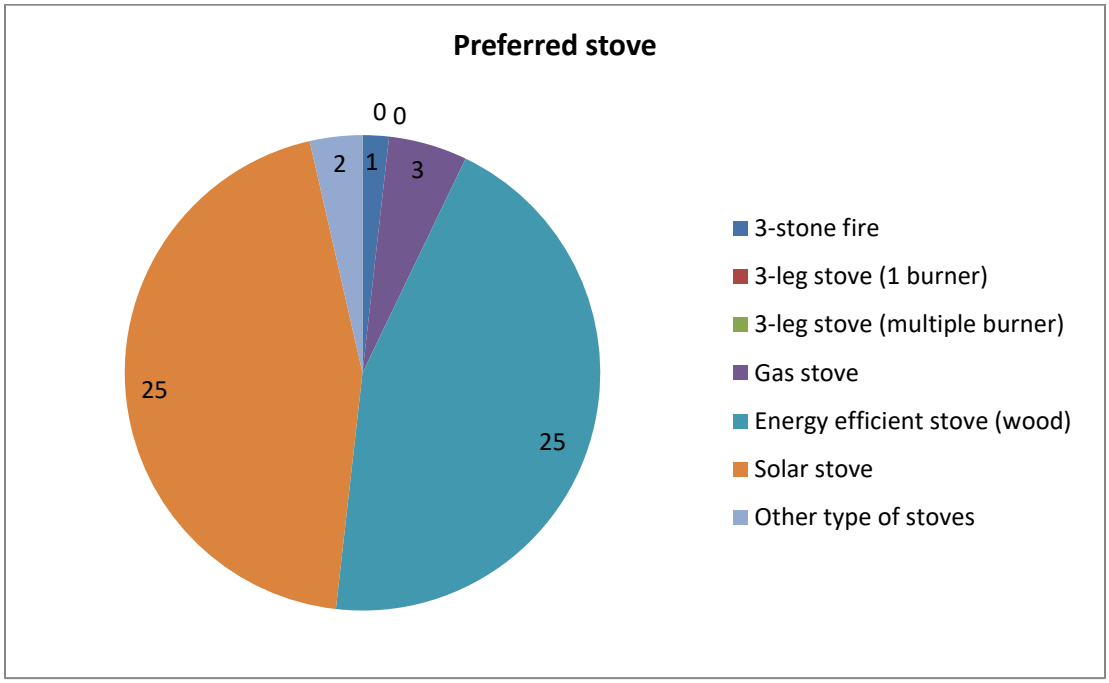
c) Stove usage

At baseline, participants were asked: “Where is your traditional (three-stone fire) stove?” The answers are below:



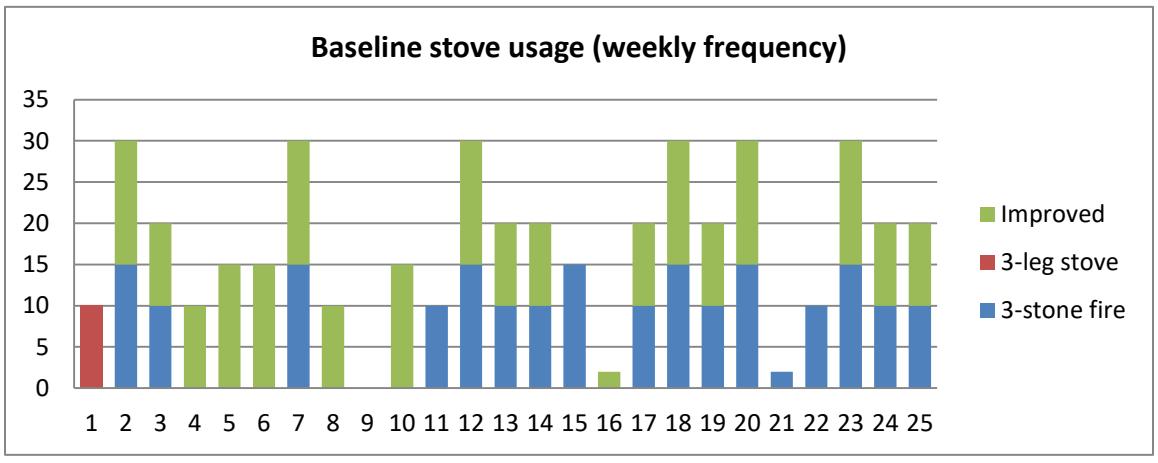
All participants said they had a three-stone fire, most of them inside, in a kitchen or separate room. 3 people gave two answers, possibly because they had two three-stone fires (second answers are not represented here).

Participants were asked: “Which stove do you most like to use?” The results are below.



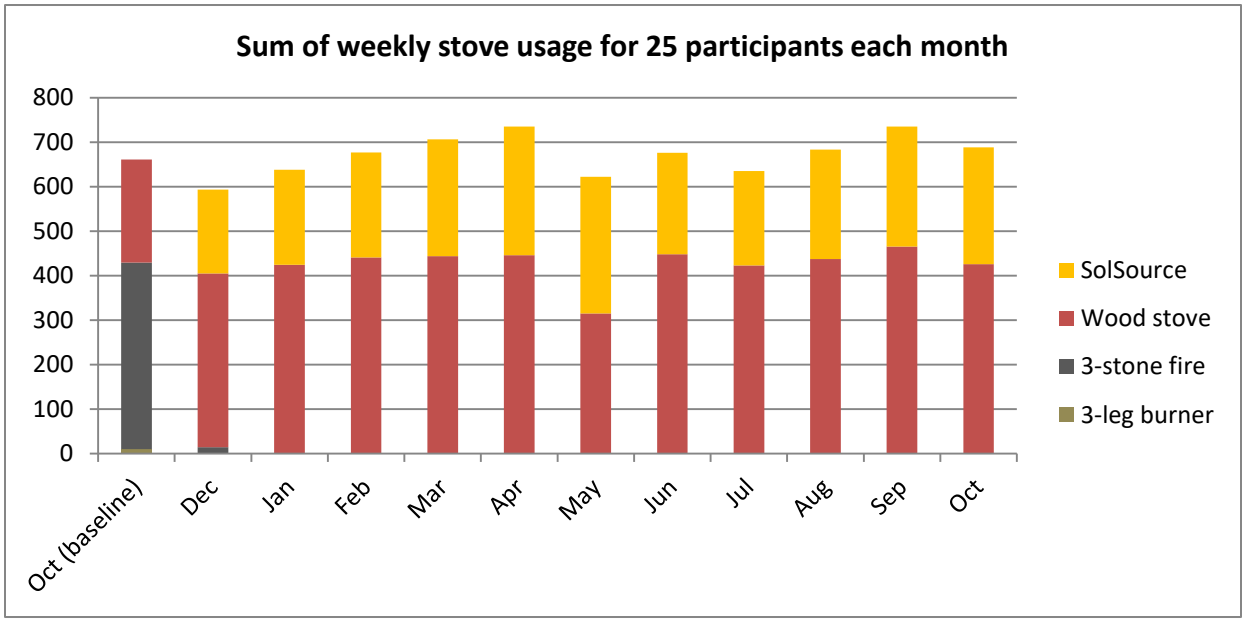
All 25 participants answered fuel-efficient stove and solar stove. However, they did not yet have a solar stove, so they probably understood the question as “which stove would you prefer using (if you had one)?” (See appendix 4: Translation issues). Three participants answered gas stove (none had gas stoves), one answered three-stone fire, and two chose “other.”

Participants were asked to estimate their weekly stove usage in both baseline and follow-up surveys. Baseline results are below.



One participant used a 3-leg stove. 4 participants only reported using a three-stone fire. 6 participants only reported using an improved stove. The remaining 13 participants reported using both a three-stone fire and an improved stove. This is puzzling, given that all of them reported having a three-stone fire, mostly inside or outdoors under a roof. Either reporting was not accurate, or many of them, rarely if ever, use their three-stone fire. It is likely that reporting was not accurate, since all reported answers were either "2," "10," or "15" (times a week), which suggests that participants made rough estimates rounded up to 10 or 15, compared to follow-up surveys where a wide range of answers was given (e.g., 7, 13, 19, etc…). Compared to follow-up surveys, where participants seem to have made an effort to keep track of the number of times they had used each of their stoves, since they knew they would be asked this question, participants were not prepared for the baseline survey and so could only estimate a rough rounded number.

Baseline and follow-up results are compared below:



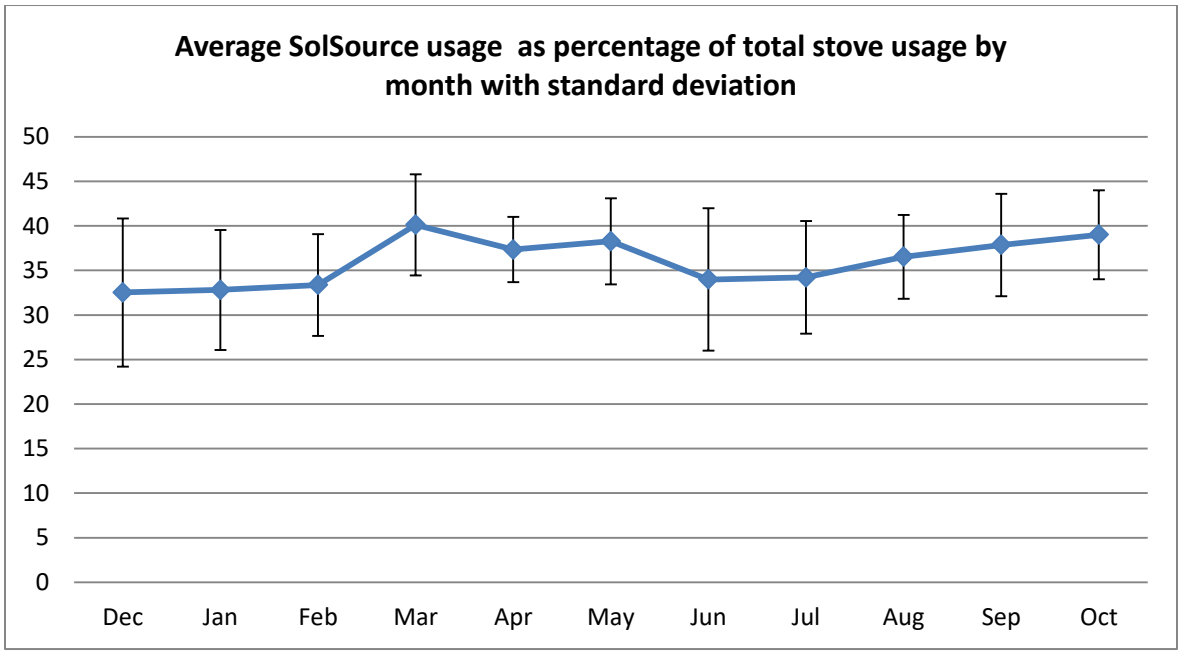
Participants did not report using a three-stone fire (or the single 3-leg stove) after baseline, except for one participant in the first month.

However, it is important to note that reporting was not always complete. For example, in May, 9 people did not report their fuel-efficient stove usage. 5 fuel-efficient stoves were reported as broken, so stove usage may effectively have been close to zero. However, no reason was given for the lack of answers for the other 4 fuel efficient stoves, so it is hard to say what actual stove usage was. Investigation into this matter at the end of the year revealed that broken "StoveTec" stoves were replaced by fuel-efficient stoves made by participants. Sometimes, participants used both partly functional "StoveTec" stoves and their home-made fuel-efficient stoves, but the frequency they reported was the combined frequency for both types of fuel-efficient stoves.

Probing further also revealed that 3 or 4 participants still occasionally used their 3-stone fire, especially for large parties, but this was not reported as the local leader was focusing on donated project stoves.

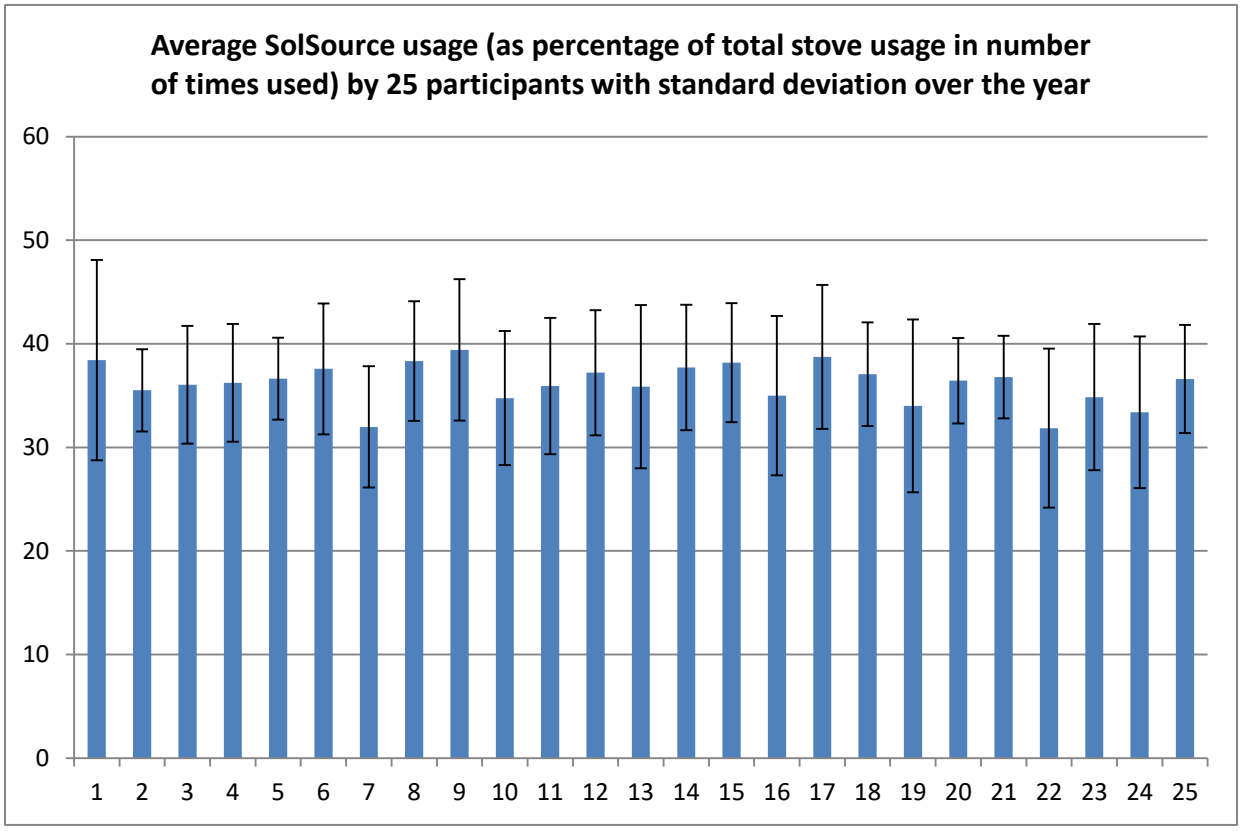
It is interesting to note, however, that, at baseline, for participants reporting both three-stone fire usage and fuel-efficient stove usage, total usage fell between 20 and 30 times a week, which is comparable to total stove usage at follow-up, where only SolSource and fuel-efficient stove usage was reported. This suggests three-stone fire use was negligible at follow-up, as asserted by the local leader.

If we exclude stove data where a participant did not report stove usage for at least one stove in a given month, then SolSource usage as a percentage of total stove usage stays fairly stable, as seen below:



According to this chart, when participants reported usage for both stoves, SolSource usage stayed on average between 33% and 40% throughout the year. The standard deviation gives us an idea of the range of usage between participants. SolSource usage started off low (lowest point of the year), and increased in the next three months, perhaps as users were familiarizing themselves with solar cooking. Usage peaked in April, in line with the hypotheses above that February, March and April would be the best months for solar cooking, weather-wise. Usage then dips in June and July, and increases back to high levels the last couple months of the year – though it useful to remember these data can only give a general idea of SolSource usage, as they are compromised by many sources of error, and one should not try to draw too many conclusions from monthly variations.

Range of usage between participants (excluding non-complete reporting) through the year is shown below:

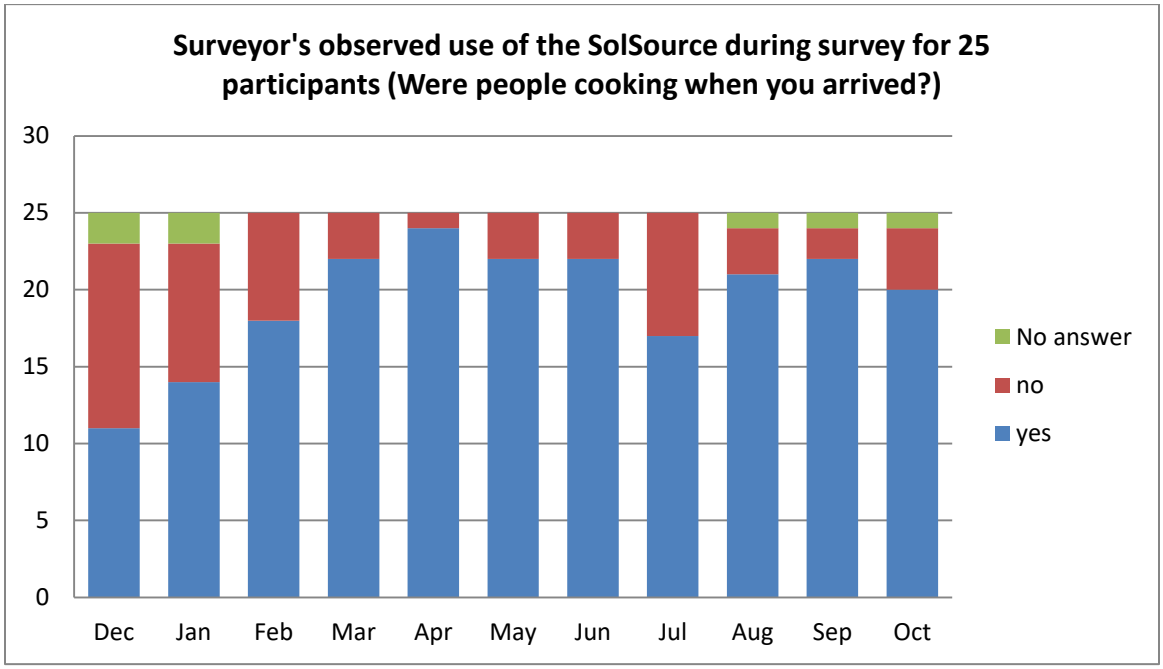


As we can see, average SolSource usage by participant ranged from 31% to 39% of total stove usage, with large variation throughout the year, with the highest reported SolSource usages at 52%.

Observed usage

As part of the survey, trainers were also asked to observe if the SolSource was being used when they arrived, what the weather conditions were, and what type of food was being prepared.

The results are charted below:



This chart shows that observed SolSource usage increased from December to April, and then stayed relatively high the rest of the year, with a dip in July. This is not a very good proxy for actual SolSource usage, as it is a snapshot in time. Many factors influence SolSource usage at the time of the survey, such as the weather, and the possibility that participants anticipated the local leader coming to survey them and prepared accordingly – although this effort would show enthusiasm for the project at least.

Weather conditions

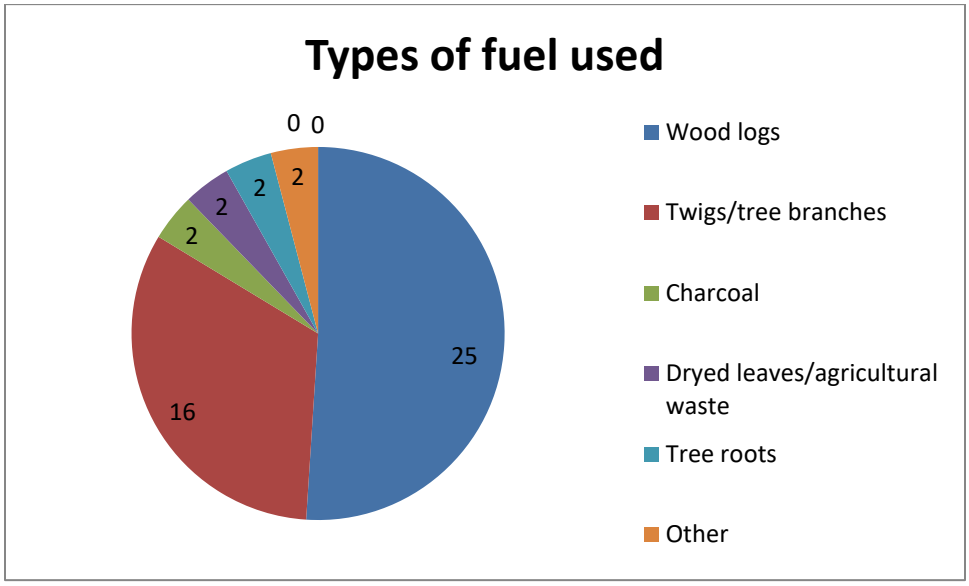
The surveys were typically taken over a few days each month. But for most participants, it was either sunny or partly cloudy each month. The low is in July, at sunny or partly cloudy weather for 16 participants (although the weather was not recorded for 2 participants).

(For more information on Weather and SolSource usage, see Appendix 1: Weather and solar cooking)

d) Fuel usage and energy savings

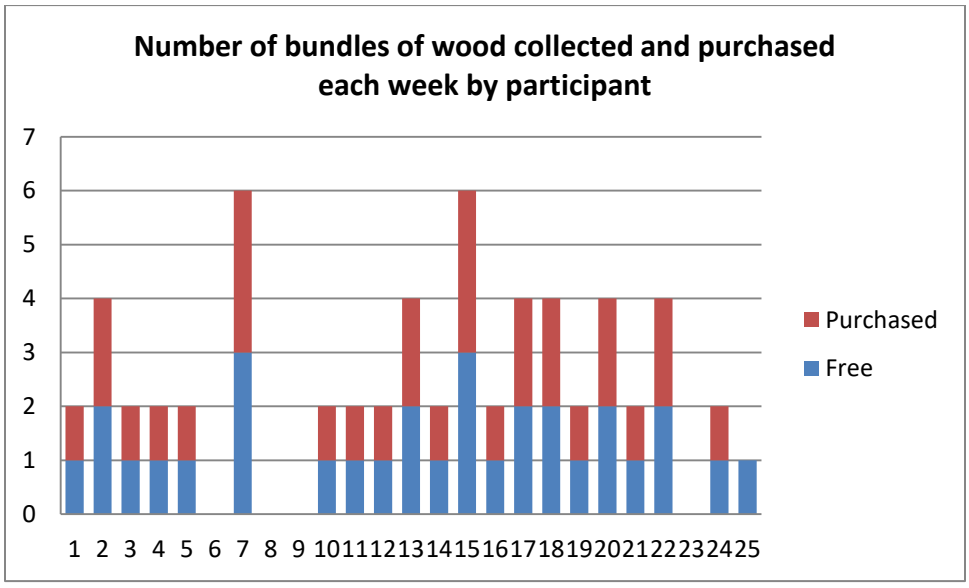
In the participant selection and baseline surveys, participants were asked several questions relating to energy and fuel – types of fuel, details on its collection, purchase and usage.

In the participant selection survey, participants were asked “Which fuel do you cook with?” The results, incorporating data from survey participants who use multiple fuel sources, are displayed below.



As noted, several participants used more than one type of fuel, although all fuels (except "other" perhaps) come from trees and contribute to deforestation and land erosion to different degrees. All 25 participants used wood logs, 16 also used twigs/tree branches, 2 also used charcoal, 2 also used dried leaves or agricultural waste, and 2 also used tree roots. 2 used another form of energy. No participants used propane gas or kerosene.

Participants were asked: how much fuel did you collect or purchase last week? Answers were given in "pake" (bundle). Some participants did not answer.



Most participants collect about half of their wood and purchase the other half.

For those that gather their own fuel, participants reported an average of 3.73 hours a week spent gathering fuel. Below are the family members who gather fuel (no participants listed grandparents as doing any fuel-gathering):

Father	Mother	Son	Daughter	Other (not including grandparents)
5	13	14	9	4

22 of the participants, out of 23 who responded, said they find obtaining free fuel too time-consuming and difficult (selecting 1 on a scale 1-5 on cost.) From these same 22 responses, all reported purchasing wood was too expensive (selecting 1 on a scale 1-5 on cost.)

Participants were asked their monthly income and expenses. Incomes ranged from 0-6,000 Gourdes (97.69 USD), averaging 1370 Gourdes (22.31 USD). Expenses ranged from 0-7000 Gourdes (113.98), averaging 2832 Gourdes (46.11 USD).

For those participants who reported buying fuel, 4 reported spending 25% of their income on fuel, and 4 reported spending 50% of their income on fuel.

At follow-up, participants were asked if they noticed savings in their energy needs from the previous month. The answers they could choose were: no savings, a little savings, some savings, impressed with savings, and very impressed with savings.

All participants who reported answered with “some savings,” except for 8 participants in December, 4 in January, 3 in February, all of whom reported “a little” savings (plus a “yes” in February), and 1 participant for a few months who answered “a little” or “none” whose SolSource was broken in March (he managed to fix it and use it a few months). Fuel savings increased on average the first three months, which correlates with observed SolSource usage patterns showing increasing usage the first three months.

e) Health Improvements from the SolSource

The participant selection survey asked participants if anyone in their family had gotten sick or burned from a cooking fire. The results are below:

Sick	Burned
19	8

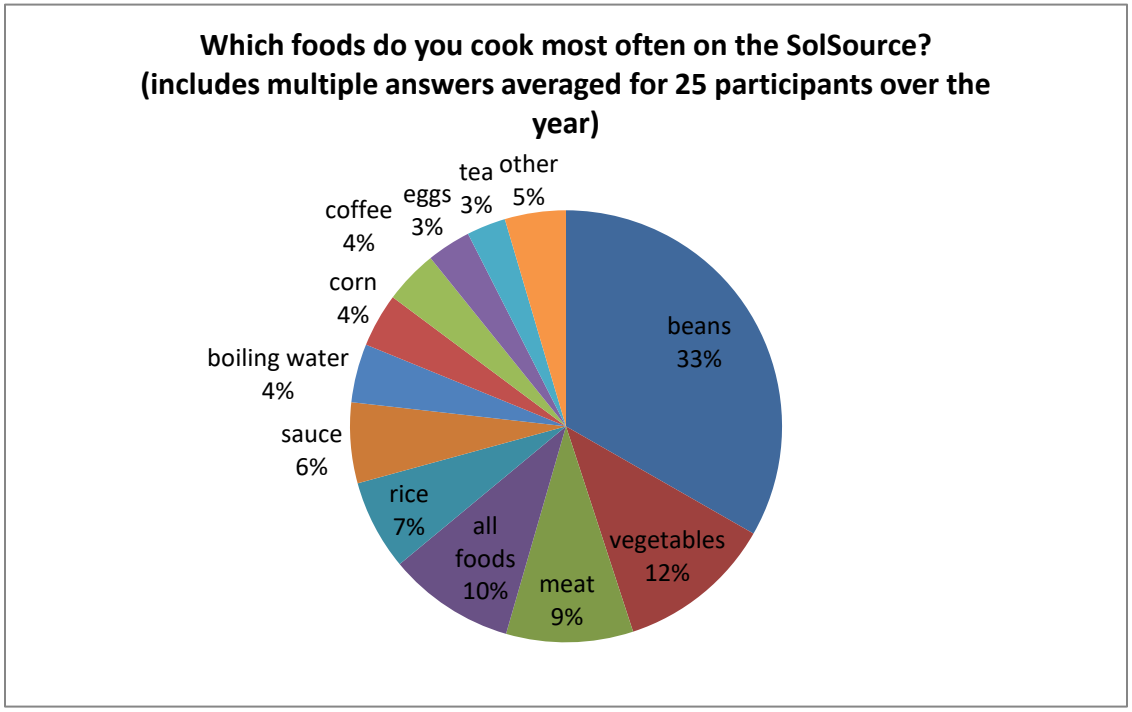
At baseline, participants were asked what health impacts cooking over an open fire can have. 23 responded. Their answers are below:

Can Make Kids Sick	Sore Eyes	Stomach Pain	Breathing Problems	Coughing/Flu	Sore Back	Family Member Burned
23	23	20	1	22	12	12

At follow-up, participants were asked if they noticed any signs of improved health, or their family members' health with use of the SolSource. They could select from the following answers: "no," "1," "2," or "3 or more" (signs of improved health). All participants reported answered with "3 or more" signs of improved health with the SolSource, except for 7 participants in December, 4 in January, 1 in February, all of whom reported only one sign of improved health, and 1 participant for a few months thereafter whose SolSource was broken in March (though he managed to fix it and use it in April and May). This suggests that for some people, health improvements took a bit longer to surface, perhaps as they familiarized themselves with the SolSource, or as their conditions took longer to heal. It also correlates with increasing observed SolSource usage the first three months.

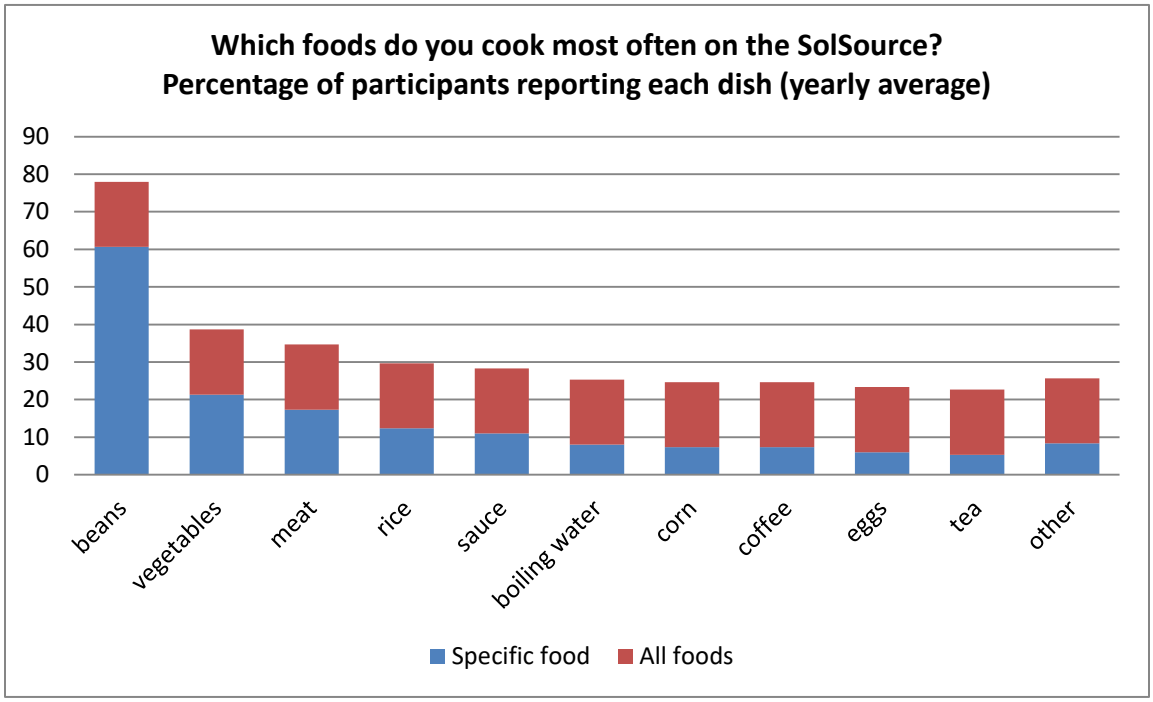
f) Types of foods cooked

Participants were asked: "Which foods do you cook most often on the SolSource?" Participants typically answered with 1 to 4 foods. The results are shown below:



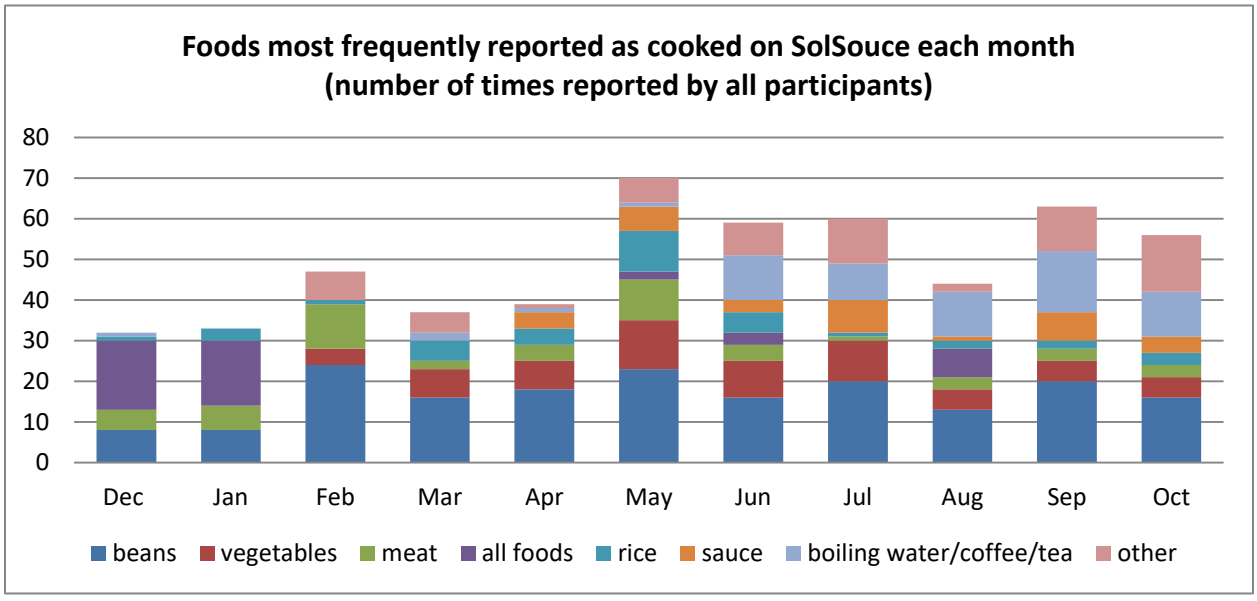
The most commonly reported food (with participants often giving multiple answers) was beans, 33% of the time, followed by vegetables, meat, rice, sauce, etc… "Other" foods, in order of decreasing frequency (each under 3% of answers) include porridge, stew, sweet potatoes, yucca, plantains, bananas, soup, spaghetti, and potatoes. "All foods" or "plenty of foods" was reported 10% of the time. For simplicity's sake, different dishes of the same food (e.g. beans vs. pureed beans) were aggregated, and different foods reported together were always considered as two separate dishes (e.g.: "rice beans" or "meat sauce."

Since participants gave multiple answers, the proportion of answers does not represent the proportion of participants that cooked these foods. The proportion of participants that cooked each food is shown below:



This graph shows that, averaged over the year, around 61% of participants reported cooking beans most frequently on the SolSource. However, since 17% of participants reported “all foods” or “plenty of foods,” assuming this includes beans, this suggests 78% of participants cooked beans most frequently on the SolSource. This was followed by vegetables (39% including “all foods”), meat, rice, sauce, boiling water, etc... Since beans are one of the foods (or the top food) requiring the most energy to cook, the SolSource is being used appropriately for maximum hydrocarbon fuel savings.

There was minimal variation in the reported most frequently cooked foods on the SolSource. The results are below:



We can observe that “all foods” was frequently reported in the first two months, but starting in the third months, participants became more specific about the foods they reported. Cooking beans, vegetables, meat, and boiling water for coffee, tea, and other uses seem to be the most common uses of the SolSource. As a general trend, participants seemed to report a greater diversity of food as the year went by. The “other” group includes 10 foods (see above).

Foods cooked at time of survey

Participants were observed cooking different foods on the SolSource at the time of the survey. The foods are charted below, in the order that they are first reported.

Food	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total months
sweet potatoes	■	■	■	■	■		■		■			7
beans	■	■	■	■	■	■	■	■	■	■	■	11
millet	■			■								2
rice	■	■	■		■		■		■			6
plantains	■		■	■	■			■				5
fish	■	■	■		■						■	5
fritters	■											1
corn		■	■	■	■			■	■		■	7
okra		■										1
meat		■		■	■		■		■	■	■	7
porridge		■						■	■	■	■	5
vegetables			■	■	■	■	■	■	■	■	■	9
Yucca			■	■		■						3
salami sauce				■								1
spaghetti				■							■	2
pumpkin				■								1
Stew				■		■		■		■		4
Sauce					■		■	■	■	■	■	6
boiling water					■	■		■	■	■	■	6
herring						■	■	■	■	■	■	6
sardines						■	■	■				3
coffee							■		■	■	■	4
Tea							■		■		■	3
chicken								■				1
eggs								■	■	■	■	4
potatoes								■		■	■	3
chocolate									■	■		2
Total foods	7	8	8	12	10	7	10	13	14	12	14	

This chart tells us which foods were observed being cooked each month (red cells) by one or more participants. The foods are listed in the same order as they were reported. So every

month up to August, new foods were observed being cooked, with chocolate being the last new food that was observed being cooked (probably in the form of hot chocolate drink). The bottom row tells us how many foods were observed being cooked each month. As a general trend, this number increased, starting at 7 and ending at 14. The last column tells us how many months a certain food was observed being cooked by one or more participants. Beans were observed every month. Vegetables were cooked 9 out of 11 months, and sweet potatoes, corn and meat were observed being cooked 7 out of 11 months. These are mostly the same staple foods that were reported as most frequently cooked.

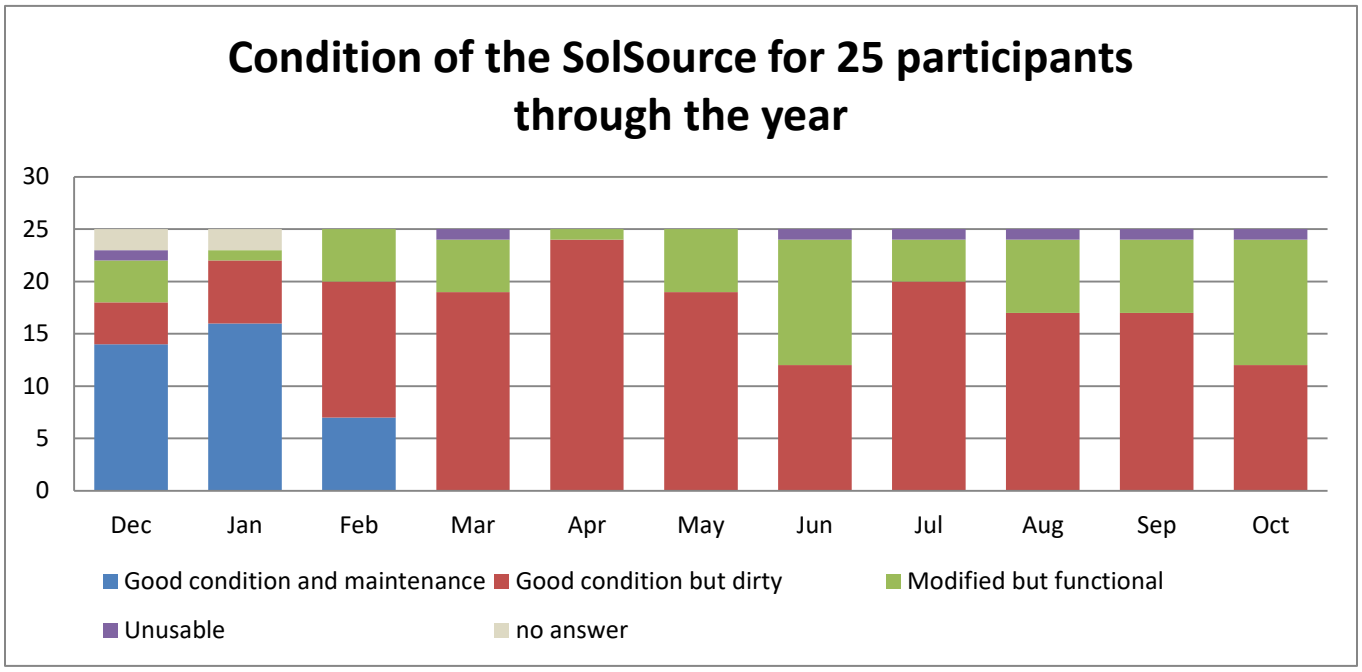
Cooking meat stew on the SolSource.

Cooking beans (left) and rice (right) on the SolSource.

g) Condition of the SolSource

Trainers Supreme Idamane and Marc Breus were asked to observe the condition of the SolSource while performing the monthly surveys. The SolSource could be listed as lost/stolen, destroyed/cannot be used, modified but not functional, modified but functional, good condition but poor maintenance (dirty), or good condition with good maintenance (clean). Trainers were also asked to specify any broken parts, and to list any replaced parts.

The results are graphed below:



In December, a month and a half after SolSources had been introduced, most SolSources were still in good condition and good maintenance (clean). By March, they were mostly in good condition with poor maintenance (dirty). However, local leader Idamane said the little bit of dust or dirt on the reflectors did not seem to affect cooking times. It may be that participants did not deem that washing the reflectors for a theoretical non-observed increase in performance was worth the effort, especially given the scarcity of water. By June, half the SolSources were reported as "modified but functional." In many cases, no explanation was given, and in most other cases, it was simply a lost redundant bolt or nut that did not affect SolSource usage. The next month, only a handful were "modified but functional," which suggests the bolts and nuts were replaced. By October, around half of them were again "modified but functional." It may be that participants or the assistant local leader did not immediately replace the nuts and bolts because their loss had no impact on SolSource usage.

Apart from redundant screws holding the reflector in place and bolts/QR pins holding the frame in place, it seems like a few small black mirrors were stolen (they are easily detached from the rest of the SolSource), and there were some issues with a few adjustment poles.

For more information on missing or broken SolSource parts, see Appendix 3: SolSource Technical Issues.

The questionnaire also included "part replaced?" after asking about a description of the broken or lost piece. For the most part, this area was left blank (non-applicable if there was no broken or lost piece), or the "no" box was checked. Although the expectation was for the local leader to replace any broken/lost pieces immediately, this was unrealistic, so it is normal that the "no" box was checked. A better question would have been: "Have any SolSource parts been replaced *in the last month*?"

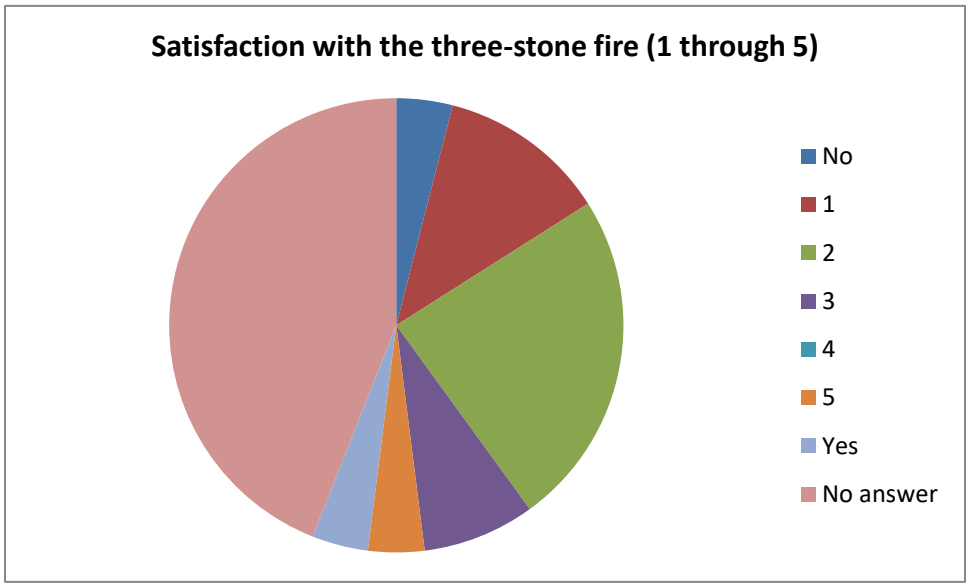
h) Satisfaction with the stoves

Three-stone fire

The participant selection survey asked: "How much do you like the open fire?" (1 - She does not like it at all; 2 - She does not like it but she thinks it is convenient for some tasks; 3 - She is indifferent (she does not like or dislike it); 4 - She likes it but acknowledges some problems; 5 - She likes it very much)

16 participants answered "do not like it at all." 9 answered "do not like it but think it is convenient for some tasks." On a scale of 1 to 5, this would be an average satisfaction of 1.36.

The baseline survey asked about stove satisfaction on a scale of 1 to 5. The results are below:



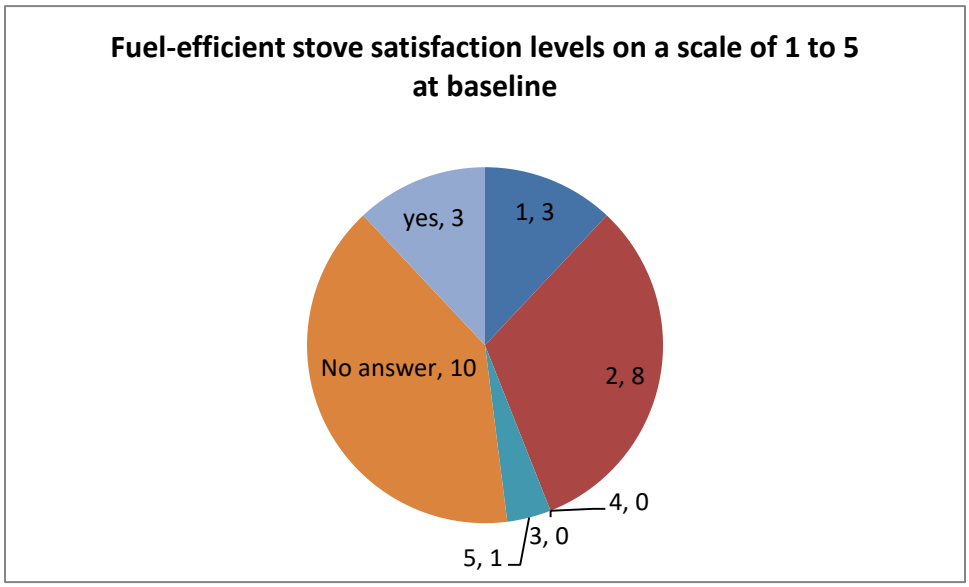
Excluding non-numerical answers, the average satisfaction rating is: 2.17. The responses to these two questions show that on average, user satisfaction with the three-stone fire is very low, on average 1.76.

3-leg stove

The satisfaction level for the one 3-leg stove was 1.

Fuel-efficient stove

Results for the fuel-efficient stove satisfaction at baseline on a scale of 1 to 5 are below.



This gives us an average of 2.

In follow-up surveys, satisfaction level with the improved SolSource was almost always a 5 or "yes" (usually 1 to 4 participants answered yes). 2 people answered "4" in March. 2 people did

not answer in April due to a broken stove. 9 people did not answer in May, including 5 people who reported broken stoves. In June, one person did not answer, due to a broken stove. If we exclude people who did not answer, the average is 4.99. If we say that people with broken stoves have satisfaction levels of zero, then the average drops down to: 4.84. If we assume no answers imply broken stoves, then the average satisfaction drops down to 4.79.

Any way we look at it, the average fuel-efficient stove satisfaction level at monthly follow-ups on a scale from 1 to 5 is very high, rounding up to 5.

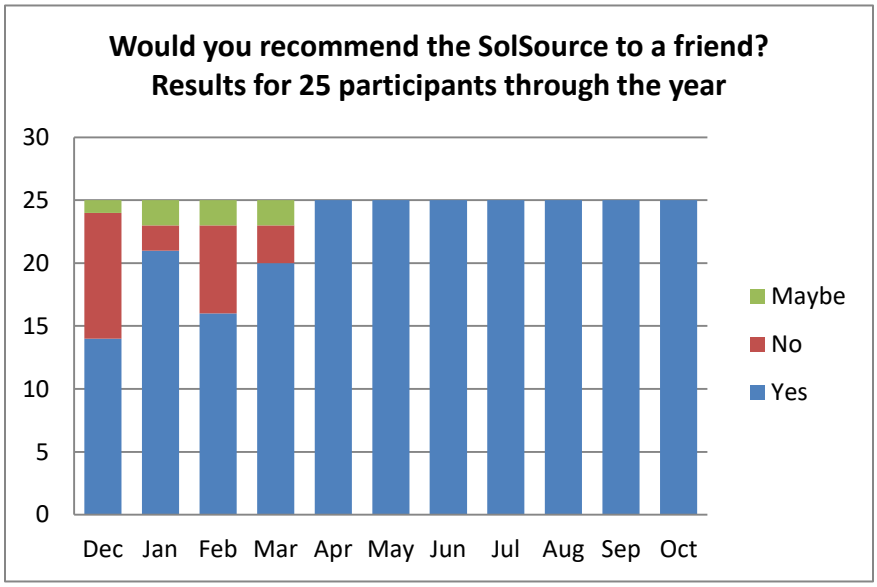
It is not clear why satisfaction levels rose from 2 to 5 on average from baseline to follow-up. Satisfaction ratings on a scale of 1 to 5 do not seem like a reliable way to assess satisfaction. The Global Alliance-promoted survey uses descriptions for each rating, which is more objective.

SolSource

User satisfaction with the SolSource was on a 1-5 scale. SolSource satisfaction, when reported, was always a 5. One rating was not reported in March, June, July, and September (not always the same participant). Oddly enough, the one participant whose SolSource was broken in March (when someone stole one of its parts) still gave satisfaction levels of 5 most of the time. If we say that people with broken stoves have satisfaction levels of zero, then the average drops to: 4.92. If we assume no answers imply broken stoves, then the average satisfaction drops down to 4.93.

Any way we look at it, the average SolSource satisfaction level at monthly follow-ups on a scale from 1 to 5 is very high, rounding up to 5. However, as mentioned earlier, ratings on a scale of 1 to 5 are not reliable.

Participants were asked “Would you recommend the SolSource to a friend?” “Why?” The results are charted below:



From December to March, a few people answered “no” or “maybe.” After that, all participants answered “yes.” However, when participants explained their “maybe” or “no” answers, the reasons were not related to SolSource performance, but rather not wanting to give others false

hope. For example: “ “Because I don't know if they'll be able to get more.”

Other answers show that the stoves are very much appreciated for the reductions in smoke, wood usage, and other benefits, and that there is a high demand for more SolSources in Tilori and beyond. Many participants said their whole neighborhood was using the stove. Others gave numbers: 5, 4. This suggests reported SolSource usage is lower than actual usage, as participants probably did not keep track of their neighbor’s usage. Also, it is possible that their neighbors’ usage of the SolSource prevented the participants from using their own SolSource at times, lowering the reported usage even more.

Question 2 on the questionnaire, regarding interest in getting another SolSource, was poorly translated, and its answers should be ignored. (See appendix 4: Translation issues)

Comments from SolSource Users

The last survey question invited participants to comment on the SolSource and related matters. The comments were overwhelmingly positive. The number of participants not making any comments also generally decreased through the year.

Most comments stated that the SolSource was good and helpful with many benefits; that they were used a lot by themselves and neighbors; that the participants wanted another SolSource; and that they were grateful to the team that provided the SolSources.

“It helps me a lot especially when it is sunny. It cooks fast in 40-60 minutes.”

“I can't say enough about how much this stove does for me. My eyes used to hurt, they don't hurt anymore. I say thank you very much.”

“This stove is very good, it lights another fire. I light pine wood”

“I have a little baby. I cook for him/her on that stove, without smoke.”

A few comments revealed some issues. In March, a “crazy person” stole a mirror from Isaac Elianise’s SolSource, rendering it unusable. His comments after that were about getting a new replacement SolSource.

Also, 6 participants (1 in December, 4 in April, and 1 in May) said that the SolSource was very good, but it broke their thin pots. During the participant selection process, it was explained that thick pots would be needed for the SolSource. All participants said they could purchase thick pots on the market at the start of the project, but apparently many chose not to. This may be because participants in previous solar cooker projects (with the 30 Sun Ovens) were given pots for free. As the second focus group meeting report states: “Dibreus Remene asked if they will not receive any cooking pots for the stoves because the other people had gotten cooking pots.”

This issue was still relevant by the end of the year, but SolSource usage was still high, so participants seem to have found a way around it. It may be that they had one thick cooking pot, but needed more to be able to cook on several stoves at the same time, (or maybe some were dirty as pots and pans cannot always be washed immediately given the scarcity of water). The second group meeting report states: St-Ilsaint Jovanise said she barely left with any cooking pots to cook. The one she has are very thin. Only one she’s got to cook.”

2. Quarterly focus group meeting results

Quarterly focus group meetings were conducted by local leaders Idamane and Marc Breus on January 21st, April 1st, July 15th, and October 5th 2016.

Some of the common themes were:
- Appreciation for the SolSources. For example: "*Many people talked about how the stoves mean a lot to them. It helps them realize some savings away from purchasing small cans of charcoal. To cook beans, they say once it is sunny, their beans get cooked in a little bit of time, without smoke, without spending nothing."* (January 2016)
- High demand for more SolSources: "*They were talking about a lot of their friends that keep asking how they can find a stove like that too, for they like the stoves a lot.*" (January 2016)
- Sharing their SolSources: ""*Dorcin Iclenise said in her case along with three other people in the neighborhood - cook with the stove, for they like it so much. She is asking if she can get a stove too."* (January 2016)
- Damage to thin pots: *"Timothé Jilienne said that the SolSource stove is so powerful if the pot is thin, it will break it. She has 2 pots that got broken that way. You have to have thick pots to use with it. Everyone said it is true. They had the same problem, too."* (July 2016)
- Demand for thick pots: *"Oce Anilia said that if they could find pots as well like with the other people (prior TNC beneficiaries), who received the big pots. Won't they get pots also for their SolSource stoves? Everyone else agreed with what she said because they have many difficulties with pots for the stoves. Because it is very good, everybody likes it a lot."*
- Replacing the one broken SolSource: *"Isaac Elianise asked if she will find another stove because a crazy person broke hers, but, that, we do not know."* (July 2016)
- Replacing the broken improved stoves: *"Salomon Monise asked if they will be given improved energy efficient stoves again because they were very good, they helped us. They do not use much firewood. When we buy a bundle of wood, it lasts us 15 days we are using it, and still it's not done, and it does not make much smoke." "Montilvert Marimene said that her improved energy efficient stoves broke, but she built one similar, and she puts firewood in one place and cooks her food without problems, and, "I tell others to do same." Marc and I went and took pictures of the kind of stoves the people built."* (July 2016)
- Damage to some of the SolSources: *"Dibreus Remene said the mirror broke, but she cooks with it that way."*

Overall, the focus group meetings showed that the SolSources were much appreciated and used, both by participants and their neighbors, and in high demand in neighboring communities. The main problem was that of the SolSource damaging thin pots, and participants opting not to buy more appropriate pots, in the hope that they would be given some for free (since this had happened for previous projects). One SolSource was unusable due to a stolen part, a few had minor modifications but were still usable. Many of the fuel-efficient stoves broke down, and were replaced by home-made fuel-efficient stoves (as clarified by local leader over the phone).

3. Global Alliance for Clean Cookstove Adoption and Impact Indices

a) Adoption index

The Global Alliance for Clean Cookstoves "Recipe for Adoption and Impact Indices" explains:

"For the purposes of this toolkit we will consider that a clean cookstove has been adopted when the user likes having the stove, knows how to use it, uses it on a regular basis, and maintains the stove in good working condition. The adoption can be considered very good (VG) if the stove is in perfect condition, used every day, and the user is highly satisfied; good (G) when the stove is in good condition, used frequently, and the user is satisfied; regular (R) when the stove is in good condition but is hardly used and/or the user's satisfaction is low; bad (B) if the user has made modifications to the stove that alter its functionality, and finally very bad (VB) when the stove is in disuse or has been destroyed.
The Adoption Index (AI) is determined as a function of four variables: the frequency of use of the clean cookstove (FCCS), the condition of the clean cookstove (CCCS), the user's level of satisfaction with clean cookstove (LSC), and the interest in replacing it with a similar clean cookstove at the end of its lifetime (IRS). Each variable is multiplied by a coefficient that reflects the weight this variable has in determining the overall index. For the AI, the proposed coefficients are respectively 4, 3, 2, and 1. The formula for the adoption index is therefore as follows: AI=4(FCCS)+3(CCCS)+2(LSC)+1(IRS)"

Let us apply this method to the SolSources in this project:

Variable	Survey Data Average	GACC equivalent	Index
Frequency of use of the clean cookstove (FCCS)	10.4 times a week	Every day	1
Condition of the clean cookstove (CCCS)	Good condition but dirty (3.8/5 score)	Working with low maintenance	0.75
Level of satisfaction with clean cookstove (LSC)	Satisfaction 4.9 out of 5	Very satisfied	1
Interest in replacing it with a similar clean cookstove at the end of its lifetime (IRS)	Due to poor translation, the answers to this question were meaningless and discounted. However, the IRS came up overwhelmingly in survey comments and during focus group meetings. Also, 99% said they would recommend it to friend.	Yes	1

SolSource Adoption Index = 4x1 + 3x0.75 + 2x1 + 1x1 = 9.25 out of 10. = "Very Good Adoption"

According to the GACC, the SolSource has the highest possible adoption value: "Very Good Adoption."

b) Impact index

The Global Alliance for Clean Cookstoves "Recipe for Adoption and Impact Indices" explains:

"The Impact Index (II) is determined as a function of eight variables: the frequency of use of the clean cookstove (FCCS); the frequency of use of the traditional stove (FTS); the frequency of use of other fuels (FOF)4; the user's level of satisfaction with the traditional stove (LSTS); the changes in the location of the traditional stove (CLTS); the perceived health improvements (PHI); perceived fuel savings (PFS) and the number of technologies used or technology stacking (TS). The formula for the impact index is as follows:

II=2(FCCS)+2(FTS)+1(FOF)+1(LSTS)+1(CLTS)+1(PHI)+1(PFS)+1(TS)"

Variable	Survey Data Average	GACC equivalent	Index
Frequency of use of the clean cookstove (FCCS)	10.4 times a week	Every day	1
Frequency of use of the traditional stove (FTS)	Three-stone fire used by one participant first month after baseline, and never thereafter.	Never or almost never	1
Frequency of use of other fuels (FOF)	Fuel-efficient stove used 17.9 times a week	Every day	0
Level of satisfaction with the traditional stove (LSTS)	Three-stone fire used by one participant first month after baseline, and never thereafter, so not satisfied.	Unsatisfied	1
Changes in the location of the traditional stove (CLTS)	Three-stone fire used by one participant first month after baseline, and never thereafter.	Open fire no longer used	1
Perceived health improvements (PHI)	3 or more changes perceived (98% of times)	Many changes perceived	1
Perceived fuel savings (PFS)	Some savings (97% of times)	Savings perceived	0.5
Number of technologies used or technology stacking (TS)	Uses fuel-efficient stove and SolSource (since LPG is not used, fuel-efficient stove replaces LPG)	Uses clean cookstove and LPG	0.75

II=2(1)+2(1)+1(0)+1(1)+1(1)+1(1)+1(0.5)+1(0.75) = 8.25 out of 10, corresponding to "High Impact"

According to the Global Alliance system, the SolSource has the second-highest impact value: "High Impact."

4. Discussion of results

As we have just seen, the SolSource project in Tilori generated mountains of data. The follow-up survey alone had 14 questions, many of those questions asking for several types of data. The questions were asked of 25 participants, 12 times (once per month). This mountain of data was analyzed in two main ways.

The simple way was to use the system promoted in the Global Alliance publication "A recipe for impact and adoption indices," which summarized the data (all participants over 12 months were averaged) in order to score and classify the clean cookstove (in this case, the SolSource) according to its degree of adoption and impact. The SolSource obtained the scores and values of 9.25 and 8.25 out of 10, corresponding to classifications of "Very High Adoption" and "High Impact." This is a user-friendly approach which gives us a useful, general measure of clean cookstove adoption and impact. It recognizes that going into more detailed statistical work may be futile and even misleading.

The second approach, the one traditionally used in similar projects, is to analyze the data point by point, month by month, participant by participant, using statistical methods and graphs to try to draw measurements, correlations and conclusions about different aspects of the project. This method arguably goes into too much depth and detail given the multiple sources of error inherent in any project of this nature. Nevertheless, this type of data analysis led to new theories (or at least suggestions) about factors affecting SolSource usage, and it was a useful learning experience in terms of examining the reach, limitations, practical applications and pitfalls of this type of data collection and analysis.

For example, total stove usage (in number of times used per week) did not in this case correlate with number of people cooked for - possibly people used their stoves around the same number of times, but with more food in their pots. There was also no obvious correlation between SolSource usage and weather conditions, perhaps because weather conditions may not have followed the 21-year averages used for comparison, especially with climate change and the hurricane passing over Haiti, or because seasonal variations in fuels played a more important role in the preferred stove, or many other potential factors.

Other possible sources of error and confounding factors on the level of impact and adoption include:
- errors in estimations and recollections of data by participants, and failing to answer certain questions
- surveyor asking questions in a leading way
- erroneous interpretation of questions, especially conditional ones (e.g.: which stove would you prefer?)
- errors in translation, both ways (e.g.: "pwa diri" could be rice and beans as one dish or separate dishes)
- pot sizes, amount of foods cooked
- efficient stoves, three-stone fire size, power & efficiency
- cooking duration by dish (a function of the type of food, the recipe, and the stove)
- food consumption levels by age and build, affecting food requirements and stove usages

- imprecise measurement methods (e.g.: a “bundle” of wood, number of health symptoms)
- effects of damaged but functional, or broken stoves
- poor understanding of what makes the SolSource truly “unusable” vs. “modified but functional”
- shared usage by many neighbors, which can decrease usage by participant
- poor reporting of use of three-stone fire after baseline
- seasonal variations in the price and availability of fuels, which could be motivating factors for SolSource usage (high fuel prices might lead to increased SolSource usage)

etc.…

For the most part, these factors have limited impact, or those impacts are canceled out on average, such that they can be ignored. The only issues that led to obvious problems were:

- the poorly translated/interpreted questions whose answers had to be discounted
- the thin pots which got damaged, leaving many unhappy and making cooking difficult
- the broken or damaged SolSources, reducing or nullifying SolSource usage
- the missing answers making statistical comparison difficult
- participants with broken stoves often giving satisfaction levels of 5

These issues should be taken into account for future projects

On the positive side, there are reasons to believe SolSource adoption and impact may actually have been higher than reported

One fact is that SolSource usage frequencies were not included in calculating average percentages of stove usage when the fuel-efficient stove data was missing for that participant for that month. Sometimes it was specified that the fuel-efficient stove was broken (e.g.: 5 broken fuel-efficient stoves in May), and sometimes no reason was given (e.g.: 4 fuel-efficient stoves in May). Although one could hypothesize that fuel-efficient stove usage was close to zero and SolSource usage was close to 100%, this is not a safe assumption to make. As a result, many of the higher SolSource usage figures were discounted.

Another important consideration is that many participants said that they were sharing the SolSource with their neighbors (“the whole neighborhood,” “5 neighbors,” “4 neighbors”). In that case, depending on how often neighbors used it, the SolSource’s impact on the Tilori community may have been far more important -- double or more its impact on participants alone.

Finally, impact was probably higher than is suggested by stove usage frequencies, as participants reported that foods most often cooked on the SolSource were beans and other slow-cooking foods requiring more fuel, as previously suggested. Although participants reported “all foods” being cooked on fuel-efficient stoves, it is likely that with stove stacking, beans were cooked on the SolSource when possible and another dish on the fuel-efficient stove.

VI. CONCLUSIONS

The SolSource project in Tilori, Haiti can be considered a success. Project objectives generally have been met:

> 25 SolSource parabolic solar stoves were successfully disseminated and promoted by SHE in Tilori. According to GACC-promoted indices, the SolSources demonstrate "Very High Adoption" and "High Impact." As a result, local residents, mainly women, have been empowered to generate economic self-sufficiency, while helping to reduce the levels of deforestation, land erosion, and household air pollution.
>
> SolSource impacts on fuel use and expenditures, health, social and other impacts were measured qualitatively, comparing baseline measurements with monthly evaluation measurements. Results are described below.
>
> Lessons were learned concerning new technology adoption, in particular in relation to the fuel-efficient stoves already introduced. Unfortunately, not much information was collected regarding the other solar cookers, as reliable mechanisms were not put in place to do so, other than through open feedback in comments and focus group meetings, so this particular project objective was not fully met.

For this evaluation, all the data generated by this project throughout the year was aggregated, analyzed, and interpreted to evaluate project impacts and outcomes, evaluate project management and implementation, draw lessons about project management, impacts and outcomes, and recommend next steps.

Project impacts and outcomes were evaluated.

Participants were well suited for the project, having a sunny space in their yard and willingness to buy appropriate thick black pots. Most of them were single or divorced women farmers between the ages of 36-50 years old. They cooked for families of 5-12 people.

At baseline, 75% of participants had three-stone fires inside their houses, 25% had them outside under a roof, and 4% had them outside. At baseline, excluding incomplete reporting, three-stone fires and fuel-efficient stoves were used about equally (rough estimates of 10 or 15 times a week were given). This is comparable to average total weekly stove usage with the SolSource at follow-up (SolSource: 10.4 times/week, fuel-efficient stove: 17.9 times/week). The three-stone fire was hardly ever used after SolSource introduction. Follow-up reported average monthly SolSource usage rates were 33%-40% of total stove rates, but occasionally went as high as 52%. Observed SolSource usage (at the time of the survey) increased in the first three months then stayed high thereafter (by more than 21 of 25 participants, except in July due to cloudy weather).

At baseline, for their non-solar stove cooking fuel, participants predominantly used wood, with two also using some charcoal, and none using propane or kerosene. They collected around half of their fuel and purchased around half. Mothers, sons and daughters gathered and/or purchased combustible fuel most often, spending an average of 3.73 hours per week. Almost all participants rated the cost and difficulty of buying and collecting wood as a 1 out of 5 ("do not

like at all"). Their monthly income ranged from 0-6000 Gourdes (97.69 USD), averaging 1370 Gourdes (22.31 USD). Expenses ranged from 0-7000 Gourdes (113.98), averaging 2832 Gourdes (46.11 USD). They reported spending between 25% and 50% of their income on fuel. At follow-up, they reported "some savings" on average.

At baseline, the most common health symptoms from three-stone fire and fuel-efficient cookstove use were sickness in children, sore eyes, coughing/flu, and stomach pain. At follow-up, virtually all participants reported three or more signs of improved health.

Foods reported as most commonly cooked on the SolSource were beans (78% of participants), followed by vegetables, meat, rice, and sauce. Most of the same staple foods were observed being cooked as well, with an increasing diversity of foods cooked as the year progressed.

SolSources were all functional throughout the year, except for one case where a part was stolen. Otherwise, most missing parts were redundant QR pins and screws, which were replaced usually within a month by local leaders. Some stolen small black mirrors and broken adjustment poles were also reported. Fuel-efficient stoves were more prone to breaking down, with up to 5 known broken stoves in May (and 4 not reporting for unknown reasons).

At baseline, satisfaction with the three-stone fire was low at 1.8 out of 5, and satisfaction with the fuel-efficient stove was a 2 out of 5. At follow-up, satisfaction with the improved stove and SolSource were virtually always rated 5 out of 5. All participants would recommend the SolSource to a friend if available.

Open feedback from survey comments and focus group meetings revealed that participants were deeply appreciative of the SolSources and their many benefits including absence of smoke, improved health, and fuel savings. Many said that they shared the SolSources with the whole neighborhood (one specified 5 people), and that there is high demand for more SolSources from Tilori and beyond.

The main issues were a few missing or broken SolSource parts (though only one participant reported decreases in usage); and that of the SolSource damaging thin pots, due to participants not buying more appropriate pots because of their expectations and demands that they should receive free pots, since others had received them in previous clean cookstove projects.

There seems to have been a learning curve in the first 2 or 3 months, as SolSource usage (both reported and observed) increased, the number of reported signs of improved health increased, the reported fuel savings increased, observed SolSource usage on partly cloudy days increased, and the number of people not commenting decreased (virtually all comments were positive). The diversity of foods cooked on the SolSource, both reported and observed, increased throughout the year, with 14 different foods (not to mention recipes/dishes) observed being cooked on the SolSource during the survey by the end of the year.

The true level of adoption and impact of the SolSource is probably greater than reported (33%-40% of total stove usage), as SolSource usage was not included in average calculations when fuel-efficient stove data was lacking (where it may have been higher if the fuel-efficient stove was broken); as foods most often cooked on the SolSource were slow-cooking foods such as beans, vegetables, and meats that require more energy/fuel to cook, and since many participants commented that they share their SolSource with their neighbors.

Solar stoves are more likely to be shared than other types of stoves for several reasons. First of

all, three-stone fires and stoves are likely to be located inside the house, whereas parabolic stoves are likely to stay outside in a sunny area even when not in use, so neighbors have free access to them without bothering the owners. Second, using a parabolic does not affect it in any significant way, unlike a fire or stove which becomes dirty from smoke and ash, so neighbors would not feel bad about using it. Thirdly, SolSources cook very rapidly -- several participants commented on this (e.g. beans ready in 45 minutes), and no prep work is needed (such as chopping up wood and kindling the fire), so several neighbors would have the time to use it quickly one after the other.

Overall, the GACC-promoted indices of “very high adoption” and “high impact” seem well-deserved. It takes into account the fact that no matter how convenient and efficient a stove is, participants are likely to engage in “stove-stacking,” the use of multiple stoves, in part to be able to cook several dishes at the same time for a meal. If we add the impact of the SolSources on the neighbors who used them, we could venture that the SolSources could attain the value of “very high impact,” thus achieving the highest possible adoption and impact values according to the Global Alliance for Clean Cookstoves.

Project management and implementation in terms of planned vs. actual methods, materials, team member performance, schedule and budget was also evaluated. Project management and implementation was successful and mostly as planned in the proposal and contracts. Despite losing two days of the training and assessment trip in Tilori due to border issues, trainer Onel managed to carry out all planned activities, though he did not visit as many individual homes as hoped for. The participant selection process was mostly based on Onel laying out the selection criteria to everyone during the workshop with help from the local leader, rather than the participant selection survey, but this was just as effective and saved time compared to surveying a large pool of Tilori residents. The first follow-up survey and all others were postponed by half a month, as the local leader felt that the participants should familiarize themselves with the SolSources. Submission of quarterly reports to SELF was delayed by communication issues in Tilori and SHE’s unexpectedly small staff. In terms of materials, they accomplished their purposes well, although a high-quality camera would have been helpful in resolving technical SolSource issues. The SolSource assembly manual’s lack of clear labels led to some parts’ translation confusion. The participant selection survey was a bit too long, and with different methods, could feasibly be eliminated. The baseline survey and follow-up surveys were appropriate, save for a couple of poorly translated questions. In terms of staff performance, the SHE management team (Sophie Brock Lyman, Kate McGarrity, and Richard Stolz), contractor Onel Joseph, and local leaders Idamane Supreme and Marc Breus excelled at their role, volunteering extra hours to get the job done. SHE was short-staffed due to Sophie’s extended maternity leave, contributing to delays in reporting. In terms of schedule, events followed the planned timeline, save for the first follow-up survey taking place in December, and the November 2016 surveys being very delayed due to communication and travel issues from Tilori. The budget was also appropriate, although the team members worked more hours than budgeted for, and the local leader was given an extra $50 for additional data clarification work for the end-of-year evaluation.

VII. LESSONS AND RECOMMENDATIONS

The project was a success overall. However, there were a few glitches and oversights that could have been prevented or corrected to improve its management.

The budget could have included an emergency fund to account for travel delays (in this case due to border issues), replacing missing or broken SolSource parts, buying extra pots, and for extra resources at every level to complete the end-of-year evaluation. One must consider, however, that any funds reserved for emergencies are taken away from other project line items, such as total number of solar cookers. Given the limited budget, SHE preferred to put as much as it could into the project, hoping to garner extra funds elsewhere if needed.

The contracts, agreements and proposals could have been more explicit in stating some of the methods and requirements, but SHE Consultant Onel Joseph did not need this level of detail to carry out the mission. He prepared for the trip well, ensuring a safe storage space would be available, hiring and preparing local leaders before they signed official contracts, and printing out papers in the US to bring to Tilori. In some cases, the improvisations and choices he had to make due to limited time can be used as example plans for future projects. For example, the participant selection process could have been planned to occur through the educational workshop and local leaders' familiarity with Tilori residents, rather than a long questionnaire.

The surveys could have gone through a professional translating service to ensure conditional vs. polite meanings of questions were not confused. More field research on the most accurate ways of measuring fuels could have been carried out prior to the training mission. Survey questions asking for ratings on a scale of 1 to 5 could be accompanied by descriptions for each rating (as in the Global Alliance survey) to increase objectivity. While SHE was hoping to receive comments from surveys and focal group meetings comparing SolSources with other types of solar cookers from previous projects, this did not happen. Specific questions on this topic should have been included. Tilori residents could have been hired to transfer survey data to excel sheets (rather than SHE management doing this) to reduce management costs. In future projects, follow-up survey frequency could be limited to quarterly, as long as local leaders visited and were available to participants more frequently. On the whole, the Global Alliance-promoted survey was sufficient by itself to give us an idea of adoption and impact. A few additional questions more applicable to solar cooking were also helpful, such as description of broken/missing part (for repair purposes), foods cooked, observed usage, and open comments. Questions regarding the number of family members, satisfaction ratings, and other items could feasibly be eliminated in the follow-up survey questionnaire.

The SolSource assembly and usage manual could be translated into Creole, including parts, for easier resolution of technical issues. This would be part of a more rigorous way of keeping track of SolSource technical issues, along with quickly taking high resolution photos of the damaged parts, and involvement by experts from the manufacturer, allowing analysis and solutions by qualified engineers.

The fact that participants were expecting free thick pots, as others had in previous projects, which led them to not buy thick pots needed for optimal SolSource usage, was difficult to anticipate – but now it should be taken into account for future projects.

Also, although this did not seem to affect SolSource adoption, the local leaders should have had their own SolSources and acted as participants, so they could give feedback as well. The problem is that they already had “Sun and Ice” parabolic solar cookers.

Due to limited funding, project planning and budget only spanned the first year. It is important to plan and budget beyond the first year to ensure the projects’ impacts do not slip away due to easily fixed issues such as lost QR pins. SolSources have a very long life-span if maintained properly, with simulated usage over 6 years showing insignificant decreases in reflectivity of the reflecting panels, and hence, efficiency and cooking power. If these are stolen, the reflectors themselves are easily replaced, and their cost and shipping costs are low. To properly support the project, minimal funding would be needed over the next 10 years to support the SHE team and local leaders in basic monitoring of SolSource usage and condition and replacing missing or broken parts.

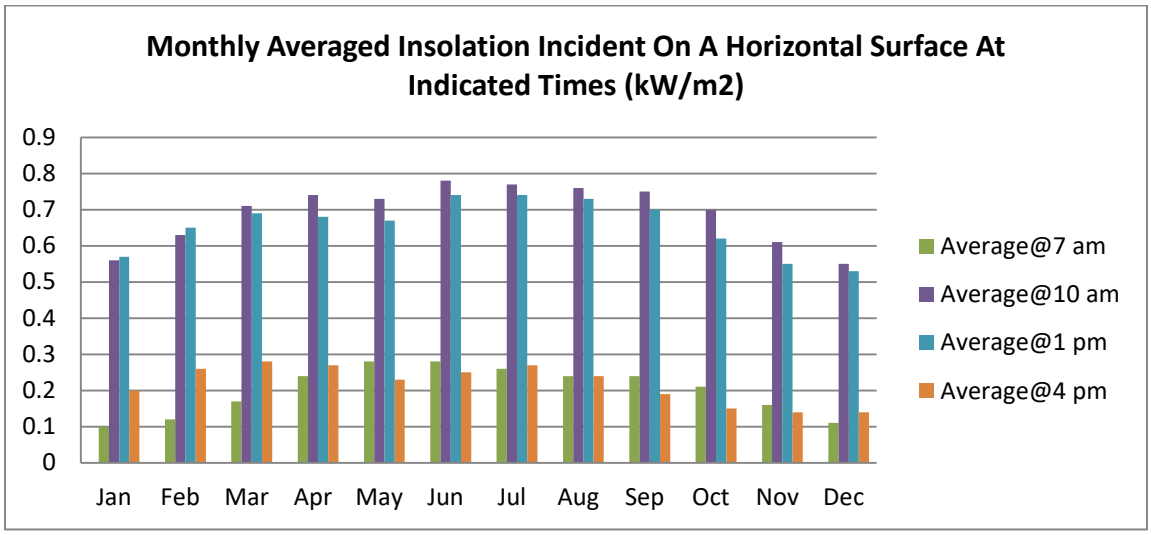
Additional funding, however, would be needed to satisfy the overwhelming demand for parabolic solar stoves by residents in Tilori and surrounding communities. Unlike most fuel-efficient cookstoves, solar cookers with their reflectors are noticeable from far away, and their heat-generating powers with no apparent source of fuel are impressive and somewhat mystifying, qualities which serve to quickly spread the word and effectively publicize them for free. Although the cost of the SolSource renders them out of reach of the average Haitian, the device can be viewed as a long-term investment benefiting both the owner and neighboring families. Compared to the average fuel-efficient stove which lasts around one year, the SolSource can last 10 years or more, so its lifetime cost is comparable or maybe even lower than fuel-efficient stoves – especially given the management costs of monitoring fuel-efficient stove condition, and shipping and replacing them entirely.

Introducing additional SolSources is one option for project expansion. Another more affordable option would be to manufacture similar parabolic solar stoves locally, with only the reflectors being imported from their source in China. This approach would create local businesses that could also repair stoves without international involvement. Indeed, SHE is already in contact with a solar cooking NGO specializing in such work, who is willing to donate materials and manufacturing expertise. This NGO also has experience with carbon funding for solar cooking projects.

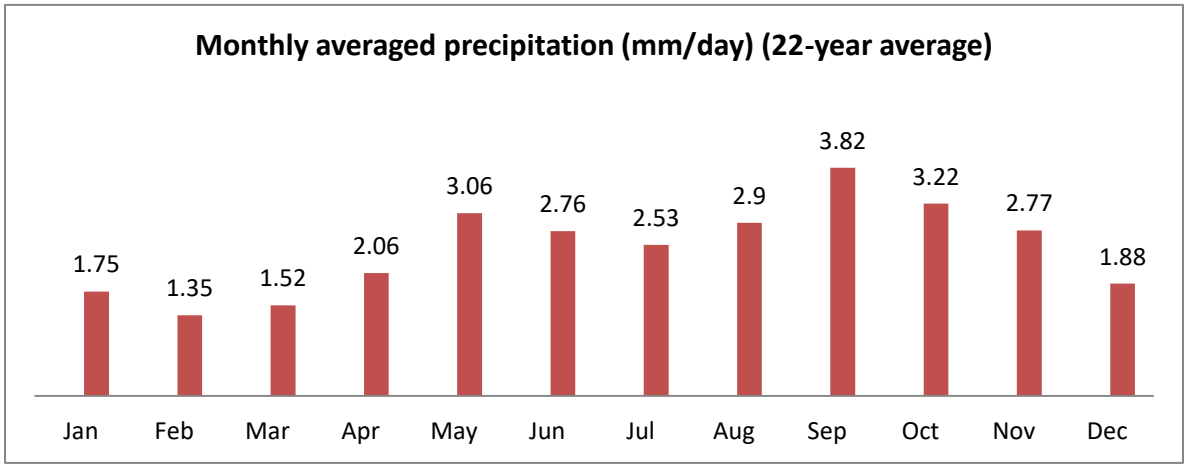
Scaling up with locally-made, affordable solar cookers in the long term would allow not just Tilori residents, but all of Haiti to benefit from solar stoves, to lift people out of poverty, improve their health, and preserve their forests.

Appendix 1: Weather and solar cooking

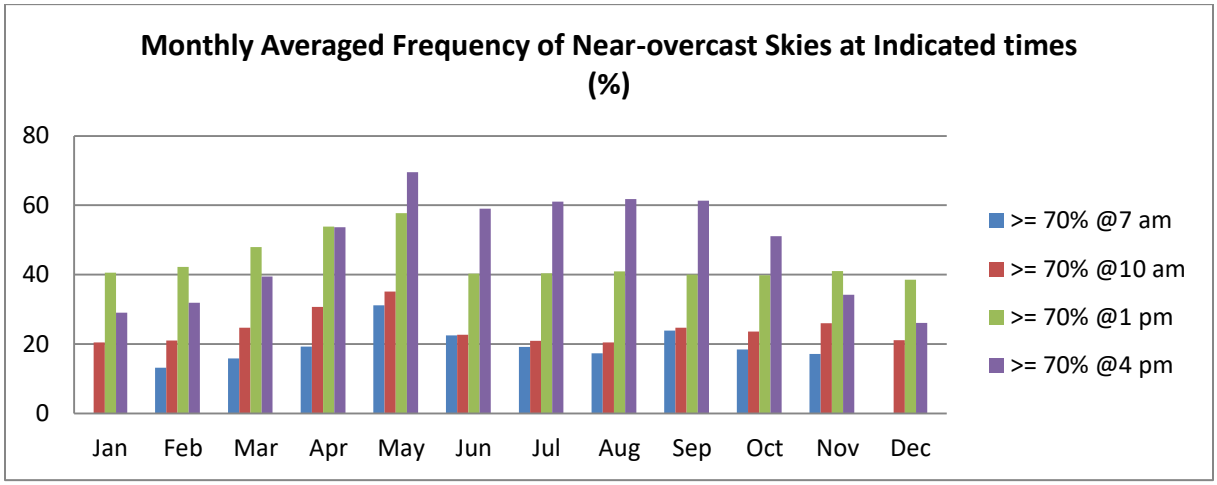
22-year weather averages are charted below
Monthly averaged insolation incident on a horizontal surface at from 10 am to 1 pm stays between 0.6 and 0.8 kW/m2 from February through October. Monthly averaged insolation takes into account clear sky insolation and cloud cover. Weaker insolation slows down parabolic solar cooking, but mostly insignificantly. Cloud cover, however, halts parabolic solar cooking.



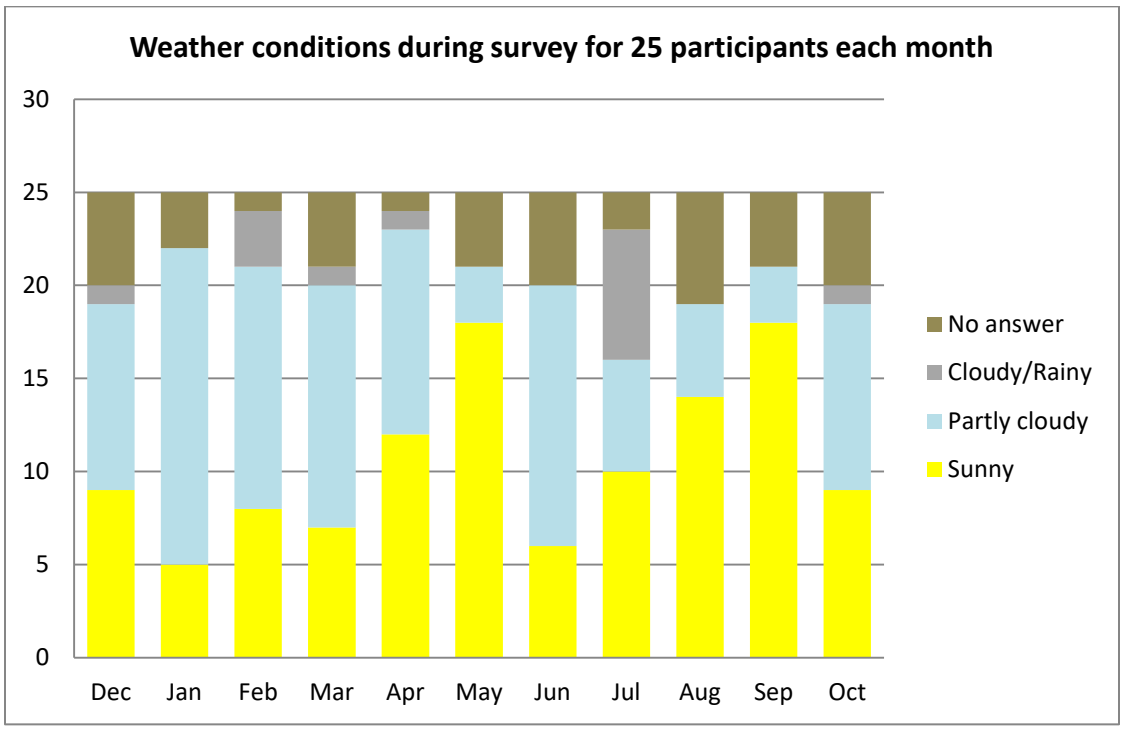
Precipitation peaks in May and September, staying above 2.5 mm/day from May through November. One cannot solar cook when it rains.



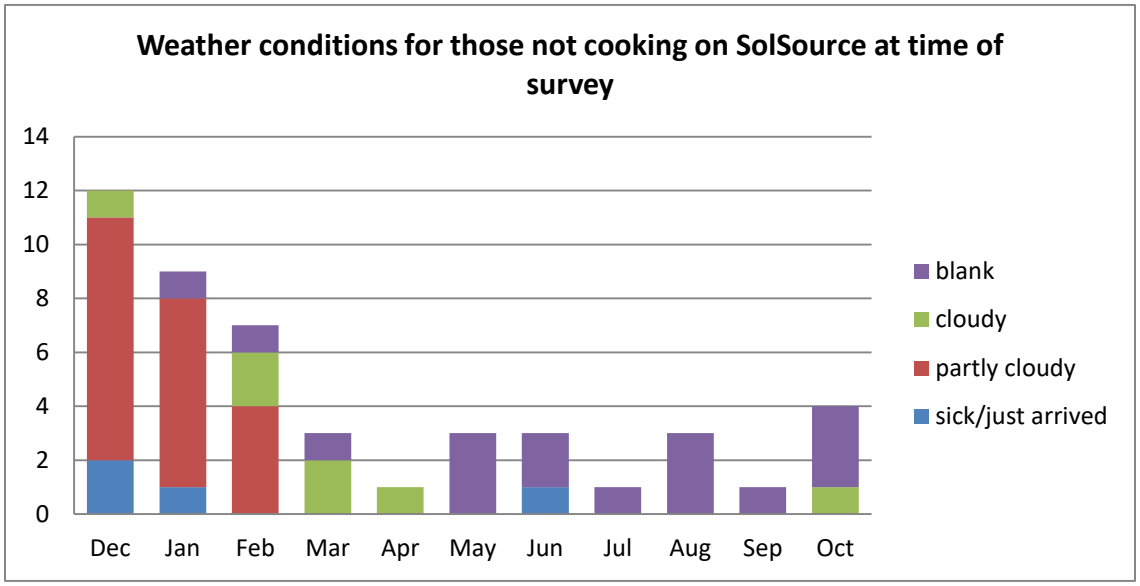
The monthly averaged frequency of near-overcast skies at different times may be the best indicator of solar cooking potential. As we see from the chart below, the frequency of near-overcast skies increases as the day goes by. According to this, afternoons are quite cloudy April through October, corresponding to the precipitation chart above. Mornings throughout the year are a better time to solar cook.



The weather at the time of the survey is charted below:



The surveys were typically taken over a few days each month. But for most participants, it was either sunny or partly cloudy each month. The low is in July, at sunny or partly cloudy weather for 16 participants (although the weather was not recorded for 2 participants).
To see how weather affected observed SolSource usage, we looked at weather conditions for those participants not cooking on the SolSource during surveys. The results are below.



As seen above, the number of participants not cooking on the SolSource at the time of the survey decreased in the first 3 months, with the weather being often partly cloudy, and sometimes cloudy. In the following months, we do not see partly cloudy weather as a reason for not cooking with the SolSource. We see cloudy/rainy weather, participants being sick, or having just arrived from somewhere else, as the main reported reasons. Unfortunately, there were also quite a few cases where no reason was given and the weather was not reported. Perhaps it was not close to lunch or dinner time. Overall, this chart suggests that participants became more confident cooking in partly cloudy weather after the first three months.

Appendix 2: Demographic data from the October 2014 Summary Report of the Alternative Cooking Project in Tilori, Haiti, by Onel Joseph

Table 1 Gender, Marital Status, and Living Arrangement

		#	PERCENTAGE
GENDER:			
	FEMALE	156	91.23%
	MALE	13	7.60%
	N/A	2	1.17%
	TOTAL	171	100.00%
MARITAL STATUS:	MARRIED	133	84.18%
	DIVORCED	10	6.33%
	SINGLE	14	8.86%
	N/A	1	0.63%
	TOTAL	158	100.00%
LIVING ARRANGEMENT:	W/SPOUSE	100	62.50%
	W/PARENTS	29	18.13%
	SINGLE	25	15.63%
	MOM ONLY	2	1.25%
	N/A	3	1.88%
	OTHER	1	0.63%
	TOTAL	160	100.00%

Table 2 Household Composition

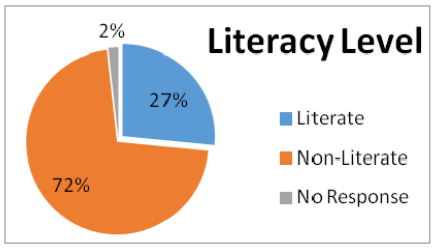
AVERAGE FAMILY SIZE:	6.95625
AVERAGE ADULT/HOUSEHOLD:	1.905063
AVERAGE CHILDREN/HOUSEHO	5.157233
AVERAGE KIDS/FAMILY:	5.393548

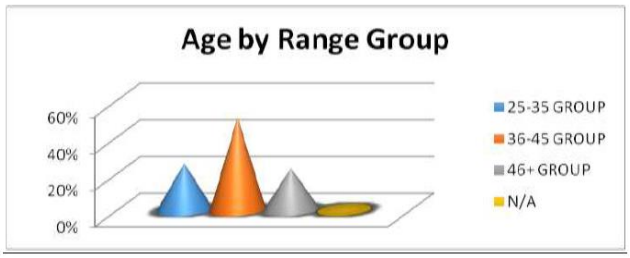
Table 3 Age Group and Reported Working Status

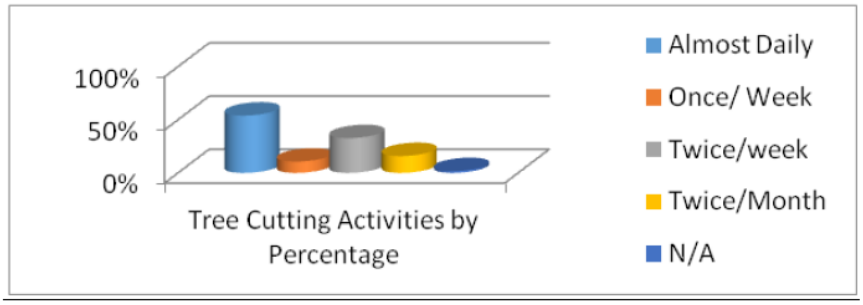
AGE GROUP:		#	PERCENTAGE
	18-25	16	10.06%
	26-35	45	28.30%
	36-50	66	41.51%
	50-65	30	18.87%
	65+	2	1.26%
	TOTAL	159	100.00%
REPORTED WORKING:		#	PERCENTAGE
	YES	114	71.25%
	NO	43	26.88%
	N/A	3	1.88%
	TOTAL	160	100.00%

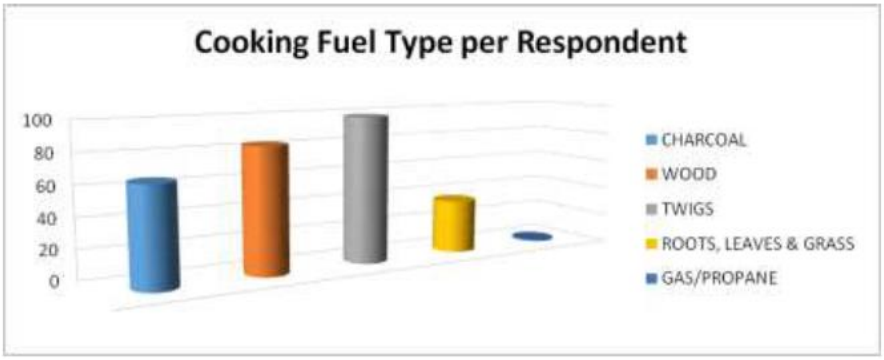
Table 4 Income and Income Source

AVERAGE MONTHLY INCOME:		1281.63 GDES
AVERAGE MONTHLY EXPENSES:		2980.60 GDES
JOB TYPE:	#	PERCENTAGE
FARMER/LABORER	93	58.13%
MERCHANT/BUSINESS	27	16.88%
HEALTHCARE PROVIDER	5	3.13%
TEACHER	2	1.25%
OTHER	33	20.63%
TOTAL RESPONDENTS	160	100.00%









Average Cost of Fuel Purchased:		Haitian Gourdes	*Average $US	Average Time /Week
		GRD 88	$2.20	2

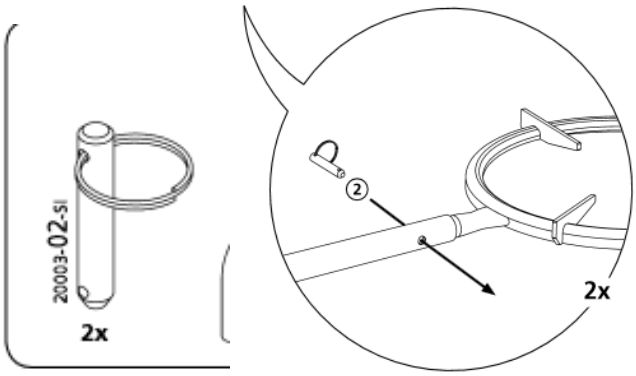
Fuel Consumption			
WOOD PURCHASE BY RESPONDENTS			
1 Bundle	2 Bundles	3 bundles	
71	22	1	
Charcoal Purchase by respondents			
1 Bag	2 Bags	3 Bags	7 Bags
2	1	1	1

Types of Health Problems Reported						
EYES	COUGH	Breathing	Back Pain	Chest Pain	Headache	Kids Sickness
109	73	0	5	34	25	110

Appendix 3: SolSource Technical Issues

The following chart displays the status of the SolSources for each of the 25 participants each month. This shows that, especially in the first half of the year, issues were usually resolved in one month. The second half of the year, participant's issues seemed more likely to persist, perhaps because there were no more replacement screws and bolts/QR pins left to repair the SolSources.

Most of the issues were redundant screws holding the reflector in place and bolts/QR pins holding the frame in place (see diagram below).



QR pin holding two pieces of the frame in place (2013 SolSource manual by One Earth Designs)

This summarizes information about participant's SolSource issues from surveys, focus group meetings, and clarifications from local leaders.
Participant 1: "the black mirror" (see explanation below) broke, but she cooks with it that way" (January focus group meeting)
Participant 2: "the fabric cover got burned, but she cooks that way in it, besides the little bolt that holds the metal tongue came off." (probably referring to small QR pin holding the adjustment pole in place) (January focus group meeting)
Participant 3: little longest metal part broken ("ti fe long lan kase") (probably referring to thinner metal pole in adjustment pole" (December survey)
Participant 5: long adjustment pole came out ("fe long lan ki soti") (May survey)
Participant 6: stolen, lost pieces (December surveys)
Participant 7: (Isaac Elianise): "Small metal piece that stops it from turning is lost", probably referring to adjustment pole ("ti fe ki kenbel pou virel la, ki pedi") (February survey); "A crazy person was passing by and broke her stove" (March survey) - stolen mirror (local leader clarification in November); April: Good condition but dirty, but Idamane says she mistook this for other stove in April. She also said a stick was used instead of the adjustment pole. May: bolt lost. June and after: unusable because of stolen mirror.
Participant 14: metal part broken ("ti fè kase") (February survey)
Participant 18: "stolen black mirror" (December survey); "black mirror" (February survey)
Participant 24: "stolen black mirror" (January focus group meeting)

As we can see, there is much confusion and inconsistency in the reporting of missing parts, whether broken, lost or stolen. Part of the problem comes from translation difficulties. Local leaders had to make up names for the various parts, and SHE's interpretation of these names could be wrong. For example:
- "boulon" – literal translation – bolt. The SolSource has bolts, but from context SHE believes "boulon" refers to the SolSource's QR pins. These QR pins hold the metals pieces together, but they often hold together without the QR pins anyway thanks to friction. The only ones which are immediately problematic when lost are the QR pins holding the adjustment pole in place, for without the adjustment pole, it is hard to keep the SolSource in the right position for solar cooking.
- "vis" – the literal translation is "screws." From context, however, SHE believes "vis" refers here to the bolts and nuts holding the reflecting panels together. There are many bolts between each

panel, so losing one or two per panel does not affect the shape of the panel.
- “ti fe lang lan” – literal translation: little metal tongue; this may refer to the tongue that releases the metal adjustment pole for elongation or shortening, much like those used on bike seats.
- “ti fe long lan” - the longest metal piece (or perhaps the spelling was misread). These may refer to the thin metal rod that slips though the other metal rod for adjustment pole elongation or shortening. Sometimes this thinner pole can fall out of the larger tubular pole, but with a little skill it can be put back in.
- “retwovize” – the literal translation is “rear view mirror”. This is a clever label for the little black mirror, as it allows one to view the bottom of the pot for more precise adjustment of the focal point where wanted.

Overall, it seems like a few small black mirrors were stolen (they are easily detached from the rest of the SolSource), and there were some issues with a few adjustment poles. The small black mirror is not necessary for SolSource functioning. It makes it more convenient to examine the bottom of the pot, so one does not have to crouch down to look from underneath. Even then, one does not need to look at the bottom of the pot to adjust the SolSource. It is for more precise adjustment, for example, if all the food is on one side of the pot and one wants to place the focal point right under the food.

The adjustment pole is more problematic. It is used to adjust the SolSource panels vertically. One participant replaced it temporarily with a stick, but getting the stick to hold the panels up at the right angle each time was most likely difficult.

In November, SHE contacted One Earth Designs concerning obtaining new replacement parts for the incomplete SolSources. As of February 2017, SHE is waiting on high-quality pictures from Idamane of the broken or lost pieces to best understand how to fix the SolSources, and which replacement parts to send.

To prevent confusion in future Haitian SolSource projects, a Creole labeling system for different parts could be developed, and perhaps even incorporated into the SolSource assembly manual to minimize errors in translation; and a good quality camera could be provided to local leaders so they could take pictures of the problematic parts (the photos they’ve sent so far have been too blurry to be helpful).

Appendix 4: Translation issues

Participant Selection Survey

"Which stove do you like using the most?" was understood as, "Which stove would you prefer using (if you had one)?", resulting in all 25 participants saying they prefer using the SolSource before they had one.

Follow-up survey

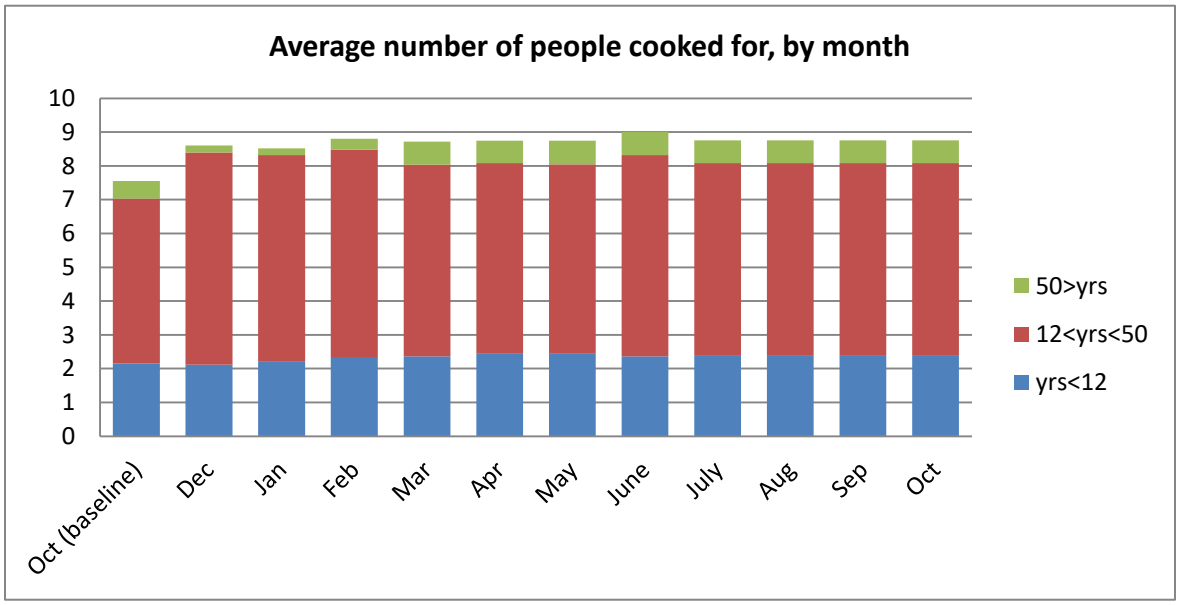
The first unclear question was: "Èske ou ka jwenn yon lòt SolSource si ou pa t' genyen l nan mwayen sa?" While originally the thought was to ask "Would you get a SolSource if you did not have this one?" as included in the survey promoted by the Global Alliance, there seems to have been some confusion when this question was translated into creole on the survey form. The creole meaning is not clear but is close to: "Could you get another SolSource if you did not have the means (to do so)? This could have been interpreted as: "Do you have the means to afford a SolSource?" or "Is the SolSource available in the area for a price?

Most participants answered no to this question, which is not consistent with their high praise for the SolSource and demand for more SolSources in the comments section.

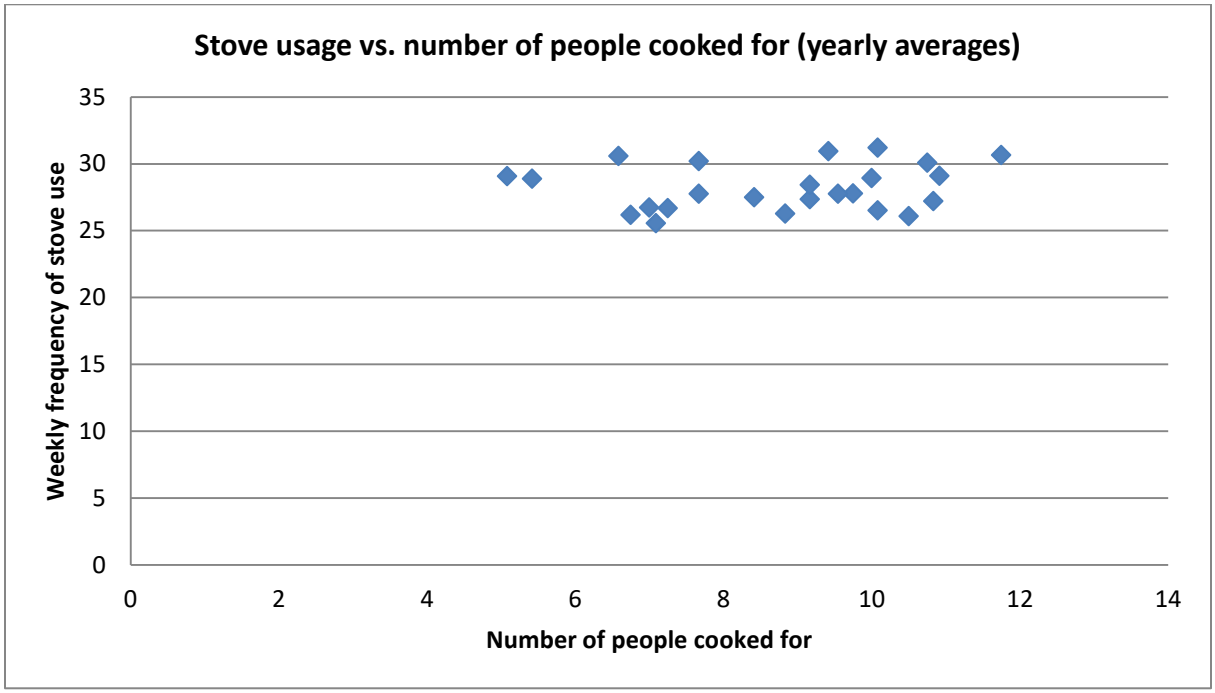
The second unclear question was: "Can you get your SolSource repaired in the community?" This question was included to ensure that the local leaders were doing their jobs in repairing SolSources as needed. Most participants answered "no" or "uncertain" – probably because they understood the question as whether the SolSources could be repaired in the community, outside the scope of the project. Seeing as SolSources were repaired, these answers don't make sense and should be discounted.

SolSource parts – see Appendix 3 SolSource Technical issues

Appendix 5: Further analysis regarding the number of people cooked for



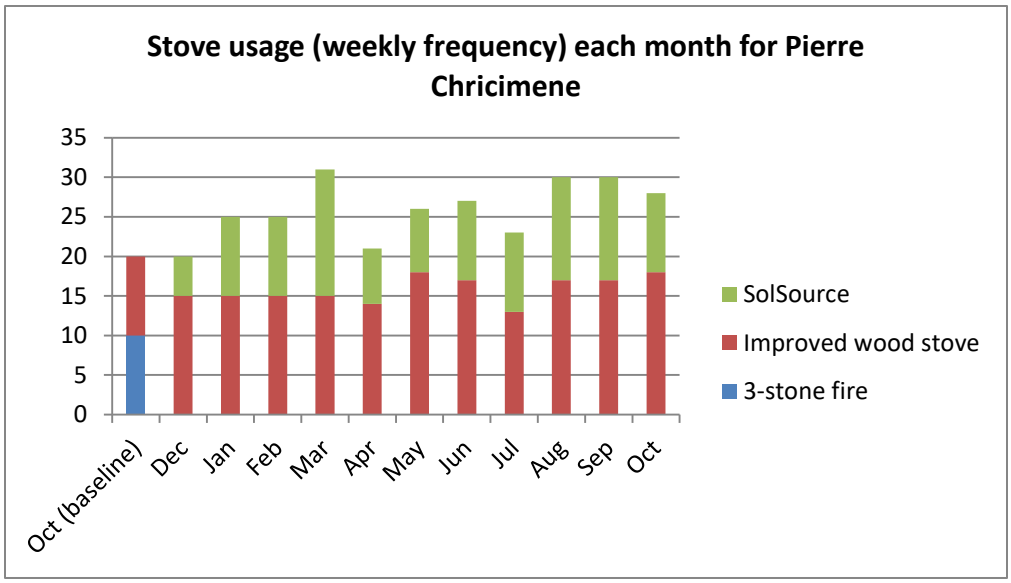
This graph shows the average number of people cooked in 25 households, by month. The October baseline average is smaller partly due to two participants not answering the question. The food consumption levels of different family members was not taken into account here, due to the many sources of error that make this depth of analysis unnecessary.

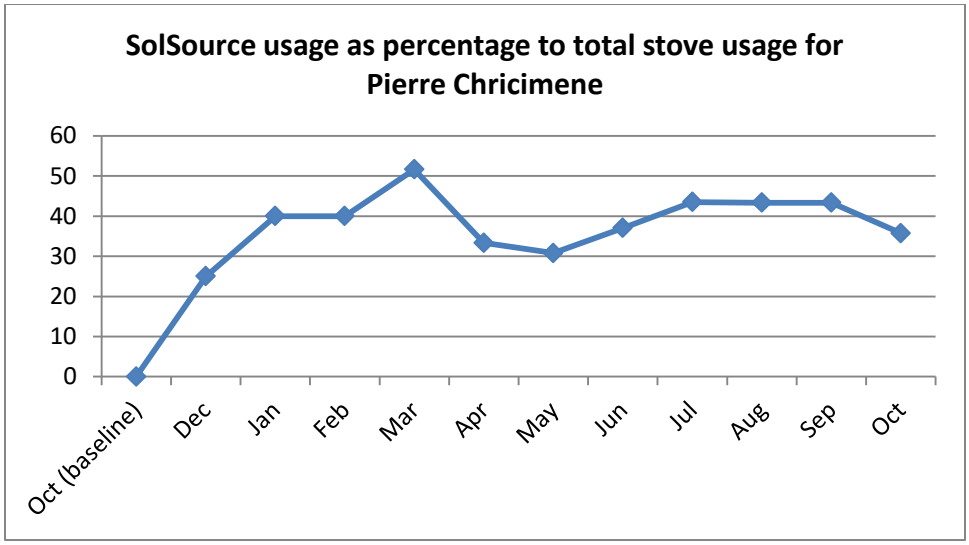


The averages for weekly stove frequency and stove usages have a Pearson correlation of 0.16, which is very low.

Appendix 6: SolSource usage for Chricimene Pierre – a case study

As a case study, let us examine the stove usage of Pierre Chricimene, a participant who reported at all times, with fairly high average SolSource usage rates.





Chricimene's SolSource usage rate does not correlate very well with the average SolSource rate, or weather patterns. Nonetheless, it is useful to see how an individual's SolSource usage rate might vary throughout the year.

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Appendix 8: SHE Team members

Sophie Brock Lyman, SHE Executive Director, report author – Sophie is responsible for Solar Household Energy's varied initiatives to carry out its mission. She has been working in environment and international development since 2005 with Greenpeace, USAID, and local NGOs in Democratic Republic of Congo, India and Haiti, where she also introduced solar cookers. She brings extensive international experience growing up and working in 10 countries, a Master's degree in Environmental Sciences and Policy from Johns Hopkins University, and fluency in English, French, Spanish, and intermediate Haitian Creole. Sophie managed a project to introduce 10 SolSources in LeBrun, SW Haiti in 2014, as Regional Development Manager for One Earth Designs, spending two weeks training in the field.

Onel Joseph, SHE consultant, field project manager and trainer – Onel Joseph implemented the second phase of the integrated cooking project in Tilori, from 2012 to 2014 with 78 "Sun and Ice" parabolic solar cooker and 177 "StoveTec" fuel-efficient stoves. He will be the main trainer and field project manager for this project.

Richard Stolz, Chief Operating Officer - Richard focuses his attention on SHE's financial affairs and strategic planning efforts. He has extensive business management experience, including managing a multi-million dollar division of a publishing company, active service on the board of directors of a communications business, as well as running his own consulting firm.

Louise Meyer, Vice President of the Board - Louise, a Co-Founder of SHE, was the organization's Project Manager for U.S. Environmental Protection Agency's Partnership for Clean Indoor Air's project in Mexico researching solar cookers and smoke inhalation. Ms. Meyer also managed the World Bank's Development Marketplace grant for the SHE "HotPot Initiative" in Mexico. Her interest in solar cooking began 20 years ago developing small business enterprises in Ivory Coast for the International Labor Organization. She later gained field experience as a volunteer trainer for Solar Cookers International in refugee camps. Ms. Meyer holds an MA in French and German Language and Literature and spent many years teaching. She obtained a graduate degree in International Development from the African Institute in Geneva, Switzerland. Louise was the SHE trainer in the TNC Tilori 2010 integrated cooking project introducing "Sun Oven" solar cookers and "StoveTec" fuel-efficient stoves.