IMPACT EVALUATION REPORT FOR THE PROJECT

‘EMERGENCY RESPONSE TO DEFORESTATION CRISIS OF THE KYANGWALI REFUGEE SETTLEMENT’

A report developed by CIDI, Caritas Denmark and SolarSack

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ACRONYMS

CBT	Compartment Bag Tests
CIDI	Community Integrated Development Initiatives
CO2	Carbon Dioxide
E. coli	Escherichia coli
GDPR	General Data Protection Regulation
HWTS	Household Water Treatment Solution
KAP	Knowledge, Attitude and Practices
MTI	Medical Team International
MoU	Memorandum of Understanding
NGO	Non-governmental Organisation
OECD	Organisation for Economic Co-operation and Development
OPM	Office of the Prime Minister
SDGs	Sustainable Development Goals
UGx	Ugandan Shillings
UN	United Nations
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations International Children's Emergency Fund
VHTs	Village Health Teams
WASH	Water and Sanitation Hygiene
WHO	World Health Organisation

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Executive Summary

Background:

This report presents findings from the impact evaluation of the project 'Emergency Response to the Deforestation Crisis of the Kyangwali Refugee Settlement'. The project is funded by the Danish Novo Nordisk Foundation and the Danish Ministry of Foreign Affairs and implemented by SolarSack, Caritas Denmark, and Community Integrated Development Initiatives (CIDI). Through the distribution of 25,000 SolarSacks - an affordable and sustainable household water treatment solution - the aim of the project was to:

1) reduce the prevalence of waterborne related diseases in targeted areas.
2) reduce deforestation by providing an alternative method for boiling water.
3) to learn about SolarSack user patterns for scale-up.

The project reached 7,891 households counting 45,770 beneficiaires. 30,8 % of the household beneficiaries had a person with special needs or children under 5.

Methods:

The study was conducted using both qualitative and quantitative research methods. The quantitative data was collected through household surveys and water quality testing, whereas the qualitative data was collected through focus group interviews, in-depth interviews, and observations at the household level. Observations were used to confirm responses from household surveys. Dialogue sessions were conducted with key informants such as camp management and chairpersons. The literature on implementation activities were further reviewed. The household surveys were conducted by 20 enumerators who also worked as SolarSack agents throughout the project distributing SolarSacks. Observations were conducted by CIDI, SolarSack and the enumerators. Dialogue sessions with key informants were conducted by CIDI and SolarSack. SolarSack's technical staff was undertaking the water quality tests.

Findings:

Reduce the prevalence of waterborne diseases: Household surveys (verified through observations) show a 98 % adoption rate of the product. 32 % of the respondents reported that someone in their household had had diarrhea within the last two weeks at baseline whereas this number was only 9 % at the end evaluation. 95 % of the respondents report that they have felt a positive health change since starting to use the SolarSack. The beneficiaries are generally using the SolarSack correctly. Observations and responses related to storage and cleaning of the SolarSack and jerry cans further indicate that beneficiaries are practicing good hygiene reducing the risk of recontamination of the treated water. A greater part of the beneficiaries that received SolarSack dispensers compared to those who did not use SolarSack for storage. In the future, dispensers will be an integrated part of the SolarSack proving a huge potential to reduce the risk of recontamination. Water quality tests conducted at the household level after SolarSack treatment indicate that the water lives up to WHO and East African (DESA 12:2017) drinking water standards for microbiological parameters after treatment and that the product is used efficiently. Altogether these findings indicate that the

beneficiaries experience a reduced risk of exposure to waterborne diseases and an improved health due to the intervention.

Reduce deforestation: The reduced deforestation rate was calculated through two methods; a theoretical and a practical method. The theoretical method based on The Gold Standard is measuring the potential savings in CO2 emissions that SolarSack has when substituting boiling water. Each SolarSack has the potential to save 551 kg of CO_2 emissions and two trees throughout its lifetime when substituting boiling water. 46,7 % of the beneficiary households (3687 households) reported that they used wood fuel for boiling water prior to receiving a SolarSack. If all SolarSacks at the 3687 households are used to their fullest, the project has the potential to save 6280 tonnes of CO_2 emissions and 22794 trees. Monitoring data over the next coming months will give further insights on how long the SolarSacks last to validate the calculation. The practical method was based on the respondents' own consumption assessment of charcoal and firewood for boiling water. It proved difficult to get reliable numbers from the respondents. The findings show that the respondents' charcoal consumption have gone down whereas their firewood consumption have gone up since receiving the SolarSacks. Nevertheless, 95 % of the respondents who reported that they boiled water prior to receiving a SolarSack estimate that they use less wood fuel since receiving SolarSacks. Based on the Gold Standard Method, the project has a considerable potential to reduce deforestation, however, it proves difficult to verify this through household surveys on wood fuel consumption.

Learn about user patterns: The SolarSacks have been positively received by the beneficiaries who have largely adopted it. 99 % of the respondents trust that it kills germs efficiently, and 99 % are either satisfied or very satisfied with the product. The majority are using the SolarSacks correctly, indicating proper usage training of beneficiaries. It generally fits well into the local context. However, challenges related to bad weather have reduced everyday use. As the settlement hosts people with diverse cultural, religious and tribal backgrounds that all uniformly have adopted the product, this gives positive indications of product adoption in diverse communities for future interventions.

The (limited) skepticism met was mainly related to SolarSack being a new technology and the uncertainty about how sun rays can kill dangerous germs through the plastic. Few beneficiaries further mentioned that they are afraid that plastic exposure can cause them cancer. To address the scepticism, it proved key to utilize local community resources to create trust around the product. The education strategy in which beneficiaries were trained at point of distribution further allowed users to ask questions and have them promptly responded to. Especially the information about the product's certification by the Ugandan Ministry of Water and Environment created trust.

Beneficiaries are generally taking good care of the product. However, households were also observed placing it at spots that could break it. Taking good care of the product needs to be emphasized even more. This might be a more significant problem in contexts in which the product is handed out for free rather than sold.

The latest product updates were introduced to selected SolarSack beneficiaires during the test and had positive responses, suggesting permanent integration of these features in the product.. This included a few dispensers that were handed out allowing for easy pouring of water from the SolarSack and indicators indicating when water is safe to drink. These were greatly demanded and adopted and should become key features of all SolarSacks in the future. Additionally, SolarSack users suggested that the product should be able to contain more water, that it should be even more durable (plastic stronger), and that one SolarSack should be expected to cover needs of only one person.

A collection system of SolarSacks has been set up in which end-of-life SolarSacks are supposed to be delivered by households at block leaders' facilities from where they will be brought to a recycling entity in the settlement. A follow-up mechanism on the effectiveness of the collection system has been set up in which Solar agents monthly will check up on end-of-life SolarSacks. In a few months when more SolarSacks start to break, the collection system and incentives will be tested and evaluated. General usage monitoring will keep going on throughout the following months to get more user insights over a longer period of time.

Conclusion:

Overall, the project has been implemented successfully with great impact potential to prevent waterborne diseases and deforestation. The product fits well into the context and the beneficiaries have made it a part of their daily habits. 98 % of respondents state that they use the SolarSack, 95 % express that they have felt an improvement in health since starting using the SolarSack and the reported diarrhea level has gone down from 32 % to 9 %. The project has the potential to save 6280 tonnes of CO_2 emissions and 22794 trees, however this proves difficult to verify through household data on wood fuel consumption. The project partners are aware of the fact that some users might feel obliged to answer in a certain way to please enumerators and monitoring will keep taking place to verify the findings and to adjust interventions to fit the beneficiaries' needs.

Various learnings have been obtained at the implementation and household level, which will help improve future processes and product features. A key success criterion has been the local project anchorage in which CIDI has utilized refugees and VHTs to implement the product and further been supported by chairmen and block leaders in each implementation village. An extension of the project will be able to benefit more people by improving their health and reduce wood fuel dependency. A project extension has been endorsed by UNHCR, Oxfam and the OPM in the settlement based on the positive results. The project contributes to several of the SGDs hereunder SDG 1, 3, 5, 6, 8, 13, 15 and 17.

Recommendations:

Based on the evaluation findings, following recommendations are made:

Product features and accessories

- Dispensers should be a key feature of every SolarSack reducing the risk of recontamination of water.
- Indicators should be a key feature of every SolarSack where funds are available. They will increase safe usage and ensure that SolarSacks can be used even on cloudy days.
- SolarSacks potentially to come along with a jerry can, cups and soap making it easier for beneficiaries to keep hygiene through the water value chain and ensure safe water at the point of consumption.
- SolarSacks to come with a nail to hang it on in households.

Implementation

- Utilizing local resources through the entire value chain is a must to succeed and to ensure local ownership and long term impact.
- SolarSack to come with a sanitation social marketing package to accompany the product for improved benefits and to create mass awareness around the product
- Linking up with other WASH initiatives will be beneficial to increase behavioral change that lasts.
- Proper transportation options or funding for this must be in place as distances and bad roads challenge the products' efficient distribution.
- Education material that can stay at the households (e.g. posters on WASH and SolarSack usage) should be tested to help remind beneficiaries of good WASH practices.

Data collection and monitoring

- The efficacy of the SolarSack has been tested and confirmed by various independent

institutions, however, it needs to be applied correctly in order to kill pathogens. Conducting water quality tests at point of consumption is one of the most important indicators to verify whether the beneficiaries are using the product correctly. It is therefore recommended that more water quality tests before and after treatment with a SolarSack are conducted to provide knowledge on efficient usage of the product.

- Following / observing a few households more closely will be beneficial to learn more about adoption, correct usage, perception and wood fuel consumption rather than conducting multiple quantitative monitoring surveys only giving insight at a single point in time.

1. Introduction and Background

1.1 Introduction

This report presents findings from the impact evaluation of the project 'Emergency Response to Deforestation Crisis of the Kyangwali Refugee Settlement' in Western Uganda. The impact evaluation was conducted in December 2020. The project is a humanitarian project that has been implemented by the Danish company SolarSack ApS, the Ugandan NGO Community Integrated Development Initiatives (CIDI), and the Danish NGO Caritas Denmark.

The project has distributed 25,000 SolarSacks - an affordable household water treatment solution using only the sun to purify water - to refugees in settlement and to the surrounding host communities. The evaluation aimed at assessing the performance and achievements of the project and generating lessons learned and recommendations to inform future programmes. The project grant was received in May 2019 and was supposed to end in April 2020. Due to the Covid-19 pandemic delaying shipping and pausing activities in the settlement as well as constraints obtaining certificates from the Ugandan Ministry of Water and Environment to start the project, it was extended until December 2020. The project has been funded by the Danish Novo Nordisk Foundation and the Danish Ministry of Foreign Affairs.

1.2 Background

The Kyangwali Refugee Settlement, located in Western Uganda, has, during the last couple of years, experienced a considerable influx of refugees from 36,000 in 2017 to more than 120,000 in 2020 (OPM Statistics, October 2020[1]). This has put enormous pressure on the settlement's resources hereunder the demand for wood fuel - the primary source for cooking and boiling water - and water and sanitation services. This has led to increased deforestation in the areas surrounding the refugee settlement and increased the risk of the spread of waterborne related diseases.

[1] https://reliefweb.int/sites/reliefweb.int/files/resources/Kyangwali_Settlement%20Profile_102020.pdf

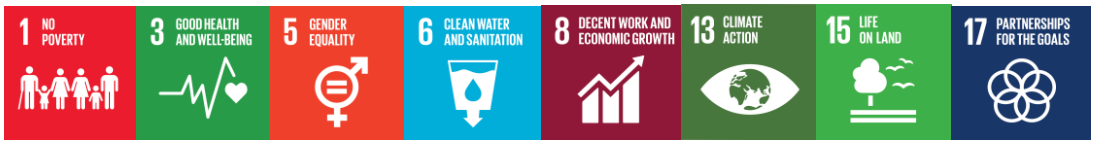
The Office of the Prime Minister (OPM) and UNHCR WASH in the Kyangwali Refugee Settlement found the SolarSack as the best solution to address these challenges due to its affordability and convenience of use. The mentioned challenges are key priorities for the camp management. In line with this mandate, the project partners have worked closely with UNHCR WASH and its key WASH implementing partner Oxfam in the settlement as well as local government departments, water officers and local leaders representing beneficiaries to design the project implementation addressing the problems most appropriately.

1.3 Objectives of the Project

The objectives of the project were to:

1) reduce the prevalence of waterborne related diseases in targeted areas.
2) reduce deforestation by providing an alternative method for boiling water.
3) to learn about SolarSack user patterns for scale-up.

The activities and the objectives of the project are contributing to various of the SDGs.



1.4 Objectives of the Impact Evaluation

The impact evaluation will follow the OECD's recommendations for development intervention evaluations[2]. The recommendations go beyond evaluating the specific project objectives and enable 'the determination of the merit, worth or significance of an intervention'. All interventions should be relevant to the context, coherent with other interventions, achieve their objectives, efficiently deliver results and have positive impacts that last. Based on this, the following criteria will guide the evaluation

- ***Relevance:*** Determining the extent to which the project and related activities were relevant and tailored to the needs of the beneficiaries in the settlement and in the host community and to the local and national needs.

[2] https://www.oecd.org/dac/evaluation/daccriteriaforevaluatingdevelopmentassistance.htm

- ***Coherence:*** The extent to which other interventions supported or undermined the intervention and vice versa.
- ***Efficiency:*** The extent to which the intervention delivered results in an economic and timely way.
- ***Effectiveness:*** The extent to which the intervention achieved or is expected to achieve its objectives, and its results.
- ***Impact:*** The extent to which the intervention has generated or is expected to generate significant positive or negative intended or unintended higher-level effects.
- ***Sustainability:*** The extent to which the net benefits of the intervention continue or are likely to continue.

1.5 Scope of the Impact Evaluation

The impact evaluation was conducted in the Kyangwali Refugee Settlement and in the surrounding host communities in the Kikuube District in Uganda. It covered beneficiaries that had received SolarSacks, organisations relevant to the project as well as key informants such as health officers and community leaders.

2. Implementation Strategy and Overview

2.1 Target Group

To integrate host communities who often are negatively affected in various ways by settlements hosting refugees, UNHCR and the Ugandan Government have agreed on the 70-30 rule implying that 30 % of resources/inputs of humanitarian projects in refugee settlements need to go to the surrounding host communities. To live up to the 70-30 rule, approximately 70 % of the SolarSacks were distributed within the settlement and 30 % were distributed to the host communities.

The target group was identified based on villages and blocks with water collection points at high risk of contamination, such as shallow wells. The areas were identified by Oxfam, who is in charge of conducting water quality tests and have an overview of areas most affected by contaminated water within the settlement. In the host communities, the Sub-county Health Officer and Mayor of Kyangwali Town Council assisted in identifying the target areas. Chairmen and block leaders assisted in identifying the specific beneficiaries within each village. An overview of the distribution villages and blocks can be found in Appendix A.

2.2. Distribution Approach and Numbers

The number of SolarSacks distributed to a household has been based on household size. Based on the literature, recommendations from the WASH Community in the settlement and baseline data, it is

estimated that one person approximately drinks two liters of water a day (baseline findings show 1,8 liters). As SolarSack provides four liter of safe water a day, one SolarSack per every two people in a household were handed out. The average household size was six people implying that a household on average got three SolarSacks.

In total, 25,000 SolarSacks were distributed to 7,891 households in 27 villages. 45,770 individuals benefited from the project. Out of the total households reached, 3,687 (46,7%) reported that they used boiling as a mean to treat water prior to receiving a SolarSack. 30,8 % of the household beneficiaries had a person with special needs or children under 5 in their household.

The distributed SolarSacks have the following batch numbers:

- L20/20/152/001 to 009 (OF06628)
- L20/20/058/006 to 0045 (OF06706)
- L23/20/110/001 to 0065 (OF06959)

2.3. Training and Education

SolarSack Agents

15 refugees living in the settlement and 5 VHTs living in the host communities also referred to as SolarSack agents were recruited to work as enumerators and to distribute and educate beneficiaries in SolarSack usage and WASH practices. The majority of the 20 SolarSack agents had previously been working with CIDI and had experience within data collection and education in WASH practices. The 20 SolarSack agents were trained by SolarSack and CIDI throughout a two day workshop.

Beneficiaries

The 20 SolarSack agents were training beneficiaries in groups of 5-30 persons on product usage and WASH practices at the point of distribution. The size of groups were adjusted on a continuous basis based on Covid-19 restrictions. The SolarSack agents worked in pairs to handle both registrations of beneficiaries and training. A session took between 30 minutes - 1 hour. Chairmen and block leaders helped mobilize the beneficiaries for training. Their facilities were further used for hosting some of the training sessions. The training was taking a participatory approach, actively involving the beneficiaries. Training was conducted in the spoken language (English, Swahili or Runyoro). Most beneficiaries received the SolarSack with the instruction manual on the back after training whereas a few beneficiaries additionally were given an education leaflet to test out different educational approaches.

2.4 Collection and Recycling

SolarSacks need to be collected at the end of their lifetime to ensure that they do not end up harming the environment as plastic waste. To address this challenge, a collection and recycling collaboration has been entered into between the project partners and CARE Denmark, reflected in an MoU between the parties. CARE Denmark is developing waste collection infrastructures in the settlement and is setting up a recycling entity. The MoU stipulates how this recycling entity will upcycle broken SolarSacks into new useful materials, including roofing tiles.

Chairmen and block leaders have agreed to use their facilities as collection hubs for broken SolarSacks. Beneficiaries have been instructed to return broken SolarSacks at the block leaders' facilities when they break. It is expected that the beneficiaries are incentivized to return broken SolarSacks to block leaders due to a community spirit ensuring no SolarSacks end up in the environment and as the beneficiaries are trusting and listening to instructions by the block leaders. To check on whether the beneficiaries had been informed properly in the return system, a question related to the return was asked at end evaluation. 96 % of the respondents reported that they knew that the SolarSacks should be returned to their block / community leader.

CARE Denmark's recycling entity in the settlement will on a continuous basis collect SolarSacks from the block leaders' facilities and bring them to the recycling entity, covering the costs of transport in turn for accessing the plastic material as a recycling material for free. Activities related to this component will take place throughout 2021 and the timeline will depend on how fast the SolarSacks break. An evaluation of this will therefore not be part of this evaluation report.

2.5 Activity Overview

In Appendix B, an overview of all detailed project related activities can be found.

3. Methodology and Approach

3.1 Evaluation Design

The study has utilized both qualitative and quantitative methods to evaluate the project. Qualitative data was collected through focus group discussions and in-depth interviews with beneficiaries at the household level. Block leaders and the 15 refugees and 5 VHTs working as enumerators and SolarSack agents helped facilitate the focus group discussions and in-depth interviews. Camp management and relevant organizations, hereunder CIDI headquarter, Caritas Denmark, SolarSack, UNHCR and Oxfam staff in the settlement, were further part of various dialogue sessions. The quantitative data was collected through household and monitoring surveys on usage and through water quality tests. The household surveys were conducted by the 20 enumerators. Observations were conducted by CIDI, SolarSack and the enumerators. Dialogue sessions with key informants were conducted by CIDI and SolarSack whereas SolarSack's technical staff was undertaking the water quality tests.

3.2 Study Population and Sampling

Household surveys

For the baseline collection, assumed intervention areas in the settlement and the host communities were selected for sampling. Based on an estimation that approximately 7,500 households would be reached with SolarSacks, the world wide formula by Bowman Kimiki O. was used to determine the appropriate sample size for the population with a confidence level of 95 % and margin of error of 5 % equal to 365 samples. Nevertheless, in total 589 samples were conducted in the identified areas. For the end evaluation, the same formula was used to calculate the sample size for a population of 7,500. Due to more resources available, the calculation was based on a confidence interval of 99 % and a margin of error of 5 % equal to 615 samples. 615 samples were conducted in all intervention areas in both the host communities and within the settlement. The data was collected using random sampling. The enumerators were instructed to interview every 5th household in areas that were densely populated. However, in areas with long distances between each household, this method was not enforced. During the field visits, the enumerators also used observations to validate the responses given by beneficiaries. The enumerators were instructed to interview the person(s) in charge of water handling at the household.

Qualitative interviews

Several interviews were conducted with beneficiaries, WASH staff, and camp management. The beneficiaries taking part in focus discussions were identified by the block leaders based on availability, whereas the in-depth interviews were conducted using random sampling. The key informants, such as camp management, were purposely selected based on their knowledge of the study subject matter.

Observations

Observations were undertaken throughout the entire project period by the enumerators, CIDI and SolarSack staff to help confirm the responses from the household surveys and to understand the users better. Observations fosters an in-depth and rich understanding of user behaviour and is an essential part of getting insights of naturalistic settings and its members.

Water quality tests

On-site water quality tests were conducted in the settlement using Compartment Bag Tests (CBT) purchased through the supplier Aquagenx. The CBT is testing for *E.coli.* In short, the water is divided into compartments in the bag before incubation, and changes of color to blue indicate *E. coli* growth. Depending on which compartments turn blue, the bacteria count can be calculated. At baseline four tests were conducted using water sources from wells in the implementation areas. At the end evaluation, four tests were conducted on SolarSack treated water at point-of-use. The sample size was based on resources available. It was SolarSack's technical team that conducted the tests overseen by Oxfam who possesses technical human resources required for this task. To ensure the quality of results, only experienced staff must undertake this exercise as various steps need to be followed thoroughly. This implied that the tests only were conducted during field trips by SolarSack personnel.

Triangulation

Different data collection methodologies have been applied to be able to triangulate data. Triangulation guard against data biases that often come from single-method, single-observer and single-theory studies. Qualitative data hereunder observations and interviews help validate and confirm findings from the quantitative data and vice versa.

3.3 Survey Tool

The household and monitoring surveys were based on the project objectives and related indicators and guided by WHO's and UNICEF's toolkit for monitoring and evaluating HWTS programmes[3] and the Gold Standard[4], which has developed methodologies for programmes and activities introducing technologies that displace decentralized thermal energy consumption leading to a reduction in greenhouse gas emissions. In December 2019, the first draft survey questions were tested in the field, and adjustments were made. The surveys were further reviewed by other WASH stakeholders and the WASH Community (all NGOs implementing WASH activities) in the settlement. The tool was transformed into an electronic survey to be administered with tablets using the software Kobo Collect. The survey logic was integrated into the software to ensure that the right questions were asked and that enumerators did not have to skip questions manually. The enumerators could choose to do it in either English, Kiswahili, or Runyoro.

3.4 Enumerators and Quality Control Measure

The 20 enumerators collected the quantitative data. The enumerators were thoroughly instructed in data collection procedures and were familiarized with the questions prior to the exercise. The data was stored on a safe Kobo server and checked every day for inconsistencies or other data problems that needed to be addressed by SolarSack.

3.5 Ethics and Consent

Ethical considerations were taken throughout the collection exercise. The respondents were explained about the survey's purpose, intended use of the collected data and that the data would be processed as confidential. The enumerators emphasized that the participation in the survey was voluntary and that the respondent could stop the interview at any time or skip questions. The enumerators got written consent from all respondents part of the survey.

[3] https://www.who.int/household_water/WHO_UNICEF_HWTS_MonitoringToolkit_2012.pdf
[4] https://globalgoals.goldstandard.org/wp-content/uploads/2017/08/401.13-TPDDTEC-V3.1_20170823-1.pdf

3.6 Data Management and Analysis

All data were consolidated into a single excel data sheet extracted from the KoboCollect server. The data was first translated into English. For the questions allowing further explanations, the answers were coded into different categories. Thematic analysis was thereafter conducted. Descriptive tables were created to present the findings for each question. The data is stored securely in a drive complying with Danish General Data Protection Regulation (GDPR) rules. It will only be stored as long as it is needed and relevant for the project.

3.7 Limitations and Challenges

Key challenges of the collection exercise were:

- Charging of tablets. Power cuts implied that it was difficult to charge the tablets fully to ensure they would last an entire day in the field.
- Some beneficiaries felt that they were "watched" when they had to answer questions regarding the SolarSack and their water treatment habits.
- Some beneficiaries felt that they had to answer in a certain way or that their equipment should appear very clean. E.g., when beneficiaries were asked to show their jerry cans they used for water storage, they often spent a long time finding the cleanest one.
- The assessment of when water is "clear / see-through" was difficult for respondents to understand.
- The assessment of how much water is collected and used for drinking was difficult.
- The assessment of how much wood fuel is used generally and for boiling water was difficult.

To mitigate these challenges, different actions were undertaken and/or will be undertaken for future interventions:

- Tablets with long-lasting battery life must be a priority for future purchases
- The enumerators were guided to be humble, understanding, objective and not judging when visiting households in order to create trust and ensure unbiased answers.
- The enumerators were instructed to explain households properly the difference between clear water and dirty water. They further asked households to see the drinking water to help assess it.
- To make the assessment of how much water was used for drinking on a daily basis, the enumerators helped households to count jerry cans used for collecting water and used for drinking water.
- To make the assessment of how much wood fuel was used for general use and for boiling water, the enumerators probed into the households' buying and collection habits of firewood and charcoal. The households, however, found it very difficult to make this assessment and some explained that their consumption also was affected by funds available the given week / month.

4. Key Findings and Discussions

4.1 Introduction

This chapter's findings will be presented following the structure of the OECD's guideline on evaluation criteria.

4.2 Assessing the relevance of the project to the needs

As part of identifying the Kyangwali Refugee Settlement as the intervention area for distributing the 25,000 SolarSacks, a need assessment was conducted prior to the choice of area. CIDI was consulting closely with the camp management in the Kyangwali Settlement. The needs assessment focused on the severity of the deforestation problem and whether the SolarSack product had the potential to address the problem. This included looking into the refugees cooking and water boiling habits. The

needs assessment further looked into the water quality in the settlement and the prevalence of waterborne related diseases.

Deforestation

Forest management hereunder reducing deforestation is a key focus area of the Ugandan Government[5]. Various statistics from OPM show changes in the forest over the last many years. Moreover, through several talks to the OPM in the settlement it was clear that interventions that could reduce deforestation were a key priority. A KAP survey from 2018 in the Kyangwali Settlement showed that 32,2% of the refugees treated water before drinking, and 76,2% of these respondents used boiling as a means showing a great potential to reduce the use of wood fuel. Project baseline data conducted in February 2020 in the implementation areas showed that 46,5 % of the respondents were treating their water, and 88 % of this group treated water through boiling, indicating an immense potential to reduce wood fuel consumption. However, it must be noted that this number might be biased as respondents tend to answer being more 'responsible' than they are.

As part of a field visit, the CIDI and SolarSack team joined the weekly 'wood fuel walk' in the settlement. The refugees living the closest to the forest (typically in the village Maratatu) walk many hours weekly through rugged terrain to fetch firewood. Typically women and young children carry heavy firewood bulks. The refugees explained that due to deforestation, they yearly had to walk longer distances which reduced the time available to be spent on other household, school, or work-related activities. The wood fuel walk emphasized the importance of presenting the refugees with alternative resources to wood fuel and the project's relevance.

Health

Through several meetings with the UNHCR WASH and the WASH community in the settlement, it was clear that water security and safety are two major concerns. In a KAP survey from 2018, 12,2 % of respondents answered that they had had a child under 5 years with watery stool, and 9,5 % had one adult with the same health conditions within the last two weeks. Project baseline data conducted in February 2020 in the implementation areas showed that 32% of the respondent households had suffered from diarrhea within the last two weeks, and many had been diagnosed with waterborne related diseases such as typhoid, dysentery, and cholera within the same two weeks. In many households, several members had been suffering from diarrhea. The respondents answered that they in average had spent 11 USD to treat the diarrhea in the household reported within the last two weeks showing significant negative economic implications for the households. This indicates the project being of high relevance to the beneficiaries' needs and to improve the social and economic development of households.

46,7 % of the households receiving SolarSacks answered that they boiled water prior to getting a SolarSack implying 53,3 % did not treat water beforehand. This shows a huge potential of both mitigating deforestation as well as improving health.

[5] https://www.mwe.go.ug/sites/default/files/State%20of%20Uganda%27s%20Forestry-2015.pdf

Beneficiaries

To avoid having beneficiaries who were not interested in the product or did not see it as a benefit for their daily life to receive a SolarSack, it was originally planned to train beneficiaries and have them actively meet up later the same day to get the SolarSack at a hand out point. Due to corona restrictions and the risk of beneficiaries queuing up and not keeping distance, this strategy could not be followed. Beneficiaries received SolarSacks right after training but only if they expressed a need.

Based on the presented findings, it must be concluded that the project has been and is highly relevant and is addressing critical needs in the settlement and surrounding host communities all contributing to the UN SDGs.

4.3 Assessing the coherence of the project with other interventions

Deforestation

Different forest management projects guided by law are already in place in the Kikuube district. The refugees are, for example, only allowed to fetch firewood one time a week from the forest, however, they are facing a lack of alternatives to the wood fuel. Therefore, the SolarSack project is coherent with existing interventions by providing alternatives to wood fuel.

Health

Through support from UNHCR WASH and Oxfam, the project was coordinated to ensure that the SolarSack intervention areas did not receive HWTS from other projects avoiding an overlap of beneficiaries. The project was not linked up to other WASH projects, even though this would have been relevant. WASH and behavioral change promotion are vital aspects when introducing a new HWTS to achieve the most significant impact. General WASH aspects were part of the training of beneficiaries, and several monitoring rounds have been conducted to encourage use and follow up with users. However, it is recommended for future interventions to tap into existing WASH promotion interventions, to help users adopt the product and make it a part of their daily routines. Moreover, it will be relevant if SolarSacks come along with a sanitation social marketing package to create awareness around the product and practices affecting its impact.

Based on this, it can be concluded that the project generally has been coherent with other interventions. However, the future focus should be to tap into existing WASH promotion programmes to experience long-term behavioural change.

4.4 Assessing the economic and time efficiency of the project

In Appendix B, an overview of the project activities can be found. All planned activities have been undertaken except activities related to the collection and recycling component, which will take place throughout 2021. The grant period was originally from May 2019 to April 2020. However, because of delays caused by Covid-19 related to product shipping and lockdown of the settlement the grant was extended to December 2020. The shipping delay implied that the 25,000 SolarSacks had to be shipped in different smaller bulks. Nevertheless, the transportation and delivery process were still handled efficiently. The delay further meant that the budget had to be adjusted to cover local salaries for the extra operational months. Caritas Denmark covered these extra expenses. It has also meant that the monitoring of users will continue in 2021. Prior to the Covid-19 pandemic break out, slight delays had further been experienced due to the time-consuming process of getting a certificate on the product's efficiency by the Ugandan Ministry of Water and Environment, which was a requirement to start the project. This time-consuming process will be taken into account for the planning of future projects.

Before the project started, several inception meetings were conducted among the project partners and in the settlement spearheaded by CIDI to strategize the project. This helped ensure that tasks were clearly divided, and needed knowledge was obtained to perform the activities efficiently and in line with the project work plan. Caritas Denmark, CIDI and SolarSack have weekly communicated on progress and project adjustments. CIDI has led the day-to-day implementation and communication with camp management, specifically UNHCR WASH, the WASH Community, Oxfam, and OPM. The information flow has generally been good, ensuring effective implementation. CIDI has continuously shared progress with camp management.

Even though all 25,000 SolarSacks were received and full implementation started in June 2020, all activities were closed down several times in the settlement due to the Covid-19 pandemic. This meant that the distribution of SolarSacks was paused multiple times and that some areas did not receive SolarSacks until November 2020. This made it possible to adjust distribution strategies based on learnings but also limited the flow of distribution. It was originally expected that the SolarSacks would be distributed within two months.

The distribution set-up in which SolarSack agents educate smaller groups of people and one CIDI staff member drives around handing out SolarSacks after education proved to be efficient. However, it became evident that the distances within the settlement and in the host communities require that funds are budgeted for the transport of SolarSack agents to move around and for the NGO staff to serve beneficiaries with SolarSacks.

To conclude, the project activities have been successfully coordinated and implemented through the partners. As the project was eight months delayed, primarily caused by the Covid-19 pandemic, the budget for salaries increased. Only minor adjustments have been made to the budget. A smaller amount of funds has been allocated to facilitate the monitoring of the project in 2021.

4.5 Assessing the effectiveness of achieving the project's objectives

To evaluate the effectiveness of achieving the project's objectives, a household survey was conducted prior to the project start (baseline) and by the end of the project. The results are triangulated with water quality tests, qualitative interviews with beneficiaries and observations. The evaluation questions have been based on indicators defined for the three project objectives:

Objective and outcome	Indicators
Objective Reduce the prevalence of waterborne related diseases in the targeted areas ***Outcome*** *Increased access to safe water*	Number of households that have received a SolarSack % of households that treat water before drinking (adopt SolarSack) % Households that can demonstrate and explain the correct use of SolarSack % of households that treat water consistently % of households that store drinking water in a clean container % of households drinking from a clean cup % of water tested at point of consumption living up to WHO standards for drinking water quality Number of occurrences of water borne related diseases before and after receiving a SolarSack
Objective Reduce deforestation by providing an alternative water treatment method to boiling ***Outcome*** Reduce dependency on wood fuel for boiling drinking water	% of beneficiaries treating water by boiling at baseline % of beneficiaries treating water using a SolarSack Average amount of bundles of firewood or sacks of charcoal consumed per household per month for boiling
Objective To learn from user patterns during the SolarSack life cycle for implementation and product improvement and for scale up ***Outcome***	% of household with a functioning SolarSack Increased knowledge on the use of SolarSack Increased use and adoption of SolarSack

Knowledge on user patterns	Perception and trust in the SolarSack

In Appendix C and D, the household surveys' results can be found along with the correct monitoring usage survey. In the following sections, the most relevant findings will be highlighted.

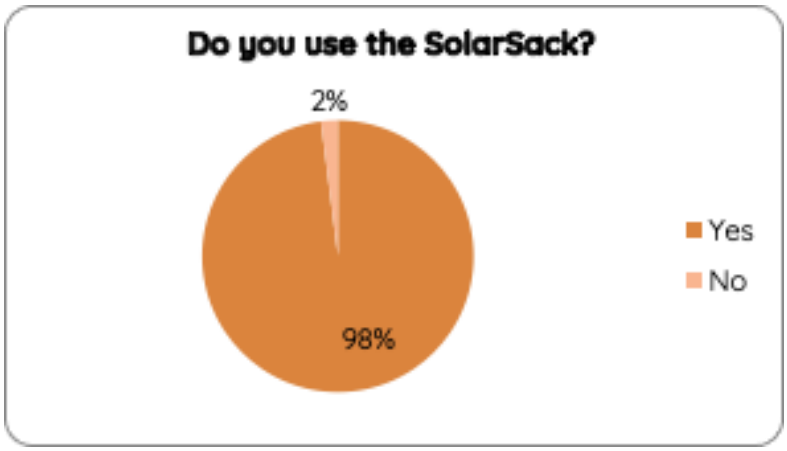
In total, 25,000 SolarSacks have been distributed to 7,891 households counting 45,770 beneficiaries.

4.5.1 Objective

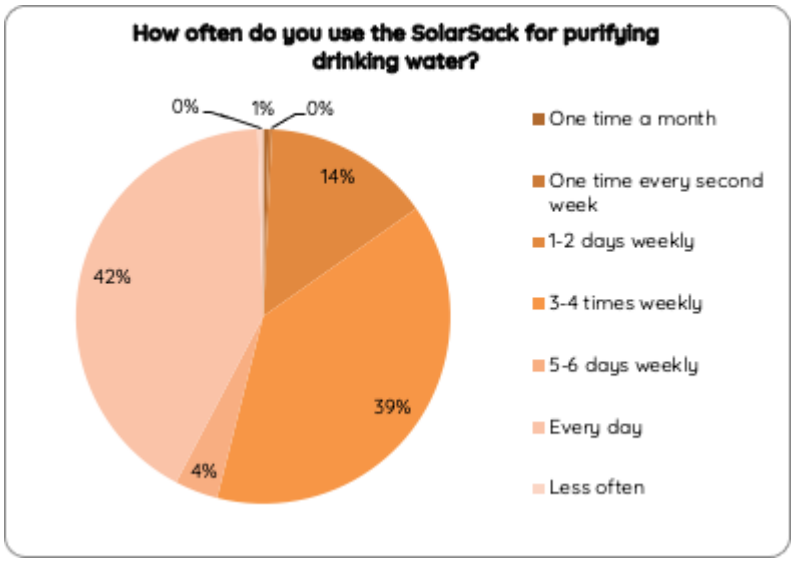
1: Reduce the prevalence of waterborne related diseases in the targeted areas

Adoption

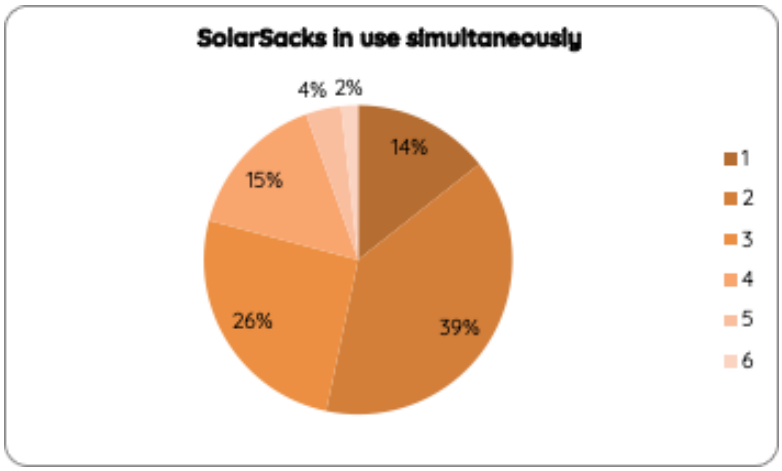
98 % of the respondents answer that they use the SolarSack.



The majority (85 %) answer that they use the SolarSack every day or every second day. As the settlement hosts people with diverse cultural, religious and tribal backgrounds that all uniformly have adopted the product, this gives positive indications of product adoption in diverse communities for future interventions.

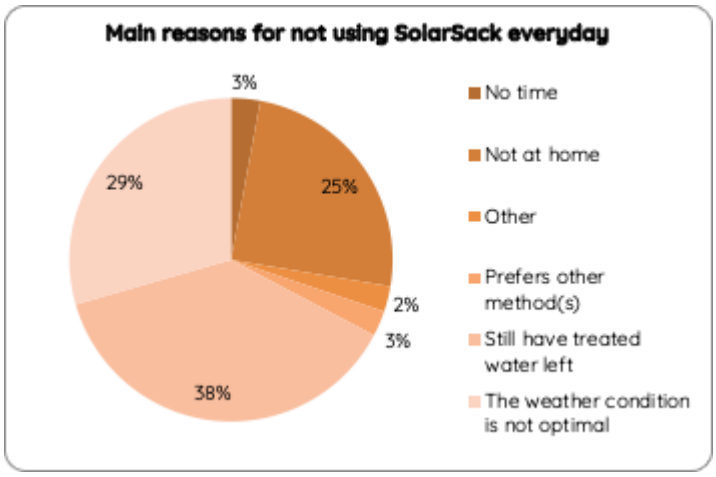


When asked about how many SolarSacks the household put out at a time for treatment, following numbers are given:



The numbers show that most households use more than one SolarSack at a time. It is most common to use two or three SolarSacks per treatment process. From in-depth interviews with the households, it came out that some households "save" some of their SolarSacks for future use to ensure that they have treated water when the first SolarSacks break.

When asked about the main reasons for not using the SolarSack every day, the following reasons are given:

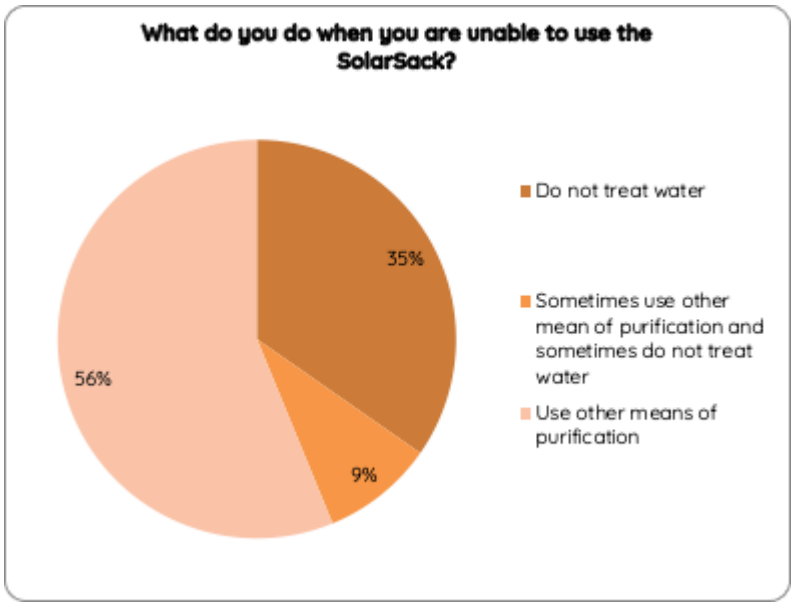


The most commonly mentioned reason is that the household still has treated water left, whereas that weather is not optimal and that the household members are not at home are other commonly mentioned reasons.

The numbers generally show a high adoption rate of the product and frequent use. However, the reported use may be considered biased as the sun in periods does not shine every day. Usage of the SolarSack every day in some weeks is therefore not possible.

Consistent use

When SolarSack is not used / can not be used, 56 % answer that they use other methods for purifying water, 9 % sometimes treat water / sometimes do not, and 35% don't treat.



This shows that the majority is consistent in treating water, indicating a huge health benefit. However, some households must still be encouraged to treat water (if they experience health problems) if resources are available. Households are often left with no other options than the SolarSack. Nevertheless, it is expected that this group can use the WASH training received by the SolarSack agents to keep water safer.

Correct usage

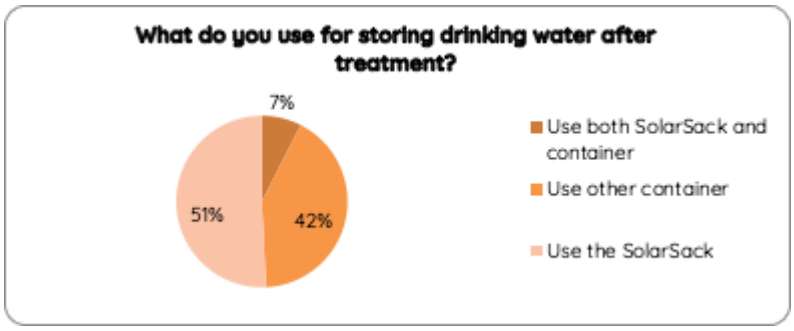
The correct usage survey (see Appendix D) indicates that the users have been trained well and understand how to use the SolarSack correctly reducing the exposure to waterborne diseases. The following were found through household surveys

- 95,6 % use clear water / can explain how to check that the water is clear enough for treatment
- 95 % know how to hold the bag correctly whilst filling
- 99,8 % know how many hours the SolarSack should be placed in the sun
- 99,5 % know to place the SolarSack with the transparent side facing the sun
- 77 % know that no sharp items should be placed under the SolarSack
- 95 % know that the process should be restarted if it becomes cloudy or rainy
- 94,7 % know that the treated water should be kept in the SolarSack or in another container only if it is clean
- 90 % know that he/she should drink water from a clean cup
- 82 % know that SolarSack should be flushed with water if dirty
- 80 % know that the Solarsack should not be used if it is broken or transparent side is blocked
- 94 % know that the SolarSack should be stored inside when not in use
- 95,8 % know that he/she should keep good hygiene and clean hands throughout the entire process

The most common issues experienced and identified through the households visits and related survey are related to the placement of the SolarSack avoiding sharp objects (some households place it at spots that can easily break the SolarSack), knowledge about cleaning the SolarSack if it is dirty and finally that the SolarSack should not be used when broken or blocked. The most critical points are understood by the far majority. Through in-depth interviews, some beneficiaries further expressed the difficulty of assessing when there is enough sun to use the SolarSack for purification. To overcome this challenge, SolarSack is at the moment developing an indicator showing when the water in the SolarSack has been exposed to enough sun to give safe drinking water. A few indicators were tested and handed out to beneficiaries as part of the project with positive feedback and high demand.

Storage

51 % of the respondents reported that they use SolarSack for water storage, 42 % use other containers, and 7 % use both.

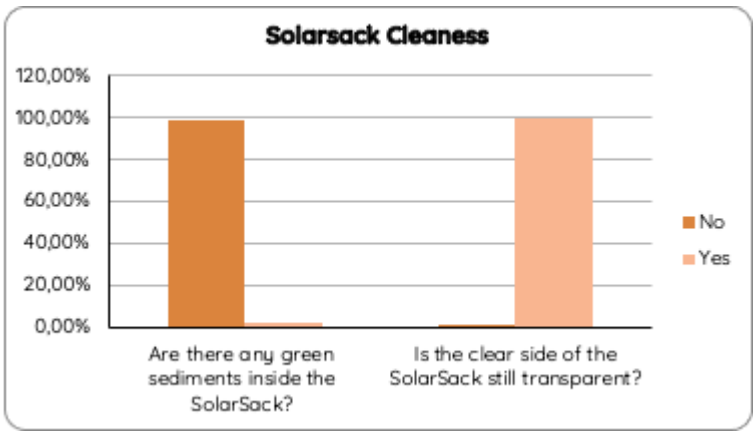


A few dispensers allowing for easy pouring of water from the SolarSack were handed out to beneficiaries to test the demand and usability. These were greatly demanded. The beneficiaries that were introduced to the SolarSack dispenser used the SolarSack for storage to a higher degree compared to those who did not get one. This indicates a potential to reduce the risk of recontamination which e.g. jerry cans often are liable to. The beneficiaires further expressed that it was much easier to pour water into cups with the dispenser. The dispensers will be a key feature of all SolarSacks in the future.

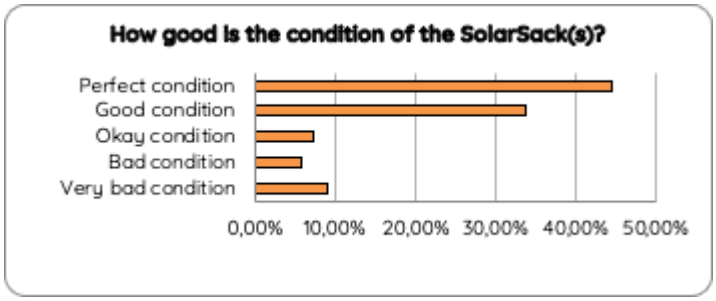
99 % answer that they clean either the SolarSack or container for storage. 82 % answer that they clean the SolarSack every time they use it. 98 % are reported to drink from a clean cup (90 % expressed being aware of this), whereas 2 % of the respondents were reported to have cups looking dirty. This generally indicates good hygiene practices when using the SolarSack, reducing the risk of recontamination.

Maintenance

The enumerators were asked to indicate the condition of the SolarSack. 99,4 % of respondents were reported to have SolarSacks with a clear and transparent front side. 98,4 % were reported to have SolarSacks without green sediments inside (the 1,6 % reported having will be investigated further).



For the overall condition rating of the SolarSacks (1 being in perfect condition and 5 being very bad), following assessments were given by the enumerators: Condition 1 (44,5 %), condition 2 (33,5 %), condition 3 (7,2 %), condition 4 (5,7 %) and condition 5 (9 %). This generally shows SolarSack in good condition working effectively, but also SolarSacks that soon might break due to usage.



Water quality

At baseline, SolarSack was conducting on-site water quality tests in the settlement using Compartment Bag Test (CBT), which allows testing for *E. coli*. In total 4 tests were conducted on local water sources before treatment. All water sources showed *E. coli* levels above the DEAS 12:2017 East African Potable Water Standard for drinking water (0 *E. coli*/100 ml) and the recommended WHO requirements for microbiologically safe drinking water (0 *E. coli*/100 ml). Further tests were conducted on water after SolarSack treatment, all showing SolarSack efficiently removing *E.coli* living up to WHO drinking water requirements.

Time (Month, Year)	**Water sample**	**Result before treatment** (*E. coli*/100 mL)	**Result after treatment in SolarSack in 4 hours sun** (*E. coli*/100 mL)
February, 2020	Source water from local well in Kyebitaka Village	>1.0 x 10^2	<1.0
	Source water from local well in Kyebitaka Village	>1.0 x 10^3	<1.0
	Source water from local well in Kyebitaka Village	>1.0 x 10^3	<1.0
	Source water from local well in Kyebitaka Village	>1.0 x 10^3	<1.0

In November, as part of a field trip, SolarSack was again conducting on-site water quality tests to be used for this report. Tests were conducted on water treated with SolarSacks by the beneficiary households and stored in the SolarSacks for two days, as well as on water stored for two days in the SolarSack and kept in a dirty cup for 10 minutes, representing point-of-drinking. The tests showed that the SolarSack treated water lived up to the WHO requirements for microbiologically safe drinking water. Even though only a few tests were conducted, all indicated that the users are using the SolarSacks correctly, providing them with microbiological safe, clean water.

Time (Month, Year)	**Water Sample**	**Result** (*E. coli*/100 mL)
November, 2020	Source water from local well in Kyebitaka Village	>1.0 x 10^3
	Source water from local well in Kyebitaka Village after rain	>1.0 x 10^4
	Source water purified in a SolarSack and stored for 48 hours	<1.0
	Source water purified in SolarSack and stored for 48 hours followed by 10 minutes storage in a dirty drinking cup	<1.0

It would have been beneficial to conduct more water quality tests at the household level as this is a key indicator for reduced risk of being exposed to waterborne related diseases. This exercise, however, requires specific resources and equipment and needs to be conducted with staff experienced in conducting these tests.

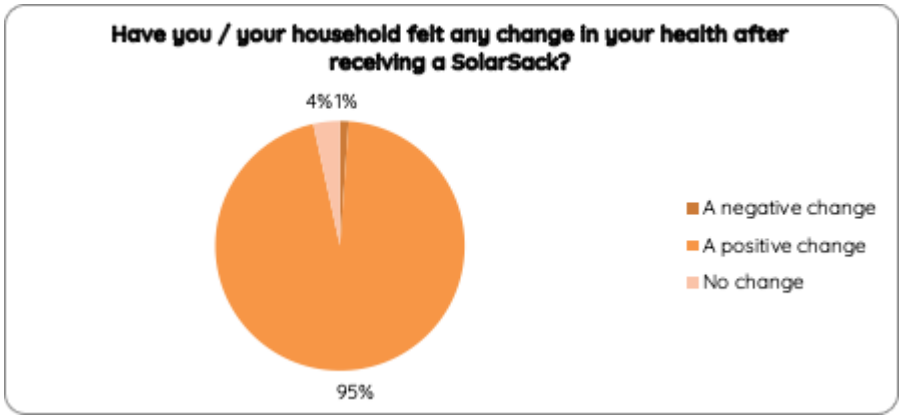
Reported diarrhea level and own health feeling

At baseline, 32 % of the respondents answered that one or more household members had had diarrhea within the last two weeks. At the end evaluation, only 9 % of the respondents reported diarrhea occurrences within the last two weeks in their household. For the households reporting that they went to a health facility for treatment, following diagnoses were reported:

Diagnosis	**Baseline**	**End evaluation**

Typhoid	33,5 %	20 %
Dysentery	14,5 %	12 %
Cholera	15 %	0 %
Other	20 %	44,5 %
No diagnosis	17 %	23,5 %

95 % of the respondents answered that they had experienced a positive health change since starting using the SolarSacks.



Sub Conclusion

Measuring reduction in diarrhea is difficult. However, by comparing different indicators on reduced diarrhea exposure related to adoption, usage, water quality and own reported health it is possible to triangulate data to validate the findings. The findings altogether indicate that the SolarSack has reduced the beneficiaries' exposure to waterborne diseases and that their health has improved by the intervention. Improved health affects an entire household's economic and social development. Improved health leads to increased school attendance and higher work productivity which are key factors to reduce poverty. The intervention thereby has a greater societal impact than reducing water borne related diseases.

4.5.2 Objective

2: Reduce deforestation by providing an alternative water treatment method to boiling

In order to measure the reduction in deforestation, two methods have been used; a theoretical calculation taking point of departure in the Gold Standard for Global Goals Methodology[6] and a practical method in which households were asked to report their wood fuel consumption.

[6] https://globalgoals.goldstandard.org/407-ee-ics-technologies-and-practices-to-displace-decentrilized-thermal-energy-tpddtec-consumption/

The Gold Standard Calculation

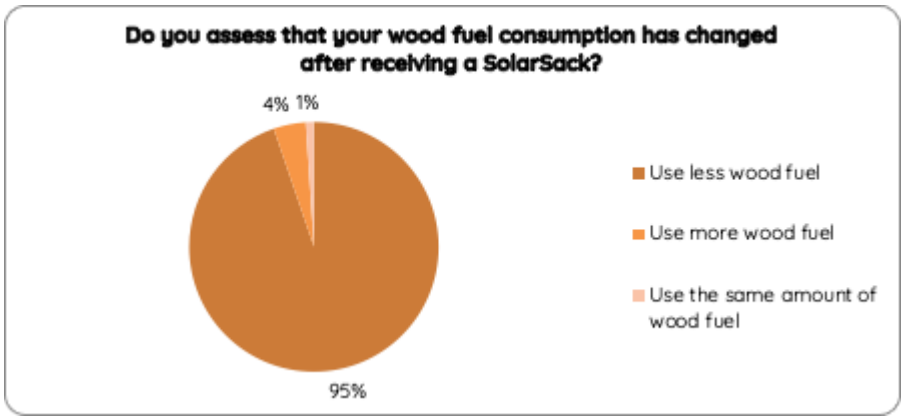
SolarSack's calculations are based on the Gold Standard Methodology specified in the "Technologies and Practices to Displace Decentralized Thermal Energy Consumption (see footnote 6)". The methodology is applicable to programmes or activities introducing technologies and/or practices that reduce or displace greenhouse gas (GHG) emissions from the thermal energy consumption of households and non-domestic premises. To calculate impact, a baseline is applied (the CO2e output through the lifecycle of fuel sources like charcoal and firewood), along with calculating the product's CO2e output throughout its lifecycle. From this, the reduction in CO2e can be calculated for the displacement of such fuels with The SolarSack product. Calculations show that one SolarSack has the potential to save 551 kg / CO_2 through its lifetime when substituted for boiling water using biofuels as well as saving the cutting down of two trees.

From the beneficiary registration list, 46,7 % (3687 households) reported that they used wood fuel for boiling water prior to receiving a SolarSack. In total, these households got 11397 SolarSacks. Based on the Gold Standard Methodology and assuming that the users will keep using the SolarSack until it breaks, the project has the potential to save 6280 tonnes of CO_2 or 22794 trees from being cut down. Monitoring data over the next coming months will give insights on how long the SolarSacks last to validate the calculation.

Own reported wood fuel consumption

To verify the prospective saved CO2 emissions, respondents were asked to report wood fuel usage (both for cooking and boiling water) before and after receiving a SolarSack. Already at the baseline stage, this was a difficult task for many of the respondents who struggled to assess and quantify their consumption over time. Many stated that this sometimes varied from month to month. Charcoal consumption was measured in sacks and firewood consumption in bundles with related average weight. The weight of sacks and bundles might however vary a bit from village to village making an exact assessment difficult.

When asking the respondents about their own consumption assessment, 95 % of the 46,7 % who answered that they boiled water prior to receiving a SolarSack report that they estimate that they use less wood fuel since receiving a SolarSack.



The end evaluation findings show that from the respondents answering that they previously boiled water, 50 % use firewood for boiling whereas 35,3 % use charcoal, 6 % use both, and 8,7 % use others. When asked about estimating firewood and charcoal consumption for drinking water on a monthly basis, the average consumption was reported to be 3,3 kg charcoal at baseline and 3,08 kg charcoal at end evaluation per person. For firewood, it was 12,5 kg at baseline and 19,5 kg at end evaluation per person. These findings do not show any clear trends and nothing can be concluded in terms of the impact on deforestation. If this method is going to be used for future projects, it is recommended to monitor a few households more closely to get a more reliable indication of the consumption. However, many factors are affecting the consumption, such as funding available for the household the given month and how often all members are at home. This needs to be taken into considerations for future evaluation designs.

Convenience

The burden of accessing energy almost always falls on women and girls. Without nearby safely accessible natural resources, women and girls often travel long distances to find sufficient resources. Wood fuel collection is often very dangerous, exposing the women and girls to the risk of physical and sexual violence. They further have to carry heavy loads of wood which is physically destructive for them. By reducing wood fuel dependency, the project has the potential to reduce the burden of women and children collecting wood fuel.

Sub Conclusion

Based on the number of households previously using wood fuel for boiling water, it is estimated that if all SolarSacks are used to their end of life, the project can save 6280 tonnes CO2 emission or the cutting down of 22794 trees. These numbers can however not be verified through household consumption data which do not show a clear trend on reduction of wood fuel consumption. Monitoring data over the next coming months will give further insights on how long the SolarSacks last to validate the calculation.

4.5.3 Objective 3: To learn about SolarSack user patterns for scale-up

Learnings on user patterns have been obtained both through qualitative and quantitative interviews. The following sections summarize the key learnings.

Adoption

98 % of the respondents answer that they sometimes use SolarSack, and 82% answer that they use it everyday or every second day. The main reasons for not using the SolarSack every day are explained to be that households still have SolarSacks with water left, that the weather has not been optimal or that the households are not home. The reported use might however be biased as the sun does not necessarily shine every day. As a result of this it is not always possible to use the SolarSack every day of the week. The reasons mentioned for not using the SolarSack at all, was that it was broken or that the person is too lazy / always away from home.

From observations, SolarSacks are generally seen filled with water placed correctly on sunny days. Observations from SolarSack agents indicate that the rural parts of the settlement are adopting the SolarSack to a higher degree than the urban parts. For future intervention, it will be key to understand the different usage motivation for a rural and urban user.

Correct usage

See findings in the health section.

Trust

99 % of the respondents trust that the SolarSack kills germs effectively. The most commonly mentioned reasons for trusting the product are:

- It looks like the water boils / there are small bubbles
- The household has not suffered from diseases since starting using the SolarSack
- The waster tastes good
- The SolarSack is tested by reputable institutions
- Because the household was trained in the usage and trust NGO products

The few that answered that they do not trust the product explained

- Do not believe that plastic can kill germs
- Do not believe that sun rays can kill germs
- The persons do not see the water boiling
- The SolarSack broke

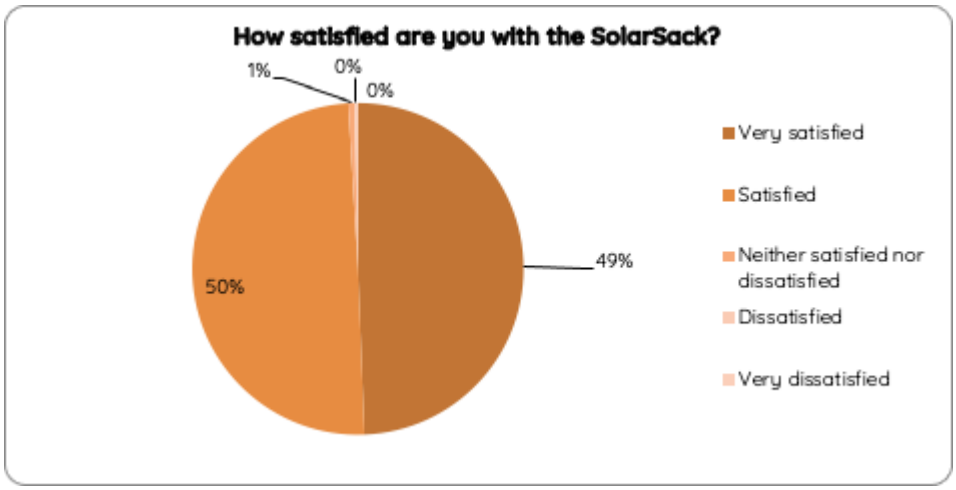
From qualitative interviews, a few further mentioned that they are afraid that plastic exposure can cause them cancer.

Beneficiaries in the host community were more sceptical towards the product and the SolarSack agents had to use community leaders to a higher degree to create trust around the product.

The general high trust can also be explained by the fact that 92 % of the respondents experienced no challenges using the product.

Satisfaction

99 % are either satisfied or very satisfied with the product.



The ones answering that they are satisfied or very satisfied commonly explain:

- "My family members are no longer falling sick or have diseases since we ever started using SolarSack"
- "It is easy and convenient to use"
- "We are witnessing a change in life as we drink SolarSack water"
- "It is cheap to maintain compared to other methods of purifying drinking water"
- "We no longer spend much money on buying charcoal"
- "We no longer use much firewood like before because we can now buy little firewood for cooking food only"

The ones being dissatisfied explained:

- "We are many and received too few SolarSacks"
- "My SolarSack broke"

95 % answer that they see SolarSack as a product that they will keep using in the future as their primary purification method if it is available. These numbers strongly indicate a high satisfaction level and a product that has been adapted and fit the local context. The respondents explain:

- "It saves me time and money"
- "It treats water without any expenses"

- "It reduces the amount of firewood bought"

For the ones not seeing it as their future purification device, they explain:

- "It cannot be used during the rainy season"
- "It breaks easily"
- "Its lifespan is short, and it needs to be replaced"

On average, the respondents thought that the SolarSack was 10625 UGX worth. 91,5 % answered that they would buy it for that price.

Number of SolarSacks per person

One SolarSack was given to every two persons to cover one person's daily water quantity needs. Nevertheless, 32 % of the respondents replied that they thought that they had received too few SolarSacks. The most common reasons given were that there were too many people in the household compared to the SolarSack handed out, that some of the SolarSack were broken and that each person should have a SolarSack. This needs to be considered for future implementation.

Product improvements

When asked about suggestions to how the SolarSack can be improved, the following points were the most common suggestions:

- Add on liters (10-20 liters)
- Change color of the handle as it quickly looks dirty
- Have dispensers for all SolarSacks
- The plastic should be harder / material thicker so it does not break that easily (rats are destroying them)
- Add cups, soaps and jerry cans to the product when handing it out
- Reduce the time for purifying water to 2 hours
- SolarSack should be able to treat water even without the sun or less sun
- Add an indicator showing when water is safe to drink

Storage and maintenance

A mix was observed related to storage. Some stored water in the SolarSack, others in a jerry can. The ones using a jerry can stated that it was difficult to pour water from the SolarSack into a cup and it is easier for children to handle the jerry can. Households that had received a dispenser used the SolarSack for storage to a higher degree compared to those who did not receive one. The dispenser will be an integrated feature of the SolarSack in the future thus having the potential to reduce recontamination

Some users had made it a practice to clean the SolarSack before every usage. Many beneficiaires clean with soap on the outside and water on the inside. SolarSack does not recommend cleaning with soap on the inside. However, some users insisted on the need as they also use soap inside their jerry cans, and that it is easier to remove any smell with soap. Generally, most SolarSacks were observed as clean inside and outside, ensuring safe use.

The condition of the SolarSacks are generally reported as good. However, observations have shown that not all households take equally good care of the SolarSack, and some SolarSacks have been destroyed by rats or by nails from roofs. The importance of taking good care of the product for long-lasting must be emphasized even more.

Training and education

Training sessions of beneficiaries varied in size between 5-30 participants and took between 30 minutes to 1 hour. The participants in groups of more than 20 people stated that they were too many. Beneficiaries generally expressed that a size between 5-20 is optimal. Most expressed that the verbal training is the most important part of training ensuring that questions can be posed directly to the trainer. However, when receiving a SolarSack education leaflet, most said that it would be good to have to verify what was being instructed or if something was forgotten. Most felt empowered by the thorough information from the leaflet. However, it only works for people that read. Users not reading, nonetheless, stated that they would have their kids to read for them. SolarSack is at the moment working on WASH posters with SolarSack instruction that can be hung up at the households increasing behavioural change. The users generally expressed that they felt confident in usage after receiving the training. Most would go to the chairman / block leader if they had any questions related to usage.

Subconclusion

Several important learnings have been obtained on user patterns and product perception. These will help make decisions to improve future implementation procedures. The key takeaway is that SolarSack generally has proven to be a product that users in this context adopt and use. It is, however, also clear that some added features and accessories can improve convenience and safe use. There are still other areas such as training and education that will need to be adjusted on a continual basis based on the context.

4.6 Assessing the impact and sustainability of the intervention

Based on the findings presented in previous sections, the project interventions have had a positive impact on the beneficiaries and the surrounding area by ensuring access to safe water and reducing wood fuel dependency for boiling water.

It is still not settled whether a project extension will be possible as funds are not yet secured. The generated WASH knowledge taught to 7891 households will, however, keep in the society and many households have experienced health benefits from drinking safe water. It is further expected that even households and villages that did not receive a SolarSack have been exposed to WASH messages and knowledge from neighbours. To ensure that the users are followed up with through the entire lifetime of the SolarSack, funds are allocated enabling CIDI and SolarSack agents to keep monitor beneficiaries until June 2021 to help sustain the benefits from the intervention.

The utilization of local resources - both refugees and VHTs working as SolarSack agents and chairmen / block leaders - to implement the project is a good sustainability measure. Managed by CIDI, knowledge and project processes have been anchored locally. The local employees and volunteers reside in the community even when the project ends and can be utilized for knowledge sharing or other projects. Using the entire value chain of refugees is assumed to lead to better results and consolidation of benefits achieved. Regular coordination meetings with the camp management, WASH community, and district leaders and sharing of project learnings is further commendable for sustainability.

The key WASH stakeholders in the settlement, Oxfam and UNHCR WASH, and OPM have endorsed the project and asked for an extension. This shows momentum by partners to keep promoting the project to sustain its benefits. Dialogues, especially with UNHCR WASH, have been ongoing and centered around what an extension could look like. It has been discussed whether the product should be tested as a subsidised commercial product that users can purchase. This would mean that some beneficiaries will not be able to afford it but oppositely lead to a more economically sustainable model and a long-lasting impact.

Subconclusion

The project has focused on utilizing local resources throughout the entire implementation value chain to create local ownership and anchorage to sustain processes and knowledge locally. The long-lasting impact will depend on whether the project is extended to cover new areas and replace broken SolarSacks at households already part of the project.

Conclusion

The conclusion presented is derived from the findings of the six development intervention criteria guided by the OECD. Overall, the project 'Emergency Response to Deforestation in the Kyangwali Refugee Settlement' has been successfully implemented. Its core impact focus on reducing deforestation and reducing the prevalence of waterborne diseases has been highly relevant for the Kyangwali Refugee Settlement and surrounding host communities, as they are experiencing enormous challenges addressing the aforementioned issues caused by the influx of refugees. The project design

was developed in close collaboration with key stakeholders in the settlement and in the host communities to ensure efforts were aligned with other interventions and areas most in need received the product.

Based on the Gold Standard Methodology the project has the potential to save 6280 tonnes of CO_2 emissions and 22794 trees from being cut down if beneficiaries that previously used wood fuel for boiling water use their SolarSack to its fullest. Further insights on how long the SolarSacks last will be captured within the next coming month to validate the calculation. Clear trends on reduction of wood fuel consumption can however not be verified from household surveys and it proved difficult to get reliable data from the respondents. Nevertheless, 95 % of the respondents that reported that they previously boiled water assess that their wood fuel consumption has gone down since starting to use the SolarSack. The findings further show that the beneficiaries use the SolarSack correctly providing them with drinking water that lives up to WHO drinking water standards. The majority of households (95 %) report significant health benefits after starting using the SolarSack and the reported diarrhea level has gone down from 32 % to 9 %. This has the potential of positively affects school attendance, work productivity and economic growth. The project has provided key learnings within user habits and their perception of the product. All learnings will be incorporated to the extent possible for future interventions.

Based on the positive findings measured from the project-related indicators and the utilization of local resources throughout the implementation, it is expected that behavioral change and knowledge will sustain in the local communities benefiting future practices and impact. Long-lasting impact will depend on project extension.

Recommendations

Based on the evaluation findings, following recommendations are made:

Product features and accessories

- Dispensers should be a key feature of every SolarSack
- Indicators will increase safe usage and ensure that SolarSack can be used on even cloudy days
- SolarSacks potentially to come along with a jerry can, cups and soap making it easier for beneficiaries to keep hygiene through the water value chain and ensure safe water at the point of consumption
- SolarSack to come with a nail to hang it on in households

Implementation

- Utilizing local resources through the entire value chain is a must to succeed and to ensure local ownership and long term impact

- SolarSack to come with a sanitation social marketing package to accompany the product for improved benefits and to create mass awarenss
- Linking up with other WASH initiatives will be beneficial to increase behavioral change that lasts
- Proper transportation options or funding for this must be in place as distances and bad roads challenges efficient distribution of the product
- Education material that can stay at the households (e.g. posters on WASH and SolarSack usage) should be tested to help remind beneficiaries of good practices

Data collection and monitoring

- Conducting more water quality tests before and after treatment with a SolarSack at household level will be able to provide further knowledge on water quality and efficient usage of the product
- Following / observing few households more closely will be beneficial to learn more about adoption, correct usage and perception rather than conducting multiple quantitative usage monitoring surveys only giving insight at a single point in time

Appendix

Appendix A: Overview of SolarSack Distribution

Kyangwali Refugee Settlement		
Village	**Block**	**Households covered**
Kyebitaka	1	329
Kyebitaka	2	240
Kyebitaka	3	58
Kyebitaka	4	65
Kyebitaka	22	52

Kyebitaka	23	46
Kyebitaka	24	65
Kyebitaka	32	237
Kyebitaka	33	162
Kyebitaka	34	64
Kyebitaka	70	77
Kyebitaka	71	104
Kyebitaka	75	156
Kyebitaka	80	143
Kyebitaka	81	132
Kyebitaka	82	16
Kyebitaka	83	145
Kyebitaka	68	41
Kyebitaka	69	52
Kagoma	11	207
Kagoma	16	126
Kagoma	18	20
Kagoma	19	21

Kagoma	17	27
Kagoma	79	158
Kentomi	1	122
Kentomi	2	62
Kentomi	3	209
Kentomi	4	167
Kentomi	6	116
Munsisa B	7	238
Munsisa B	8	130
Kirokore	1	135
Kirokore	7	170
Kirokore	2	130
Kirokore	3	42
Kirokore	4	52
Rwenyawawa	4	25
Rwenyawawa	5	120
Nyampindu	4	88
Kasonga	29	95

Kasonga	30	24
Kasonga	31	24
Kasonga	35	40
Kasonga	36	24
Kasonga	37	24
Kasonga	73	17
Kasonga	39	13
Nguruwe	1	30
Nguruwe	2	30
Nguruwe	3	30
Nguruwe	4	17
Kinakitaka	49	26
Kinakitaka	47	21
Kinakitaka	42	10
Kinakitaka	41	66
Kinakitaka	45	47
Kinakitaka	40	72
Kinakitaka	48	25

Mukalange	82	23
Mukalange	21	15
Mukalange	7	31
Mukalange	6	43
Mukalange	5	35
Kinakitaka	54	68
X		379
11	**65**	**5778**
Host Community		
Village		**Households covered**
NGOMA		52
HANGA 2B		91
NYAKATEHE 2		234
NSUJU		118
NGOGOLI 1		221
NYASENGE B		68
KINYAMAHWA		125
KITUTI		154

KAMWOKYA		240
NYAKATEHE1		118
NYASENGE A		201
NYAMENGO		134
RWENSAMBYE		143
NYAMAHEMBO		78
KYANGWALI		66
HANGA 1		70
16		**2113**
OVERALL TOTAL		**7891**

Area of distribution	**Number of SolarSacks distributed**	**Number of households reached**	**%**
Refugee settlement	18107	5778	72,4 %
Host community	6893	2113	27,6 %
Overall total	**25000**	**7891**	

Appendix B: Activity Overview

Activity	Period	Status
Project approval and inception meetings	May - December 2019	Done
Recruitment of 20 volunteers	October 2019	Done
SolarSack field trip to the settlement	November / December 2019	Done
SolarSack Training of 20 Volunteers	November/December 2019	Done
SolarSack field trip to the settlement	February / March 2020	Done
SolarSack Refreshment Training of Volunteers	February 21st 2020	Done
Baseline data collection in the settlement and host communities	February 20th-29th 2020	Done
Round 1 distribution of 462 SolarSacks and 6 indicators	February 22nd-24th 2020	Done
Monitoring of beneficiaries by SolarSack and volunteers (1st round)	February 24th - March 27th 2020	Done
Anthropologist field trip / monitoring of beneficiaries by three anthropologists	March 3rd -15th 2020	Done
Monitoring of beneficiaries with indicators by CIDI and volunteers	April 15th - 17th 2020	Done
Monitoring of beneficiaries with SolarSacks by CIDI and volunteers (2nd round)	April 20th - May 1st 2020	Done

Implementation of remaining SolarSacks (affected by various lock downs of the settlement)	June-December 2020	Done
Hand out of 500 dispensers	October 12th - 14th 2020	Done
Monitoring of beneficiaries with SolarSacks by CIDI and volunteers (3rd round)	October 13th - 20th 2020	Done
Monitoring beneficiaries with dispenser	October 21st - 23rd 2020	Done
SolarSack field trip to the settlement	November 2nd - November 13th	Done
Monitoring of beneficiaries with SolarSacks by CIDI, volunteers and SolarSack (4th round)	November 4th - 11th 2020	Done
End-evaluation	December 6th - 15th 2020	Done
Monitoring of SolarSacs in the field	January 2021 - June 2021	*On-going*
Collection and recycling of used/broken SolarSacks	January 2021 - June 2021	*On-going*

Appendix C: Baseline and End Evaluation Household Survey Results

Parameter	**Indicator**	**Location**	**Survey findings BASELINE**	**Survey findings END EVALUATION**
BIO DATA				
Bio data	Gender	**Total**	**68 % female** **32 % male**	**65 % female** **35 % male**

		Settlement	68% female 32% male	67% female 33% male
		Host community	69% female 31% male	58% female 42% male
Bio data	Average age	**Total**	**37,37**	**37**
		Settlement	37,35	37
		Host community	37,46	36,5
Bio data	Average household size	**Total**	**5,9**	**6**
		Settlement	5,8 persons	6
		Host community	6,3 persons	6
Bio data	Average amount of SolarSack received / household	**Total**		**3,2**
		Settlement		3,2
		Host community		3,1
Bio data	Persons with special needs or children under 5 in the household	**Total**		**30,8 %**
		Settlement		30, 7 %
		Host community		31,2 %
Bio data	Households that are or have previously been participating in programmes distributing HWTS	**Total**		**4,2 %**
		Settlement		5,2 %
		Host community		1,6 %
WATER HABITS				

Water source	% hh collecting from X water source	**Total**	**Boreholes: 64 %** **Shallow wells: 7,5 %** **Surface water: 4 %** **Various sources: 13,5 %** **Other (swamp, tap, stagnant water, buying): 2 %**	**Boreholes: 70%** **Shallow wells: 11,7%** **Surface water: 12%** **Spring: 5,9%** **Other 0,1%**
		Settlement	Boreholes: 83 % Shallow wells: 7 % Surface water: 0,5% Spring: 6% Other (swamp, tap, stagnant water, buying): 3%	Boreholes: 81% Shallow wells: 8,5% Spring: 6,3% Surface water: 3,8% Other 0,25%
		Host community	Boreholes: 28 % Shallow wells: 26% Surface water: 23% Spring: 21,5% Other: %	Boreholes: 45% Shallow wells: 18,75% Spring: 5,11% Surface water: 30,68% Other 0%
Water quanti y collected	Average litres of water / per persons / per day collected at HH level	**Total**	**18,4 liters**	**15,0 liters**
		Settlement	18,5 liters	14,4 liters
		Host community	17,7 liters	16,6 liters
Water quantity for drinking	Average litres of water / per day / per person used for drinking	**Total**	**1,8 liters**	**1,6 liters**
		Settlement	1,6 liters	1,45 liters
		Host community	2,3 liters	1,89 liters
Water colour	% household having clear / see-through water for drinking	**Total**	**Clear: 70 %** **Not clear: 30 %**	**Clear: 91%** **Not clear: 9%**
		Settlement	Clear: 69 % Not clear: 31 %	Clear: 88,5% Not clear: 11,5%
		Host community	Clear: 75 % Not clear: 25 %	Clear: 97,3% Not clear: 2,7%
Water treatment	% of HH treating	**Total**	**46,5 %**	**57%**

	their drinking water before receiving a SolarSack	Settlement	46,5%	72%
		Host community	46,4%	20%
Water treatment	Methods of treating drinking water before receiving a SolarSack	**Total**	**Boiling/Heating: 88 %** **Disinfection/chlorine: 4 %** **Filtration: 3 %** **Let water stand and settle before drinking: 3 %** **Different methods: 1 %** **Other: 1 %**	**Boiling/Heating: 77%** **Disinfection/Chlorine 5,75%** **Filtration: 5,75%** **Let water stand and settle before drinking: 8 %** **Other: 1%**
		Settlement	Boiling/Heating: 90,5% Disinfection/Chlorine: 4% Filtration: 1% Let water stand and settle before drinking: 2,2% Other: 1%	Boiling/Heating: 77% Disinfection/Chlorine 6,38% Filtration: 6,38% Let water stand and settle before drinking: 6,7 % Other: 1%
		Host community	Boiling/Heating: 75% Disinfection/Chlorine: 4,5% Filtration: 16% Let water stand and settle before drinking: 4,5%	Boiling/Heating: 80% Disinfection/Chlorine 0% Filtration:0% Let water stand and settle before drinking: 20 % Other: 0%
Water treatment	Reasons for not treating water before receiving a SolarSack	**Total**	**Lack of access to wood fuel: 32%** **Cannot afford it: 16 %** **Lack of generel treatment options: 11 %** **Water is safe: 9 %** **No time: 9 %** **Not used to treat it: 6 %** **Water tastes badly when treating it: 3 %** **Get sick of boiled water: 1 %** **Other: 13 %**	
		Settlement	Lack of access to wood fuel: 33% Cannot afford it: 19 % Lack of general treatment options: 11 % Water is safe: 5,5 % No time: 9 % Not used to treat it: 5,5 % Water tastes badly when treating it:	

			1,5 % Get sick of boiled water: 1 % Other: 12,6 %	
		Host community	Lack of access to wood fuel: 29% Cannot afford it: 2% Lack of general treatment options: 4% Water is safe: 23,5% No time: 8% Not used to treat it: 8% Water tastes badly when treating it: 11,7% Other: 13,7%	
Water treatment	Reasons for treating water prior to receiving a SolarSack	**Total**	**Prevent diseases: 67 %** **The water is dirty: 6 %** **Used to do it: 1 %** **Other: 26 %**	
		Settlement	Prevent diseases: 72 % The water is dirty: 7,7 % Used to do it: 1% Other: 19%	
		Host community	Prevent diseases: 46% The water is dirty: 0% Used to do it: 0% Other: 54%	
Water treatment	% of households normally treating water but that have been drinking untreated water within the last week	**Total**	**43 % (majority answering several times)**	**12% (average 5 times)**
		Settlement	39,5%	14% (Average 5,2 times)
		Host community	58%	7,5% (Average 4,4 times)
Water treatment	Reasons for drinking untreated water prior to receiving a SolarSack	**Total**	**Out of treatment options: 45 %** **No treated water left: 17 %** **When moving around: 13 %** **Didn't have time: 10 %** **No money to get treatment options: 7 %** **By mistake: 6 %** **Other: 2 %**	
		Settlement	Out of treatment options: 42,5 %	

			No treated water left: 17 % When moving around: 16 % Didn't have time: 4 % No money to get treatment options: 7 % By mistake: 6 % Other: 2 %	
		Host community	Out of treatment options: 45 % No treated water left: 15 % When moving around: 13 % Didn't have time: 30 % No money to get treatment options: 5 % By mistake: 0 % Other: 0 %	
SOLARSACK USAGE				
SolarSack usage	% thinking they were given correct amount of SolarSack	**Total**		**Correct amount: 67,81 %** **Too few: 31,88%** **Too many: 0,31%**
		Settlement		Correct amount: 63,72% Too few: 35,84% Too many: 0,44%
		Host community		Correct amount: 77,66% Too few: 22,34% Too many: 0%
SolarSack usage	% of households sometimes using the SolarSack	**Total**		**97,85 %**
		Settlement		97,19 %
		Host community		99,47 %
SolarSack usage	Time SolarSack has been in use	**Total**		**Less than a month: 0,47%** **1-2 months: 58,22%** **3-4 months: 39,28%** **5-6 months: 0,63%** **7-8 months: 1,41%**
		Settlement		Less than a month: 0,67% 1-2 months: 44,57% 3-4 months: 51,88%

				5-6 months: 0,89% 7-8 months: 2%
		Host community		Less than a month: 0% 1-2 months: 90,96% 3-4 months: 9,04% 5-6 months: 0% 7-8 months: 0%
SolarSack usage	Frequency of use of the SolarSack	**Total**		**Every day: 41,84%** **5-6 days a week: 3,73%** **3-4 days a week: 38,72%** **1-2 days a week: 14,46%** **Less often: 0,47%**
		Settlement		Every day: 40,88% 5-6 days a week: 3,74% 3-4 days a week: 39,12% 1-2 days a week: 14,51% Less often: 0,66%
		Host Community		Every day: 44,15% 5-6 days a week: 3,72% 3-4 days a week: 37,77% 1-2 days a week: 14,36% Less often: 0,0%
SolarSack usage	Reasons for not using the SolarSack every day	**Total**		**No time: 2,91%** **Not at home: 24,73%** **Still have treated water left: 37,82%** **The weather is not optimal: 29,45%** **Prefer other methods: 2,55%** **Other: 2,55%**
		Settlement		No time: 4,32 % Not at home: 23,78% Still have treated water left: 26,49% The weather is not optimal: 40% Prefer other methods: 1,62% Other: 3,78%
		Host Community		No time: 0% Not at home: 26,67%

				Still have treated water left: 61,11% The weather is not optimal: 7,78% Prefer other methods: 4,44%
SolarSack usage	Treatment when SolarSack can't be used	**Total**		**Do not treat the water: 34,64% Use other methods of purifying water: 56,11% Sometimes do not treat, sometimes use other method: 9,0 %**
		Settlement		Do not treat the water: 19,33% Use other methods of purifying water: 73,11% Sometimes not treat, sometimes other methods: 7,56%
		Host community		Do not treat the water: 71,28% Use other methods of purifying water: 15,43% Sometimes not treat, sometimes other methods: 12,77%
SolarSack Usage	Number of SolarSacks emptied on a weekly basis	**Total**		**9,57 SolarSacks per person per week**
		Settlement		8,98 SolarSacks per persons per week
		Host community		11,01 SolarSacks per persos per week
SolarSack Usage	SolarSacks usually put out for purification at the same time	**Total**		**1: 30,36% 2: 41,16% 3: 18,15% 4: 8,14% 5: 1,56% 6: 0,63%**
		Settlement		1: 30,53% 2: 37,83% 3: 20,58%

				4: 8,19% 5: 2,21% 6: 0,66%
		Host community		1: 29,95% 2: 9,20% 3: 12,30% 4: 8,02% 5: 0% 6: 0,53%
STORAGE AND MAINTENANCE				
Storage	Storage of drinking water	**Total**	**Jerrycan: 90 %** **Tin: 5 %** **Bucket: 2 %** **More: 1 %** **Other: 2 %**	**SolarSack 50%** **Other container 41%** **Both SolarSack and other: 8%**
		Settlement	Jerrycan: 90 % Tin: 6 % Bucket: 2 % More: 1 % Other: 1 %	
		Host community	Jerrycan: 90 % Tin: 1 % Bucket: 0 % More: 0 % Other: 8 %	
Cleaning	% of HH with reported clean container	**Total**	**68 %**	**96,20%**
		Settlement	64%	92,26%
		Host community	85%	98,75%
Cleaning	% of HH cleaning the container used for drinking water	**Total**	**90,5 %** **(Daily: 49 %** **Weekly: 43 %** **Less frequent: 8 %)**	**99%**

		Settlement	89%	100%
		Host community	95%	99%
Cleaning	% cleaning the SolarSack	**Total**		**Yes: 99,84%** **No: 0,16%**
		Settlement		Yes: 99,78% No: 0,22%
		Host community		Yes: 100% No: 0%
Cleaning	Methods used for cleaning the SolarSack	**Total**		**Soap and water: 11,5%** **With water: 88,5%**
		Settlement		Soap and water: 9% With water: 91%
		Host community		Soap and water: 17,2% With water: 82,8%
Cleaning	Frequency of cleaning SolarSack	**Total**		**Every day: 9,48%** **Before each use: 82,31%** **Every week: 2,05%** **Every month: 0,16%** **Less often: 2,05%** **Only when its dirty: 3,95%**
		Settlement		Every day: 6,28% Before each use: 83,41% Every week: 1,57% Every month: 0,22% Less often: 2,91% Only when its dirty: 5,61%
		Host community		Every day: 17,11% Before each use: 79,68% Every week: 3,21% Every month: 0% Less often: 0% Only when its dirty: 0%
Hygiene	Equipment used for drinking water	**Total**	**98 % drinking from a cup (it was reported that 18,5 % of the respondents' cups**	**81% Cup** **19% Cup and other**

			looked dirty)	**(2% dirty)**
		Settlement	97% (20% dirty)	83% Cup 17% Cup and other (2% dirty)
		Host community	99% (10% dirty)	76% Cup 24% Cup and other (2% dirty)
Maintenance	Is clear side of SolarSack still transparent	**Total**		**Yes: 99,37%** **No: 0,63%**
		Host community		Yes: 99,12% No: 0,88%
		Settlement		Yes: 100% No: 0%
Maintenance	Are there any green sediments inside the SolarSack?	**Total**		**No: 98,43%** **Yes: 1,57%**
		Settlement		No: 98% Yes: 2%
		Host community		Yes: 0,54% No: 99,46%
Maintenance	Condition of the SolarSack (1 perfect - 5 very bad)	**Total**		**1: 44,5%** **2: 33,5%** **3: 7,23%** **4: 5,66%** **5: 8,96%**
		Settlement		1: 30,0% 2: 39,3% 3: 10,0% 4: 8,00% 5: 12,7%
		Host community		1: 79,3% 2: 20,2% 3: 0,53% 4: 0% 5: 0%

ENERGY CONSUMPTION				
Energy consumption	Cook stove used when boiling water	**Total**	**Three-stone / open fire: 65 %** **Improved cookstove: 32 %** **Both: 3 %**	**Three-stone / open fire: 61%** **Improved cookstove: 29%** **Both: 3%** **Other: 7%**
		Settlement	Three-stone / open fire: 62 % Improved cookstove: 33 % Both: 3,5 %	Three-stone / open fire: 59% Improved cookstove: 30% Both: 3% Other: 8%
		Host community	Three-stone / open fire: 79 % Improved cookstove: 18 % Both: 3 %	Three-stone / open fire: 82% Improved cookstove: 18% Both: 0% Other: 0%
Energy consumption	Type of woodfuel used for boiling water	**Total**	**Firewood: 53 %** **Charcoal: 41 %** **Both: 6 %**	**Firewood: 50%** **Charcoal: 35,3%** **Both: 6%** **Other: 8,7%**
		Settlement	Firewood: 49 % Charcoal: 44 % Both: 6,5 %	Firewood: 46,5% Charcoal: 37,7% Both: 6% Other: 9,8%
		Host community	Firewood: 79 % Charcoal: 18 % Both: 3 %	Firewood: 82,8% Charcoal: 13,8% Both: 3,5% Other: 0%
Energy consumption	Kg charcoal used monthly / person*	**Total**	**7,3 kg (0,24 kg daily)**	**8,4 kg**
		Settlement	7 kg	8,6 kg
		Host community	9,8 kg	4,4 kg
Energy consumption	Kg charcoal used monthly / person for drinking	**Total**	**3,3 kg (0,11 kg daily)**	**3,08 kg**
		Settlement	3 kg	3,05 kg
		Host	7,7 kg	3,5 kg (5 persons)

		community		
Energy consumption	Kg firewood used monthly / person**	**Total**	**34,3 kg (1,14 kg daily)**	**51 kg**
		Settlement	31 kg	52 kg
		Host community	45 kg	48 kg
Energy consumption	Kg firewood used monthly / person for drinking***	**Total**	**12,5 kg (0,42 kg daily)**	**19,5kg**
		Settlement	12,8 kg	19 kg
		Host community	11,5 kg	21,4 kg.
Energy consumption	Own reported change of wood fuel consumption since starting using the SolarSack	**Total**		**Uses less wood fuel: 94,77%** **Uses more wood fuel: 4,18%** **Uses the same amount: 1,05%**
		Settlement		Uses less wood fuel: 94,19% Uses more wood fuel: 4,65% Uses the same amount: 1,16%
		Host community		Uses less wood fuel: 100% Uses more wood fuel: 0% Uses the same amount: 0%
HEALTH				
Health	% of households suffering from diarrhea within the last two weeks	**Total**	**32 % (191)**	**9% (57)**
		Settlement	33% (162)	10% (49)
		Host community	30% (29)	4% (8)
Health	% of households suffering from diarrhea that went to a health center	**Total**	**84 % (160)**	**89,5%**
		Settlement	82,5% (133)	89,8%
		Host	93% (27)	87,5%

		community		
Health	Diagnoses received at HC / no diagnosis received	**Total**	**Typhoid: 33,5 % (51)** **Dysentery: 14,5 % (22)** **Cholera: 15 % (20)** **Other: 20 % (most stating water diarrhea) (33)** **Did not get a diagnosis: 17 %** **(Most stating reasons thought to be poor eating habits or drinking untreated water)**	**Typhoid: 20%** **Dysentery: 12%** **Other: 44,5%** **No diagnosis: 23,5%**
		Settlement	Typhoid: 35 % (45) Dysentery: 12,5 % (16) Cholera: 13 % (20) Other: 22 % (25) Did not get a diagnosis: 15 % (19)	Typhoid: 13,5% Dysentery: 13,6% Other: 56,9% No diagnosis: 27%
		Host community	Typhoid: 22 % (6) Dysentery: 22 % (6) Cholera: 0 % (0) Other: 30 % (8) Did not get a diagnosis: 26 % (7)	Typhoid: 57% Dysentery: 0% Other: 43% No diagnosis: 0%
Medicine spendings	% reported diarrhea within the last two weeks that spent money on medicine	**Total**	**58 % spent money on medicine to get cured**	**59,6%**
		Settlement	60%	53%
		Host community	48%	100%
Medicine spendings	Money average spent to treat diarrhea	**Total**	**41961 UGX / 11 USD**	**35647 UGX / 9,72 USD**
		Settlement	45.239 UGX / 12,32 USD	35500 UGX / 9,68 USD
		Host community	16833 UGX / 4,8 USD	36125 UGX / 9,85 USD
Health	Have you felt a change in health since receiving a SolarSack?	**Total**		**A positive change: 95,46%** **No change: 3,44%** **A negative change: 1,10%**
		Settlement		A negative change: 0,67% A positive change: 94,68% No change: 4,66%

		Host community		A negative change: 2,13% A positive change: 97,34% No change: 0,53%
TRUST AND PERCEPTION				
Trust and perception	Do you trust that the SolarSack kills germs effectively?	**Total**		**Yes: 98,75%** **No: 1,25%**
		Settlement		Yes: 98,67% No: 1,33%
		Host community		Yes: 98,94% No: 1,06%
Trust and perception	Do you experience any challenges using the product?	**Total**		**No: 92,33%** **Yes: 7,67%**
		Settlement		No: 90,47% Yes: 9,53%
		Host community		No: 96,81% Yes: 3,19%
Trust and perception	How satisfied are you with the SolarSack?	**Total**		**Very satisfied: 49,38%** **Satisfied: 49,69%** **Indifferent: 0,63%** **Dissatisfied: 0,31%** **Very dissatisfied: 0 %**
		Settlement		Very satisfied: 40,04% Satisfied: 58,63% Indifferent: 0,88% Dissatisfied: 0,44% Very dissatisfied: 0 %
		Host community		Very satisfied: 71,81% Satisfied: 28,19% Indifferent: 0% Dissatisfied: 0% Very dissatisfied: 0 %
Trust and perception	Do you see SolarSack as a product that you will keep using as	**Total**		**Yes: 95,31%** **No: 4,69%**
		Settlement		Yes: 93,36%

	your primary water purification method in the future?			No: 6,64%
		Host community		Yes: 100% No: 0%
Trust and perception	How many UGX do you think the SolarSack is worth?	**Total**		**10625 UGX / 2,90 USD**
		Settlement		10863 UGX / 2,96 USD
		Host community		10104 UGX / 2,76 USD
Trust and perception	Would you buy a SolarSack for the perceived price (which the user indicates in previous question)	**Total**		**Yes: 91,55%** **No: 8,45%**
		Settlement		Yes: 88,25% No: 11,75%
		Host community		Yes: 99,47% No: 0,53%
Do you know where to bring the SolarSack when it breaks?		**Total**		**Yes: 95,92%**
		Settlement		Yes: 95,33%
		Host community		Yes: 97,34%

* A sack of charcoal based on data from the settlement: 30 kg (20000 UGX), a basin of charcoal: 7,45 kg (5000 UXG), 1 mound of charcoal: 1 kg (1000 UGX)
**A bundle of firewood based on data from the settlement: 15 kg (4000 UGX) (most were collecting their own firewood, so large dataset on bundles were not collected)
***It was difficult for the respondents to assess the consumption of firewood / charcoal specific for boiling drinking water as this is sometimes done at the same time and with the same woodfuel for cooking. However, the study has obtained both the overall consumption level for woodfuel as well as specific for drinking water in order to see whether trends can be found by comparing baseline and end evaluation data on both indicators.

Appendix D: Correct Usage Survey Results

1. User uses clear water / can explain how to check if the tubidity of the water is okay	Total	Yes: 95,60% No: 4,40%
	Settlement	Yes: 93,76% No: 6,24%
	Host community	Yes: 100% No: 0%
2. User holds the bag correctly when filling it / can explain how to do it	Total	Yes: 95,12% No: 4,88%
	Settlement	Yes: 94,18% No: 5,85%
	Host community	Yes: 97,34% No: 2,66%
3. User knows how many hours SolarSack should be placed in the sun	Total	Yes: 99,84% No: 0,16%
	Settlement	Yes: 99,78% No: 0,22%
	Host community	Yes: 100% No: 0%
4. User knows to place the SolarSacl with the transparent side facing the sun	Total	Yes: 99,53% No: 0,47%
	Settlement	Yes: 99,33% No: 0,67%
	Host community	Yes: 100% No: 0%
5. User know that no sharp items should be placed under the SolarSack	Total	Yes: 77,12% No: 22,88%
	Settlement	Yes: 70,44% No: 29,56%
	Host community	Yes: 93,09% No:6,91%
6. User knows that the process should be	Total	Yes: 94,98% No: 5,02%

restarted if it becomes rainy or cloudy	Settlement	Yes: 93,78% No: 6,22%
	Host community	Yes: 97,87% No: 2,13%
7. User knows the he/she should drink water from a clean cup	Total	Yes: 89,97% No: 10,03%
	Settlement	Yes: 85,78% No: 14,22%
	Host community	Yes: 100% No: 0%
8. Users know water should be kept in the SolarSack or another clean container after purification	Total	Yes: 94,67% No: 5,33%
	Settlement	Yes: 92,46% No: 7,54%
	Host community	Yes: 100% No: 0%
9. User knows that the SolarSack should be flushed with water if dirty	Total	Yes: 81,95% No: 18,05%
	Settlement	Yes: 77,33 % No: 22,67%
	Host community	Yes: 93,05% No: 6,95%
10. User knows that the SolarSacks should not be used if it is broken or transparent side is blocked	Total	Yes: 80,13% No: 19,87%
	Settlement	Yes: 74,72% No: 22,67%
	Host community	Yes: 93,05% No: 6,95%
11. User knows that the SolarSack should be stored inside when not in use	Total	Yes: 94,06% No: 5,94%
	Settlement	Yes: 91,59% No: 8,41%

	Host community	Yes: 100% No: 0%
12. User knows that he / she should keep good hygiene and clean hands throughout the entire process	Total	Yes: 95,78% No: 4,22%
	Settlement	Yes: 94,25% No: 5,75%
	Host community	Yes: 99,47% No: 0,53%