

Exploring the third-party evaluation method that applies for China's South-South Cooperation on Climate Change In-Kind Aid

Using Thanbayarkhon (TBK) Village pilot project for promoting clean rural energy usage in Myanmar as an example

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Preface

Climate change caused by greenhouse gas emissions is a global issue that needs international efforts to combat. The actual implementation of the global climate agreement and the nationally determined intended contributions will be a key focus in the post-Paris era. As China has gained strength in economic and political clout, it plays a vital role in achieving the targets set in the Paris Agreement. China is taking initiatives to foster a new paradigm of South-South Cooperation in the climate change sector. In 2015, the Chinese government announced that China will set up a South-South Cooperation Climate Fund of 3.1 billion USD as a financial support to help other developing countries tackle climate change and develop clean energy. In this instance, an assessment mechanism is needed to guarantee the effectiveness and sustainability of the aid. Thus, Global Environmental Institute (GEI) recently conducted some research to develop an assessment methodology and indicator for those in-kind aid projects from a third party perspective.

The promoting of clean rural energy usage in the Thanbayarkhon village project, which was co-funded by the China Green Carbon Foundation and the US blue moon fund, and co-operated by GEI and Myanmar's Spring Foundation, serves as a perfect example for this evaluation, one year after project completion. This pilot project assessment study evaluates performance and the impacts of three donated appliances: improved cooking stoves, solar powered lighting and a water pump system. We are hoping this evaluation research will serve as a reference for the future programming of China South-South climate change in-kind aid project, and provide insights to this field and stimulate further in-depth research.

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List of Acronyms

ADB	Asian Development Bank
DFID	Department for International Development in the UK
GACC	Global Alliance for Clean Cooking Stoves
GEF	Global Environment Facility
GEI	Global Environmental Institute
ICS	Improved Cooking Stove
INDC	Myanmar's Intended Nationally Determined Contribution
NAPA	Myanmar's National Adaptation Programme of Action to Climate Change
NDRC	China's National Development and Reform Committee
NEP	Myanmar's National Energy Policy
SNV	SNV Netherlands Development Organization
SPL	Solar Powered Light
SPWP	Solar Powered Water Pump
SPWPC	Solar Powered Water Pump Committee
TBK	Thanbayarkhon village
MoNREC	Myanmar's Ministry of Natural Resources and Environmental Conservation
USAID	United States Agency for International Development
VEC	Village Electrification Committee
WB	The World Bank

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Executive summary

This evaluation study develops a methodology and indicator to assess China's South-South Cooperation on climate change in-kind aid that builds upon the current assessment studies from international organizations. A tailored assessment indicator is provided to evaluate the performance and impacts of the TBK village pilot project for promoting clean rural energy usage in Myanmar. Three types of appliances: improved cooking stoves, solar powered lights and a solar powered water pump are distributed to 350 households in the village, which aim to improve their quality of life, while addressing deforestation and carbon emission issues.

This study applies the widely adopted four criteria: relevance, effectiveness, efficiency and sustainability to assess the performance of the aid project. The evaluation of the impacts of the in-kind aid mainly focus on three broad areas: economic, social and environmental impacts. Eventually, the pilot project assessment identifies key lessons for improving project design, implementation, operation and evaluation, as well as serving as a basis to provide recommendations for future programming of the China South-South climate change in-kind aid projects.

The pilot project field evaluation conducts 75 household surveys, 2 focus group discussions and 10 key informant and beneficiary interviews. They concluded that the overall performance of the pilot project is relatively successful due to the project being relevant to the beneficiary country's plans and policies, whilst also achieving most of project objectives efficiently. However, financial and institutional aspects proved to be less sustainable. The project has also contributed to less household expenditure on fuel, a decrease in deforestation, greenhouse gas emissions and health risks, as well as longer lighting time for students to study at night. These impacts are however relatively small in magnitude due to the limited household practice on donated appliances.

Some key lessons and issues are identified through the pilot project evaluation:

- **Increase in demand of energy-efficient appliances.** Villagers are becoming aware of the benefits and opportunities of clean and renewable energy. They are showing a greater interest when there are affordable and suitable appliances, but the current supply is inadequate as demand is increasing.
- **Limited capacity building.** The Implementing agency is lacking experience in community development and the participatory approach. The local committees receive insufficient operation and appliance maintenance training.
- **Inadequate public participation and benefits to vulnerable communities.** Although the committee members and local seniors are involved in the decision-making process, an increase in public participation is not witnessed. Vulnerable groups are likely to benefit the most from the donation, but are not involved in the decision-making process.

- **Limited impact on the local community.** The use of donated appliances for income-generating activities has been very limited, which reduces its economic impact. Due to the small size of the appliances and the poor design of SPWP system, households benefit disproportionately from it.
- **Insufficient baseline data.** Although some baseline data has been collected it is still inadequate and does not meet certain requirements for this project evaluation. The lack of data collection also leads to an ineffective service delivery.

Given the issues that have been identified from this pilot project, the study provides five recommendations for future in-kind aid programming:

- **Establish a database and a regulatory in-kind aid project evaluation mechanism.** It is important to establish a database of individuals, households and community level baseline data, which can assist with the setting of the aid project targets and activities. An evidence-based and rigorous project evaluation mechanism needs to be established. It would include pre-project baseline data studies, periodical project progress monitoring and post-project evaluation.
- **Strengthen local capacity building.** To ensure the sustainability of the in-kind aid benefits, instead of it acting as a one-off practice, there is a need to strengthen the local communities' and implementing agencies' capacity building when it comes to aid implementation, operation and appliance maintenance.
- **Encourage greater public participation including vulnerable groups.** A greater public participation should be encouraged during the donation, selection, distribution and operation of the appliances. Priority should be given to vulnerable communities in the in-kind aid projects.
- **Stimulate local demand and increase local supply.** To extend the benefits of the one-off donation to all, the next step should help boost local demand and establish a local market for the energy-efficient appliances.
- **Strengthen stakeholders' partnership.** A greater coordination and partnership among Chinese government, NGOs and enterprises, as well as the beneficiary country's local NGOs, government, and enterprises should be established. With the joint efforts to deliver in-kind aid, it could achieve a more effective implementation and operation of the aid project.

1. INTRODUCTION

A. Evaluation background

China started to provide in-kind aid to its neighboring countries in the 1950s, and has always been committed to promoting the South-South Cooperation. From 2005 to 2010, China conducted 115 climate change related foreign aid projects with developing countries across the world, counting for 1.17 billion RMB¹. Moreover, to support developing countries address the issue of climate change, China's National Development and Reform Committee (NDRC) began to provide gratuitous aid to the developing countries in 2011, with energy-saving and low-carbon appliances. Over the past five years, NDRC has signed 22 in-kind aid MOU's with 20 different developing countries, providing 1.2 billion LED lights, 9,000 LED streetlights, 20,000 energy-efficient air conditioning units and 8,000 solar PV systems².

An example is the MOU between NDRC and Myanmar's Ministry of Natural Resources and Environmental Conservation (MoNREC) where they signed a 3.3 million USD climate change mitigation aid program. GEI implemented a demonstration project promoting clean rural energy usage in Thanbayarkhon (TBK) village, Myanmar, by providing 193 improved cooking stoves (ICS), 180 solar powered lights (SPL) and one solar powered water pump (SPWP) to 350 households. The project aims to improve villagers' livelihoods, while addressing deforestation and carbon emissions. Ultimately, the empirical evidence demonstrates a potential in-kind aid model for South-South cooperation on climate change.

The long-term implementation of the South-South cooperation on climate change, related to in-kind aid, is crucial for China and other developing countries to tackle climate change and develop clean energy sectors. In this instance, GEI recently conducted some research on climate change in relation to in-kind aid evaluation from a third party perspective. This was to provide a suitable reference and advice on an assessment mechanism for promoting an effective and sustainable future for the China South-South cooperation in-kind aid projects.

B. Purpose and scope of evaluation

The main purpose of this evaluation study is to develop a methodology and provide indicators for evaluating the performance and impacts of pilot projects and in turn provide recommendations for the implementation of China South-South climate change in-kind aid projects in Myanmar, as well as in other countries.

1 NDRC (2012) *The second communication of the People's Republic of China on climate Change*. Available at: <http://qhs.ndrc.gov.cn/zcfg/201404/W020140415316896599816.pdf>. (in Chinese)

2 NDRC (2016) *Addressing South-South Cooperation on climate change has made positive progress*. Available at: http://qhs.ndrc.gov.cn/qhbhnhz/201601/t20160128_773390.html. (in Chinese)

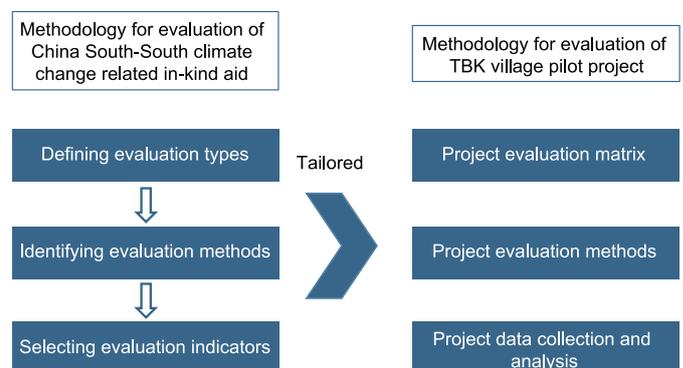
First, it reviewed existing evaluation types and methods for foreign aid programs from the World Bank (WB), Asian Development Bank (ADB), United States Agency for International Development (USAID), the Department for International Development in the UK (DFID), Global Environment Facility (GEF) and so on. Second, it reviewed assessment reports on climate change related aid in the energy, water and sanitation sectors, whilst also determining a set of pragmatic indicators for evaluating the performance and impacts of climate change in-kind aid program, which form the conceptual basis for the evaluation. Third, taking the TBK village pilot project as an assessment example, it evaluated the performance of the project using relevance, effectiveness, efficiency and sustainability criteria based on document review, interview and focus group discussions. Fourth, the study undertook a quantitative evaluation of the impacts of the project, mainly in three broad areas: economic, social and environmental impacts. Lastly, the study identified key lessons from the pilot project and made recommendations for strengthening the project's design and operations as well as future programming for China South-South cooperation climate in-kind aid in Myanmar and other countries.

C. Limitation of the evaluation

There are limited evaluation practices on climate change related in-kind aid, which could lead to a less comprehensive assessment design, particularly for the assessment indicator. Furthermore, current evaluation studies are mainly from international organizations and practices in the Chinese context are limited. Regarding the evaluation of the pilot project, there is an absence of baseline or comparable counterfactual data, making it difficult to evaluate periodical progress towards achieving each target and comparing the changes before and after the program.

2. METHODOLOGY AND DATA FOR EVALUATION

This section is divided into two parts: a proposed methodology for the evaluation of the China South-South Cooperation on climate change related in-kind aid and a tailored evaluation method for the pilot project. The proposed evaluation methodology and indicators are built upon current evaluation studies of climate change related aid projects, particularly from WB, ADB, USAID, DFID, GEF, Global Alliance for Clean Cooking stoves (GACC), SolarAid, SNV Netherlands Development Organization (SNV), etc.



A. Defining types of evaluation

Performance evaluation and impact evaluation are the two most widely adopted evaluation types. The former focuses on the achievements of particular activities, projects and programs, while the latter measures the change in a development outcome that is attributable to a defined intervention (Figure 2.1). Relevance, effectiveness (efficacy), efficiency and sustainability are often considered as evaluation criteria when conducting performance evaluation^{3 4 5}. Impact evaluation, however, tends to assess the impacts on the economy, health, education, environment, time savings, gender empowerment, institutions and so on^{6 7 8 9}.

3 Asian Development Bank (ADB) (2016) Guidelines for the evaluation of public sector operations. Independent Evaluation Department: ADB.

4 The World Bank (WB) (2014) Project performance assessment report - Democratic Republic of Sri Lanka - Renewable energy for rural economic development project. Report No. 88547, Independent Evaluation Group: WB.

5 Global Environment Facility (GEF) (2010) The GEF monitoring and evaluation policy. Evaluation Document No. 4, Washington, DS: Evaluation Office: GEF.

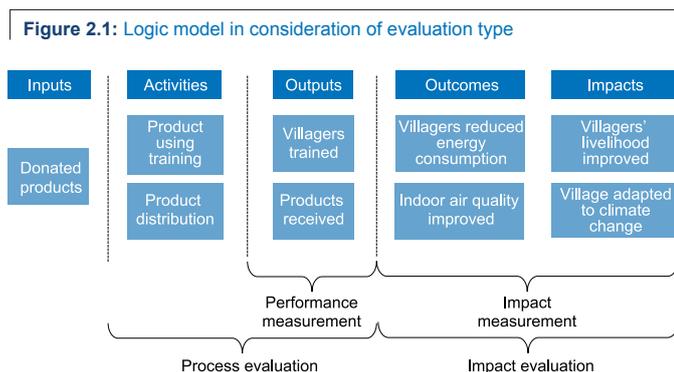
6 ADB (2010) Asian Development Bank's assistance for rural electrification in Bhutan - does electrification improve the quality of rural life? Reference Number: IES: GHU 2010-27, Independent Evaluation Department: ADB.

7 WB (1998) Sri Lanka impact evaluation report - community water supply and sanitation project. Report No. 18113, Operation Evaluation Department: WB.

8 Global Alliance for Clean Cooking stoves (GACC) and International Center for Research on Women (ICRW) (2016) Measuring social impact in the clean and efficient cooking sector: a how-to guide.

9 SolarAid (2015) Impact Report Autumn 2015.

For in-kind aid, the actual performance of the project and the impact of the donated products on climate change mitigation and improvement of local people's livelihoods, should be the priority for evaluation. Therefore, performance of the aid could be assessed on a relatively macro level, based on its relevance and sustainability, whilst the impacts of the project could be evaluated on a micro level, such as the changes to the local people's environment. By covering both performance and impact assessment, this thorough evaluation could provide some constructive suggestions for both the current and future China South-South climate change aid, and promote a more effective and sustainable aid model.



Source: made by author

B. Identifying methods of evaluation

Having decided to conduct a performance and impact assessment, an evaluation method is needed. The study summarizes the current widely adopted evaluation methods, which can be divided into experimental and non-experimental methods. Figure 2.2 shows that the experimental method uses randomized controlled trials, which is dubbed the 'golden standard' for impact evaluation as it requires considerable sophistication, resources and a large enough research base for findings to be statically valid¹⁰. Regarding the non-experimental methods; goals and outcomes comparison, cluster evaluation and individual changes 'before and after' the program is widely adopted.

Since the China South-South Cooperation in-kind aid lacks any specific measurable objectives, baseline data or many similar projects, it suggests comparing the effects on the locals before and after the aid. Although there is a lack of baseline data, it can still be done through a household survey and interviews with key informants to understand the changes involved both before and after the project. For future projects with an established database and baseline studies, more precise evaluation with a variety of evaluation methods could be employed.

10 Rockefeller Philanthropy Advisors (n.d.) *Assessing impact*. Available at: <http://roadmap.rockpa.org/assessing-impact/>.

Figure 2.2: Comparison of evaluation methods^{11 12}

Experimental Method

Randomized control trials: seeks to document results by measuring the target population against a comparable group who did not participate in the program, which requires considerable sophistication, resources and a large enough research base for findings to be statically valid.

Non-experimental Methods

Summative Goals vs Outcomes: compares a set of defined goals or objectives with actual results, which requires precise and measurable goals.

Individual 'before and after' comparison: compares individual changes before and after program, which requires a set of variables.

Cluster evaluation: compares results across a series of similar programs and combines results as a way of assessing the type of program or compare different types of programs that had the same goals.

C. Selecting evaluation indicators

The study proposes an evaluation matrix for performance evaluation and impact evaluation, which is built upon current evaluation studies on energy, environment, water and other climate change related aid programs, particularly from WB, ADB, USAID, DFID, GEF, GACC, SolarAid and SNV.

Indicators for performance assessment

Table 2.1 shows four widely adopted evaluation criteria when conducting performance evaluation. Specifically, relevance often refers to the outcome relevance to the beneficiary country's development priorities and the donor's development strategies, as well as relevance of the project design to achieve its objectives. Sustainability considers whether the activities could go beyond the scope of the project funding from financial, sociopolitical, institutional and environmental perspectives. These two indicators form a relatively macro level assessment. With regards to the performance of the project itself, indicators of effectiveness and efficiency examine the achievement of the intended outcomes and resources used to reach those outcomes.

On the one hand, most of the indicators that are widely adopted by the international organizations, could serve as indicator examples

11 Ibid

12 Zhang L. X. (2013) 'Randomized Controlled Trails: a state-of-art impact evaluation method', *Progress in Geography*, 32(6), pp.843-851.

when establishing an indicator system for the China South-South climate change in-kind aid. On the other hand, some adjustments are made according to the context of the in-kind aid, which has no or less revenue concerns compared to other loan programs conducted by many international organizations. For instance, instead of considering the relevance to the organization, its own development strategy and some certain international guidance, the proposed evaluation indicator could focus on the relevance to the Chinese government’s foreign aid development goals, strategy and China’s foreign policy. For efficiency, it could examine the efficiency of the project in meeting its objectives, instead of calculating the cost and benefit of a fund or loan, since the aim is to assess the in-kind aid.

Indicators for impact assessment

Apart from performance assessment, this research proposes an indicator framework for impact assessment based on the current assessment studies on rural electrification, water supply, renewable energy and other climate change related aid programs. Three main impacts have been identified after reviewing existing studies, which are economic, social and environmental impacts. Generally, selection of an indicator is based on the availability of data, measurability of data and the context of the China South-South Cooperation aid. Furthermore, the indicator should be able to evaluate the impacts of climate change mitigation and adaptation, and livelihood improvement.

Table 2.2 shows that both the spending and saving on time and money are relevant indicators to assess the economic impacts. In this case, all the data can be quantified, for example, the relative change in fuel expenditure per year before and after the program. With respect to the environmental impacts, there are both qualitative and quantitative indicators. For the quantifiable indicators, data can be collected through either official records or experimental measurement. Relatively measurable indicators are proposed to assess the social impacts, such as proportion of vulnerable beneficiaries and comparative change of time on studying. For health impacts, these could be examined through clinic records, looking at the relative change in incidence of health issues and qualitative analysis of local people’s perceived changes in health issues. All indicators are expected to examine the impacts that are associated with the in-kind aid.

Table 2.1: Performance assessment indicator^{13 14 15}

Performance assessment	Indicator
Relevance	<ul style="list-style-type: none"> - Relevant to global guidance - Relevant to donor’s strategies or donor country’s foreign aid development goals - Relevant to beneficiary country’s own development policies, plans and programs - Relevance of project design to achieve its objectives
Effectiveness	<ul style="list-style-type: none"> - Effectiveness in achieving project objectives - Effectiveness in achieving global (environmental) objectives
Efficiency	<ul style="list-style-type: none"> - Efficiency of project in meeting its objectives - Project profitability
Sustainability	<ul style="list-style-type: none"> - Catalytic effects of the project, e.g. project demonstration, replication and scaling-up - Sustainability of project outcomes beyond the project’s timeframe: financial, sociopolitical, institutional, frameworks and governance, and environmental.

13 ADB (2016) *Guidelines for the evaluation of public sector operations*. Independent Evaluation Department: ADB.

14 WB (2014) *Project performance assessment report – Democratic Republic of Sri Lanka – Renewable energy for rural economic development project*. Report No. 88547, Independent Evaluation Group: WB.

15 GEF (2010) *The GEF monitoring and evaluation policy*. Evaluation Document No. 4, Washington, DS: Evaluation Office: GEF.

Table 2.2: climate change related in-kind aid impact assessment indicator^{16 17 18 19}

Impact	Indicator	Information required	Data collection
Economic impacts	Household income	Annual income earned using products	<ul style="list-style-type: none"> Household survey End-users' interview on household income, expenses and time use
	Fuel expenditure	Relative change in fuel expenditure per year	
	Money spending	Shifts in household expenditure, especially money saved and earned	
	Time saved	Time saved using products	
	Time used	Additional time spent on income-generating activities per day	
Environmental impacts	Deforestation	Relative change in amount of tree cutting for household wood fuel consumption	<ul style="list-style-type: none"> Household survey Laboratory test results of products Interview with forest department CO₂ monitoring and measurement
	GHG emissions	Products' CO ₂ emissions	
	Environmental awareness	Education conducted for raising environmental awareness	
Social impacts	Health issues	Relative change in incidence of health issues, like eye irritation, cough and headaches	<ul style="list-style-type: none"> Household survey Clinic records review School records Focus group discussions or workshops with students, vulnerable groups and service's committee
	Drudgery	Relative change of drudgery' impacts on health, e.g. muscle strain, blisters	
	Sanitation	Relative change in frequency of hand washing, bath, laundry and toilet washing per day	
	Safety	Perceived safety of products	
	Gender empowerment	Women's participation in decision making process at home and committees; proportion of women beneficiaries	
	Benefit of the poor	Proportion of poor beneficiaries	
	Studying time	Additional amount of time spent studying at home after sunset	
	Academic performance	Records of children's academic performance, and motivation	

16 WB (1998) Sri Lanka impact evaluation report - community water supply and sanitation project. Report No. 18113, Operation Evaluation Department: WB.

17 GACC & ICRW (2016) Measuring social impact in the clean and efficient cooking sector: a how-to guide.

18 SolarAid (2015) Impact Report Autumn 2015.

19 Berkeley Air Monitoring Group (2015) Quantifying the health impacts of ACE-1 biomass and biogas stove in Cambodia. SNV Netherlands Development Organization.

D. Evaluation approach and data collection instruments for pilot project

Evaluation matrix

To conduct the TBK village pilot evaluation, a tailored evaluation design matrix with specific evaluation questions, required data, data collection methods and data analysis methods were developed based on the previous proposed evaluation indicator for the China South-South climate change in-kind aid.

The performance of the pilot project is assessed through the following four indicators: Relevance, effectiveness, efficiency and sustainability. Specifically, it evaluates the relevance between the project design for meeting local people's needs and the Myanmar government development priority; the effectiveness and efficiency of the project in achieving its objectives; the sustainability of the project outcomes and the potential for replication and scaling-up.

With regards to the pilot project's impact assessment, three tailored evaluation matrices are designed in accordance with the three donated appliances: ICS, SPL and SPWP. In this case, the evaluation indicators are created to measure the appliances' features and their intended impact. Please see Appendix A for more details about these matrices.

Evaluation method

This research project used both quantitative and qualitative methods. The quantitative method was through a household survey, whilst the qualitative methods included key user and informant interviews, focus group discussions, as well as a project document review. Both of these methods were adopted to ensure the best combination of quantitative and qualitative data as the basis for deriving significant conclusions.

Quantitative methods

a. Household survey

The household survey is used to answer several of the impact evaluation questions. The respondents of the survey were the main users of the appliances in each of the households.

The households were selected at random according to the beneficiary list. There were 354 households that received donated appliances, with 179 households receiving the SPL and the other 175 households receiving the ICS. In total, 75 out of 354 households were interviewed, including 30 ICS users, 31 SPL users and 14 out of the 50 households who received the SPWP service, given that there was a relatively small number of beneficiaries who received this appliance.

Qualitative methods

To complement the data collected from the household survey, the study team held focus group meetings with the Village Electrification

Committee (VEC) and Solar Powered Water Pump Committee (SPWPC). Interviews were held with key user groups and the local implementing agency, as well as in depth reviews of the project documents. These qualitative methods aimed to answer many of the performance evaluation questions and the impact assessment.

a. Semi-structured interviews with key user groups and local implementing agency

Eight interviews with key beneficiaries were conducted, including five students who use SPL for studying after sunset and three other households who use SPL for income-generating activities. In addition, the research team interviewed the chairman and field manager of the local partner, Spring Foundation, who is responsible for implementing the TBK village project.

b. Focus group discussion with TBK village committees

Two focus group discussions were held with six out of the eleven members from the VEC and seven out of the eleven members from the SPWPC. In addition to answering the project evaluation questions, the focus group discussions helped to evaluate the role and level of participation of the committee in the project's implementation, as well as assessing the sustainability of the committee beyond the project period.

c. Project document review

This research reviewed all the relevant documents of the project, including the project application, the interim report and the final report. This review not only enabled a project 'before and after' scenario comparison, but it also helped the research team to understand the project and prepare the field evaluation survey.

Data collection and analysis

To ensure the quality and accuracy of the data, several steps were taken. A one-day training for the field survey team was undertaken, including two lead researchers, one supervisor and four enumerators. The training reviewed all the content in the questionnaires and provided guidance on how to fill in each question. There was also advice given on how to conduct a household survey, as well as two imitation questionnaire tests. Interview and focus group discussion questions were also reviewed.

All the data collection was completed in four days. The supervisor was responsible for monitoring the quality of the quantitative data that was collected every day. For the focus group discussions, one researcher played the role of moderator and the other recorded the discussions to ensure effective debate and quality of the note taking.

A descriptive analytical approach was used for the evaluation report to present the household survey results, whilst the content analysis method was used for the evaluation and interpretation of the key user, informant interviews and focus group discussions. This research used qualitative data to give greater depth to the explanation of the findings and to triangulate with quantitative information.

3. PILOT EVALUATION PROJECT

A. TBK village basic information

TBK village is located on the Yangon-Naypyidaw Highway at mile marker 92/7, nestled into the base of Bago Yoma Mountain Range. The village has an estimated population of 1,200 people (or 357 households), with around three to four members in each family, comprised mainly of Burmese and Karen ethnic groups. Only 32% of the villagers have access to electricity and often they face a water shortage during the dry season. Moreover, the average wood fuel consumption per household per month is around 25kg, meaning the entire village consumes 1071 tons of wood fuel per year.

The majority of the villagers cultivate and raise livestock for household consumption, as well as selling to the local markets. Many other villagers work in nearby paddy fields and plantations, or are involved in the illegal cutting of timber and bamboo. The majority of households have an average daily income that is not sufficient to meet their basic needs. For instance, about 30 percent of the poorest households cannot afford to send their children to school or afford to access basic healthcare services. Furthermore, people's health is damaged by the smoke from the cooking stoves; children are not able to study at night without lights and villagers have to walk around one mile to collect unclean water in plastic containers from the nearby stream. Apart from the poor social, economic and health conditions of the local residents, there is a serious environmental degradation too. It is reported that forest resources in the Bago Yoma Mountain Range have been gradually degraded over the past 50 years due to cultivation and grazing practices. Poverty has also accelerated the deforestation, as many families rely on the illegal extraction of forest resources for their own use and to supplement incomes.

B. TBK project introduction

The "Pilot project for promoting clean rural energy usage in Myanmar" in TBK village is co-funded by China's Green Carbon Foundation and the blue moon fund, and is co-operated by GEI and Myanmar's Spring Foundation. The project lasted for one year from January 2015 to January 2016. The project team had successfully donated 193 clean stoves and 180 solar powered home lights to the TBK village, while also leveraging a 1.1 Kw PV DC pump at USD 7,200, which was donated by Yingli Energy (Beijing) Co., Ltd. All of these materials were manufactured in China. In addition, the project helped establish two village committees, which are the Village Electrification Committee (VEC) and the Solar Powered Water Pump Committee (SPWPC). The villagers were also trained on how to use the donated appliances properly.

The pilot project also provided reference to NDRC on clean energy in-kind aid. The project helped NDRC understand that clean stoves and solar lights are very much in need in the villages of Myanmar, thus adding them to the list of donations as part of an in-kind aid

to Myanmar. In fact, the Climate Change Department of NDRC and the Forest Department of MoNREC signed the "Supplementary Agreement to South-South Cooperation Donation" in November 2015. Following GEI's project at the TBK village, the agreement confirmed an in-kind aid of 5000 household solar electricity systems and 10,000 clean cooking stoves to Myanmar, helping the rural villages improve their livelihood and energy access, while reducing forest loss and carbon emissions. This signified a collaboration between China and Myanmar on climate change mitigation and adaptation.

C. Project objectives and design

Objectives

- To improve villagers' quality of life through solar electrification, clean cooking stoves and a clean water supply;
- To achieve local social and economic development while addressing climate change;
- To raise people's awareness in using renewable/clean energy appliances for environmental conservation and reduction in fuel wood consumption;
- To increase villagers' participation in the decision-making process and capacity building.

Design and components

- Solar powered lighting system
180 SPL were donated to the village. The project SPL is a 6W DC solar system, with a solar panel, LED lamp, power supply host and a mobile charger. The lighting system enables children to study at night and to have general household lighting.
- Improved cooking stoves
193 ICS were distributed to villagers. The ICS is advanced in saving wood fuel, efficient cooking, less smoke and easy carry.
- Solar powered water pumping system
A 1.1 KW DC SPWP was donated to the village. The water system includes a solar panel, a water pump, an overhead tank (first water tank), as well as a grand tank (final water tank), located in the south of village connected by a pipe. The water system serves as an alternative water source for households who are affected by the water shortage during the dry season. It provides sufficient water for participants who practice meditation at the monastery during the water festival.
- Village electrification committee and solar water pump committee

At the initial stage of the project, VEC and SPWPC were established mainly for the management of appliances. There are 11 members of each committee and all are nominated by the

existing Rural Development Committee. Members are involved in all the decision-making processes, such as deciding where the pump should be located and selecting the parameters of the donated appliances. A committee fund was also planned to establish the collection of funds from beneficiaries for routing maintenance and organizing community activities.

4. PERFORMANCE ASSESSMENT RESULTS AND DISCUSSION

The performance results summarized in this section are as a result of reviewing the project documents, key informant interviews, focus group discussions, as well as household surveys. Overall, the TBK village pilot project was rated moderately successful based on the four key parameters: relevance, effectiveness, efficiency and sustainability.

A. Relevance

Relevant to the country's development policies or plans

The project's objectives and design are highly relevant to Myanmar's priorities in terms of climate change adaptation and mitigation. The solar powered systems for both lighting and the water pump system as renewable energy developments under the project, are in line with the government's 2014 'National Energy Policy' (NEP). The NEP seeks to develop renewable energy, particularly solar energy used for battery-charging stations and water pumping. It is also consistent with Myanmar's 'Intended Nationally Determined Contribution' (INDC), which commits to achieving rural electrification with at least 30% of the source from renewable energy, such as solar and solar mini-grid technologies by 2030. The project continues to be relevant to the 2012 'Myanmar's National Adaptation Programme of Action to Climate Change' (NAPA), which supports solar powered water purification and irrigation pumping systems, as well as renewable solar electricity systems in rural communities.

The promotion of improved cooking stoves under the project remains highly relevant to the Government's NEP, which commits to reducing wood fuel production from natural forests (for cooking), from 71.4% in 2000 down to 46% by 2030. In addition, it is in line with the INDC and NEP with the distribution of cooking stoves and the introduction of fuel efficient stoves.

The project's component and objective of improving community capacity through establishing two committees also compliments Myanmar's INDC, which aims to increase capacity-building, education and awareness to cope with climate change. The project is also consistent with the policy objectives and work programs as described in NEP; 1) to increase people's awareness and their participation in the use of sustainable energy; 2) to build people's awareness of the benefits and opportunities of using renewable energy.

Relevance of design

The design was appropriate for the identified project objectives, which were to improve villagers' quality of life and address the social and economic constraints, as well as climate change. Specifically, the project component of SPL provided a sustainable, free and good

quality lighting solutions for the beneficiaries, compared with the kerosene lamps and candles they previously used. Regarding the ICS, this not only saved wood fuel, but also reduced cooking time as well as the amount of smoke produced when compared with the traditional cooking stoves. In this case, it supported the achievement of the identified objectives, as it provided better indoor air quality, addressed certain health issues, as well as mitigating climate change due to reduced deforestation and carbon emissions. The SPWP system also reduced the distance that villagers had to travel to fetch water, saving beneficiaries' time and energy.

The project design also saw the establishment of two committees, which further met the project objectives. On the one hand, the two committees were responsible for making all appliance related decisions. On the other hand, interviews with the Spring Foundation's staff indicated that the project design failed to promote capacity building and public participation. Specifically, the committee was relatively weak due to insufficient training around the committee's operation and product maintenance. The committee members did not have a point of reference or regular official meetings to support its operation. Overall, the project objectives are highly relevant to Myanmar's national development plan and policies. However, the project design is only partially relevant to the objectives.

B. Effectiveness

The main objectives summarized in the previous section were partially achieved. The three donated appliances have improved the quality of life for the majority of villagers. The SPL had the biggest impact. In general, it provided a brighter, safer, economical and more reliably lit environment. From a social aspect, villagers felt more in control of their environment, and children improved their academic performance through the extra lighting for study. However, SPL did not meet all the families' needs, as the size and power of the lighting system was relatively small.

With regards to ICS, this brought significant economic, social and environmental impacts, particularly for smaller families. The stoves not only saved time when cooking and when collecting wood fuel, but wood fuel was saved for cooking. This reduction in wood fuel consumption and its efficient burn contributed to less carbon emissions and deforestation. However, the ICS is only moderately effective for larger families with more than 5 members, because the stove is too small for large cooking pots, thus they have to use both the ICS and the original brick stove.

The SPWP was the least effective appliance to satisfy the objectives. On the one hand, the water pumping system alleviated villagers' troubles of getting fresh water by delivering water from the stream to a tank located in the village. Nevertheless, according to the field manager of the Spring Foundation only benefited 50 out of the 350 households. Moreover, the quality of the water from the stream is relatively poor and the volume of water that can be pumped is limited. The pump also malfunctioned at times and therefore, it failed to meet villagers' needs.

The project marginally increased villagers' awareness of using

renewable energy appliances as an alternative energy source. People now see the benefits of using renewable energy in money saving, social improvements and environmental protection. According to the household survey, the majority of beneficiaries would like to purchase the donated appliances if their current appliances were to break, and if the product specifications were improved, the number of buyers would increase accordingly.

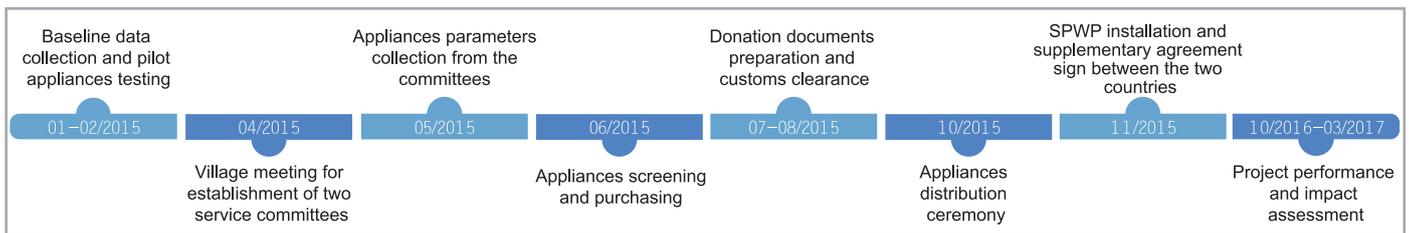
However, the project failed to move towards greater public participation and capacity building. Although the project established two committees to manage the rollout of the appliances, which lead to some public participation, overall the committees were still weak. Secondly, due to the insufficient institutional capacity building in the committee operation and the maintenance of appliances, some committee decisions were ineffective. Lastly, there was not full participation from the villagers involved with this project. According to the field manager of the Spring Foundation, all the committee members were appointed by senior villagers, instead of through a democratic election, and all members were male. The field manager explained that it took him five months to build trust with the villagers, and thus there is no systematic project design for capacity building. This is part of the reason behind the lack of public participation. Furthermore, participants of the focus groups advised that the local implementing agency lacked experience with community development and their participatory approach.

Overall, the objectives of improving quality of life, addressing economic, social and environmental issues, as well as raising awareness of renewable energy sources, were mostly achieved. However, the project failed to increase public participation and institutional capacity building.

C. Efficiency

The project lasted for one year from 1st January 2015 to 31st December 2015. Overall, each activity ran smoothly and to schedule for the entire project period, starting with the baseline data collection, appliance selection, purchase, shipping and customs clearance, through to the distribution. The project evaluation was launched in October 2016, one year after project completion.

Figure 4.1: project timeline



Source: draw by author

Figure 4.1 shows a complete project timeline. During the period between the 5th January and 9th February 2015, GEI and Spring Foundation conducted a baseline survey and tested the appliances. Three solar powered lights and clean cooking stoves were distributed to several representatives from the village for testing.

In April, Spring Foundation held a village meeting to establish two committees: VEC and SPWPC. The meeting addressed the solutions for the water shortage and electricity. The two committees decided to use SPWP to pump water from the stream and deliver it to the village, and to introduce SPL to provide lighting for children to study.

According to the appliance requirements and parameters proposed by the village committees, GEI created an appliance screening process by comparing the price and performance during the months of May and June. Eventually, SPL and SPWP, produced by Yingli Energy (Beijing) Co., Ltd and ICS from Florida Group Inc., were selected.

From July through to August 2015, GEI prepared the details around the donation of appliances, including contract signing, applications for the export customs code, organization of the shipping company, a discussion with the Myanmar Government around the shipping and customs clearance, as well as preparing the customs clearance documents.

The ceremony was held as scheduled on the 12th to the 14th October, with the attendees from China Green Carbon Foundation, Blue Moon Fund, Spring Foundation and GEI. During the ceremony, SPL and ICS were distributed to 179 and 175 households respectively.

After the ceremony, in early November, the SPWP arrived in the village. Simple SPWP installation and operation training was given to the committees over a few days. Furthermore, China's Climate Change Department of NDRC and Myanmar's Forest Department of MoNREC signed the "Supplementary Agreement to South-South Cooperation Donation", which confirmed an in-kind aid of 5000 household solar electricity systems and 10,000 clean cooking stoves to Myanmar.

Finally, the pilot project performance and impact evaluation was conducted from October 2016 to March 2017, a year after project completion.

D. Sustainability

Social, financial, environmental and institutional sustainability

The assessment of sustainability is based on social, financial, environmental and institutional factors. Over the last year of operation, a mutual trust has developed between villagers and the project staff. The field manager stated that more people were participating in group activities and meetings as time went on. After using the appliance donated by the project, villagers' awareness of the benefits associated with renewable energy and the sustainable use of energy has increased. Thus, the social sustainability side of the project was mostly achieved.

The main concern is the financial sustainability of the project beyond the scope of the initial donation. The two committees tried and failed to raise community funds by collecting user fees from the beneficiaries for appliance maintenance and for the organization of community activities. Focus group participants advised that there were fewer water users, due to the poor water quality, which was caused by the missed location of the SPWP. This was the main reason for the failure. Consequently, Spring Foundation paid for the maintenance of the SPWP when it last broke down, thus indicating the project is not financially sustainable.

The project results were limited in terms of the environmental benefits. The main environmental benefit was the contribution towards a reduction in deforestation and carbon emissions, however, the benefit could be greater if more villagers switched to the donated appliances.

With regards to the institutional sustainability, although the two committees were established and they will remain functioning as long as the donated appliances are still operating, the two committees are still very weak. The committees do not have a rigid schedule of meetings, nor an operational plan or technical skills for the maintenance of the appliances. Given the above considerations, the institutional sustainability is rated as unlikely.

Catalytic effects of the project

The catalytic effects of the project consider replication outside of the project and the scaling-up of the project. During the interviews with Spring Foundation's project staff, they pointed out that there is definitely a need for similar rollouts in other villages, as the donated renewable appliances are in high demand, but limited supply. The upcoming in-kind aid of 5000 household solar electricity systems and 10,000 clean cooking stoves to Myanmar, through the "Supplementary Agreement to South-South Cooperation Donation", also indicates a catalytic effect. This pilot project has clearly triggered a larger scale technology donation.

5. IMPACT EVALUATION RESULTS AND DISCUSSION

A. Economic impacts

Household income

The donated appliances have limited use when it comes to income generation, mainly due to their limited capacity. Only five of the households used the SPL for income-generating activities. Three of them were for business purposes, such as weaving and opening up a ‘home shop’ and the other two beneficiaries who used SPL for lighting were not directly related to productivity.

SPL provides an opportunity for income-generating activities and productive work-hours at home through extra lighting hours and better lighting quality. The Participant who used SPL for weaving claimed that her monthly income increased by 50,000 Kyats²⁰, and she could finish about 3-4 dresses per week. She used SPL for 2-3 hours per night from 6pm to 9pm, and then candles and battery light if she needed to work until midnight during the peak season.

One of the respondents who used the light for his betel nut shop at night indicated that although the SPL provides the same lighting quality and hours as the battery light that he had before, it saved him 7,500 Kyats per month overall. The shop owner used three 1.5 volt bulbs, which cost 750 Kyats per battery charging per three days. However, now he is able to use the SPL, which provides the same brightness for four hours per night.

Apart from the direct economic impacts that the SPL has had, one interviewee noted that it provided a safer environment and more control when he was staying in the forest at night after cutting bamboo. Bamboo cutting is the main source of income for a villager, and it normally takes 7 to 10 days for each bamboo cutting trip. Before receiving the SPL, candles were used, but now the SPL can provide a brighter and safer lighting without being affected by wind and rain.

Spending on fuel

The most significant economic impact on beneficiaries is the money saved on lighting. Before receiving the SPL, 28 of the participants spent an average of 7,000 Kyats on kerosene lamps, candles, storage batteries or diesel generators each month. After receiving the SPL, kerosene lamps have almost been eliminated for those 14 families

who used to spend 3000 Kyats a month on them and so too for the five beneficiaries who used storage batteries and diesel generators before.

For the 22 households that used candles before, 61% of them noted that all the candles had been replaced by SPL, and 35% of the beneficiaries stated that the SPL has significantly reduced their spending on candles (Figure 5.1). Furthermore, as is shown in Figure 5.2, both the number and the cost of candles has decreased dramatically when using SPL. On average, beneficiaries now save about 4,000 Kyats on candle lighting each month.

Figure 5.1: Change of candle consumption before and after having SPL

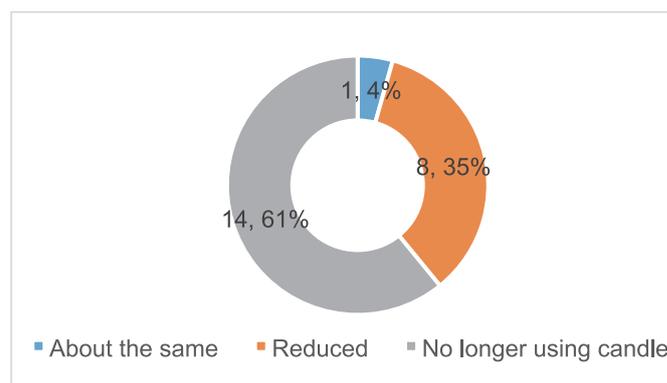
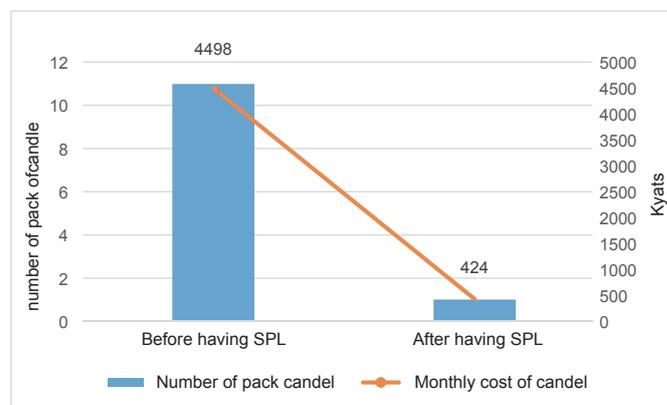


Figure 5.2: Average candle consumption before and after having SPL



Regarding the ICS beneficiaries, although only 2 out of the 31 respondents purchased charcoal, whilst the others collected wood fuel. One participant reported that she spent 4,500 Kyats per month on charcoal before, but after having the ICS she only spent 2,250 Kyats; the other participant also reduced her monthly expenditure from 1,200 to 800 Kyats.

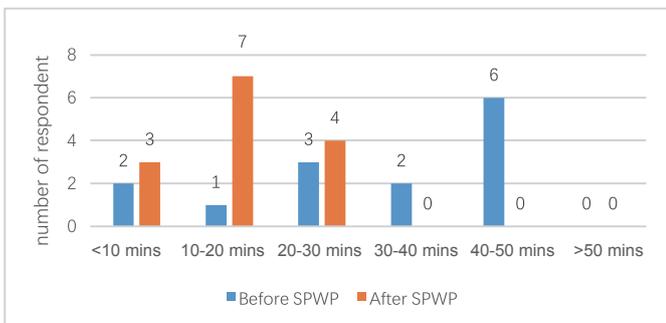
Time saving

One of the main economic impacts of the pilot project has been the time saved on water collection and cooking. 12 respondents out of 14 stated that SPWP reduced their time to go and collect water. As can be seen from Figure 5.3, before having the SPWP, the majority of villagers spent 40 to 50 minutes on each water collection trip, but after receiving the SPWP they all spent less than 30 minutes, with

²⁰ 1,400 kyats = 1 USD

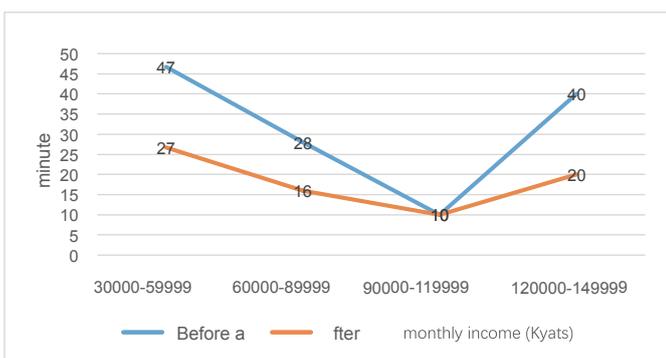
some trips only taking 10 to 20 minutes. The time saved is mostly due to the reduced distance that villagers have to walk to the grand tank to collect their water. Previously, the journey was more than 1 mile to reach the stream.

Figure 5.3: Time use for a water collection return trip before and after having the SPWP



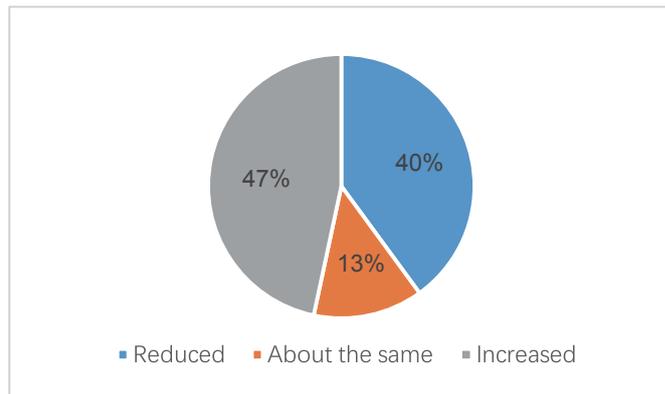
In addition, there is a correlation between income and the time saved in water collection. Figure 5.4 shows that the average water collection time dropped the most for lower-income households. The time spent on each water collection trip decreased on average by 20 minutes for those who receive less than Ks 60,000 per month, followed by a decrease of 12 minutes and 0 minutes for villagers with higher incomes. One possible reason for why the highest income earners also enjoyed a significant time reduction for water collection, could be because of the limited number of respondents (only 2 respondents). This indicates that the project brings the biggest positive economic impact to those who are the most vulnerable in terms of income.

Figure 5.4: Average time spent on water collection by income



Apart from time saved during water collection, there is also a slight time saving on cooking when using the ICS. It is clear from the pie chart that 40% of households took less time to cook their meal, including the preparation of the cooking stove and cleaning it after use (Figure 5.5), than before they had the ICS. 13% of respondents reported that they spent the same amount of time cooking, and almost half of the participants said that they spent more time using the ICS when compared to their traditional stove. For those who found that the ICS saved time, on average it was around 11 minutes less per meal. However, the potential reason behind the longer cooking time is that the ICS is too small for cooking larger meals, and that the fuel feeding hole is rather small, adding time onto the overall process.

Figure 5.5: Change of cooking time before and after having ICS



B. Environmental impacts

Deforestation

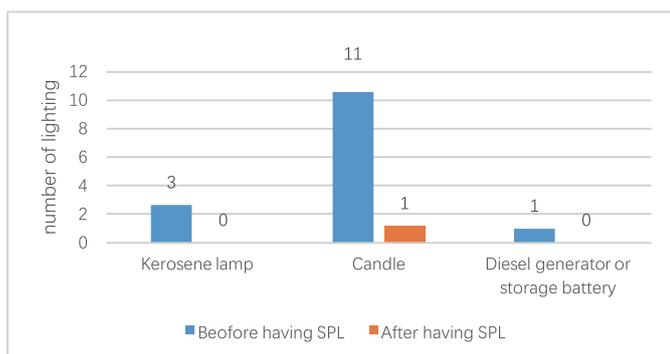
The environmental impacts of the project are difficult to quantify, but clear improvements have occurred. Data analysis found a decrease in the use of polluting sources of energy, such as wood fuel, kerosene and candles, with the arrival of the ICS and the SPL. All the villagers rely on wood fuel for cooking and thus the ICS was expected to help reduce deforestation. The survey data found that 83% of the participants used less fuel compared to the previous cooking methods, and on average it saved 2/5 of the fuel that was normally used to cook. According to the baseline data collected before the donation, villagers consumed average 25kg of wood fuel per month. Thus, after receiving the ICS they are likely to have reduced that to about 15 kg per month, meaning the whole village could save approximately 31.5 tons of wood fuel each year from those 175 beneficiaries who received the ICS. Results from the study indicate that the ICS has a positive environmental impact by reducing deforestation.

However, the environmental impacts could have been even greater if all the beneficiaries only used the ICS. It is reported that 73% of households, which consists mainly of large families, still use their former cooking methods. This is due to the small size of the ICS and the small wood fuel feeding hole, which requires constant attention when cooking.

Greenhouse gas emissions

There has been a decrease in dependence on kerosene and diesel generators for lighting because of the SPL and thus the villagers' carbon footprint has been reduced. This has consequently contributed to a more sustainable environment. The Figure 5.6 show that after receiving the SPL, the use of kerosene lamps, candles, and diesel generators has almost been eliminated in the beneficiaries' households. The SPL beneficiaries saved about 10 packs (6 candles for each pack) of candles every month. The two main reasons behind the villagers' reduced use of these lighting methods are: 1) the SPL is an effective lighting source and 2) households have bought larger capacity solar lighting systems or battery storage devices to replace the kerosene lamps, candles and diesel generators.

Figure 5.6: Average number of different lighting before and after receiving SPL



Furthermore, according to the ICS testing report, each ICS is expected to reduce greenhouse gas emissions by about one ton of carbon dioxide-equivalent annually, which means using 175 ICS could reduce emissions by 175 tons of carbon dioxide-equivalent each year. The UNEP research estimates that per liter of kerosene released about 2.6 kg CO₂ is produced²¹. Out of the 31 SPL users, 45% of them used an average of 2.6 liters of kerosene per month, which means the use of kerosene lamps in the whole village releases approximately 12.8 tons of CO₂. The switch from kerosene lamps could reduce the same amount of CO₂ and equivalent in the form of black carbon each year. This also goes for the elimination of candle use, which is an effective way to mitigate climate change.

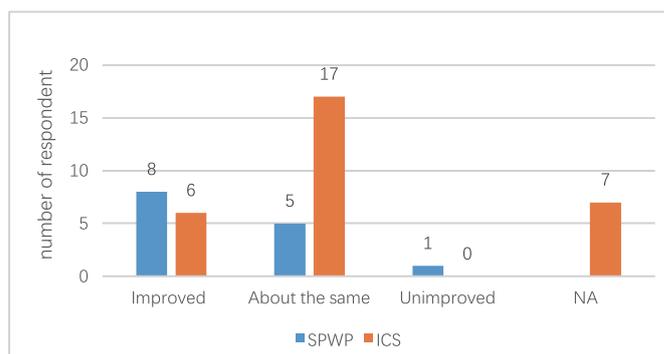
C. Social impacts

Health risks

The study examined the effect of three donated appliances on the health risks that are associated with drudgery and exposure to pollutants, such as muscle strain, back pain, waterborne diseases, eye irritation, headache and burns. The survey collected subjective data on the occurrence of these health risks.

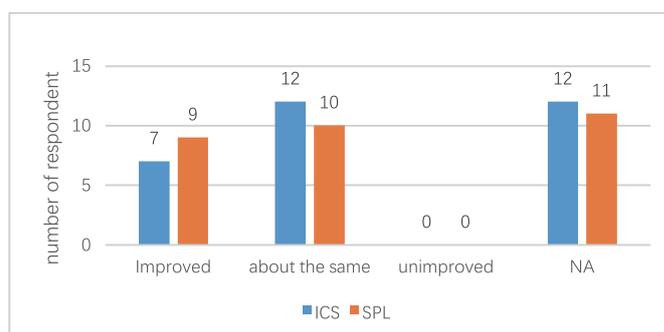
Figure 5.7 shows that 14 of the SPWP beneficiaries and 30 of the ICS beneficiaries, reported changes to their health in relation to drudgery, including fetching water and collecting fuel wood. It is clear that the majority of respondents believed that the SPWP had a positive impact on reducing their muscle strain, blisters, heat stroke and back pain when fetching water. Women tend to be responsible for the water collection and thus they did not need to travel as far to carry the heavy water or expose themselves to the strong sun. With regards to the health issues related to wood fuel collection, 6 out of the 30 participants using the ICS reported that their health had improved, whilst the majority think their health issues remain the same. One possible reason could be that many households still use the traditional stone fire, due to the small size of the ICS and therefore they still suffer with various health issues when burning the wood.

Figure 5.7: Change of health risks that associated with drudgery after receiving SPWP and SPL



The survey results suggest that the ICS and the SPL improved health conditions and reduced the occurrence of health incidences that are associated with the use of wood fuel and other polluting sources of energy, such as kerosene and candles. It can be seen from Figure 5.8, although approximately 1/3 of participants claimed that their health issues remain the same after receiving the ICS and the SPL, 7 and 9 beneficiaries respectively experienced an improvement in their health.

Figure 5.8: Change of health risks when cooking and lighting

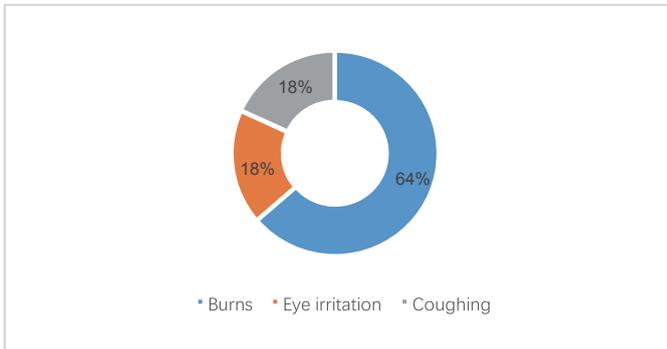


There is approximately 1/3 of participants who suffer from some health issues while using lighting. As is shown in Figure 5.9, burns are the most common risks reported (64%), followed by eye irritation (18%) and coughing (18%). The interviews with the children suggested that there was a burn risk when using candles for studying, but the SPL reduced this risk. For those beneficiaries who received the ICS, 28 of them believed that the ICS was safer than their previous primary stove, and only two reported that they felt it was at the same safety level as their previous stove. The main reasons given for the improved perception of safety by 64% of participants was that the flames are more enclosed, followed by safe wood fuel burning (24%) and a reduction in the amount of smoke (22%).

In addition, about 4 out of 14 participants who used SPWP claimed that they or their household members had experienced a waterborne disease, such as diarrhea. However, only one of them reported that the incidence of the disease had reduced since using the SPWP and the other three noted that there was no change. This is mainly due to the lack of a purification function in the pumping

²¹ UNEP (2013) Modelling methodology for energy and financial savings potential from switching to solar LED lanterns. UNEP/GEF en.lighten initiative.

Figure 5.9: Health risks that associated with lighting



system and thus it can only be used for general use instead of drinking, particularly during the dry season when the water from the stream is very muddy. In general, SPWP can provide accessible water to a certain number of households during the dry season and sunny days, but the water quality is not reliable or safe enough, which ultimately has a limited health impact on the villagers.

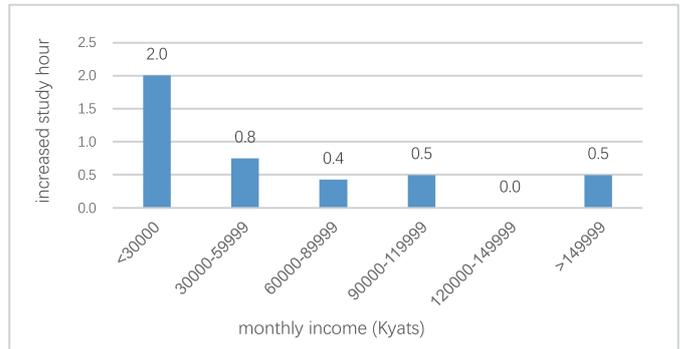
Education

Families use SPL for general household lighting which benefits the whole family, as well as for students to study at night. Access to clean and safe SPL contributes to improving children’s education, as they are able to study after sunset at home under electric bulbs with better quality light. For those 18 households who used SPL for study purposes, 83% of them stated that their academic performance has improved since receiving the SPL, while only few of them claimed their academic record remained the same. The results suggest that children are able to study longer since receiving the SPL, with an increase from on average 1.5 hours to 2.4 hours. Furthermore, the majority of respondents stated that the quality of light produced by the SPL is far superior when compared to the kerosene lamps and candles.

The results from the interviews with children suggest that those whose prior lighting source was by candle, only studied one hour at night for a few days per week. However, after receiving the SPL, the children noted that they could study every night for two hours from 6pm to 8pm, and their grades across all subjects improved from 40 to 60. In addition, for those families who already owned large solar panels, their children stated that SPL could only be used for studying at their desk, while the large solar powered lights could be used in the larger common room areas.

Moreover, children from poorer families are more likely to benefit the most from the SPL, as they had previously not been allowed to study under kerosene lamps or candles every night because of the excessive cost to the household. As is shown in Figure 5.10, there is a significant increase in longer study hours for children from low-income households, which is four times higher than that of high-income families.

Figure 5.10: Increased study time by income group



Benefits of vulnerable communities

The survey results show that the donated appliances benefit the vulnerable communities the most, including women, children and the poor. It is reported that the main person responsible for household chores at 88% are the females in the family, including water collection (100%), wood fuel collection (76%) and cooking (97%). Therefore, the benefit of time saving have benefited woman the most, as well as the health impacts with the reduction in drudgery associated risks and exposure to pollutants. In this case, women could have extra time for other community and social activities, whilst also improving their health condition. However, the project did not support women’s participation in the decision-making processes, with all members in the two established committees consisting of males.

Almost all households where children were present, they benefited the most from the SPL as they were able study longer hours. However, the SPL also benefited 16% of households who did not have children. There were children who really needed the SPL but they could not receive it; the initial idea was to give priority to children, but it failed to do so.

With regards to the benefits from the donated appliances by income groups, there is a slight difference between the lower-income and higher-income households. Low-income families tend to benefit the most from the time saved on water collections, and they could rely on the SPWP instead of borrowing water from their neighbors, as they could not afford to install a hand pump themselves. In addition, poor households are more likely to benefit the most from SPL with longer lighting hours, replacing the need for candles and kerosene lamps. However, there is statistically less of a difference between the different income groups when it comes to frequency of water collection, wood fuel collection and the reduction of health risks.

6. OVERALL ASSESSMENT, LESSONS AND RECOMMENDATIONS

A. Overall assessment

The overall performance of the TBK pilot project was relatively successful based on the relevance of the beneficiary country's development priority and partial relevance of design, effectiveness in implementation, efficiency of operations, and less than likely sustainability. Specifically, the project components of the donation and committee establishment are highly relevant to Myanmar's development policies and plans on energy and climate change. The project design is particularly relevant to the objectives as well, except for the establishment of the committees with regards to the improvement of public participation and capacity building. The main objectives of the project were mostly achieved in terms of improving quality of life and addressing development issues. Having said this, more effective project management could have led to greater success. The project was also highly efficient, as all the activities proceeded smoothly and to schedule for the entire project period. The pilot project itself is unlikely to be continued, since the financial and institutional sustainability was not there, even though socially and environmentally it would be justifiable. However, a catalytic effect of the project is likely to be seen in terms of replication and scaling-up.

The impact assessment found that the project's impacts are quantifiable, statistically significant and positive, as well as being visible both socially, economically and environmentally, however these impacts were relatively small in magnitude. This is largely due to limited household practice with the donated appliances, particularly the SPWP, since the products did not meet all households' needs. The study concluded that the project contributes positively to improving several villagers' income through income-generating activities and a reduction in household expenditure on energy, particularly lighting. The time spent on household chores was significantly reduced, including water collection and cooking. The project brought about positive environmental impacts by reducing deforestation and greenhouse gas emissions through the use of ICS and SPL. However, these impacts could have been enhanced if all the beneficiaries completely switched to the donated appliances and moved away from their primary lighting devices. There was also a reduction in the number of health issues associated with drudgery and exposure to pollutants, leading to an improvement in the health status and perceptions of people, particularly with children studying under better quality lighting. In addition, the project also supported the vulnerable groups, including women, children and the poor.

B. Lessons and issues

Improvement of demand. Villagers intend to purchase renewable energy products when they are aware of the benefits and opportunities

that these donated appliances can bring. With increased awareness, the majority of households investigated are opting for SPL and are willing to pay for it if their current device no longer works, and even more households would like to purchase SPL and ICS if it were cheaper and larger in size. It is clear that the beneficiaries have shown a great interest in energy-efficient appliances, however, they have noted that the supply is inadequate for SPL, as demand is increasing.

Role of NGOs. The role of NGOs in the project implementation is significant and has a strong bearing on the success of the project. The performance evaluation indicated that each activity proceeded smoothly and to schedule for the entire project period, under the partnership between GEI and the Spring Foundation. However, in order to sustain the project outcomes and impacts beyond the project period, NGOs should equip local committees with the technical know-how of managing, operating and maintaining the services in an equitable and sustainable manner. In addition, executing and implementing agencies themselves should also develop adequate capacity in terms of human resources, including technical, social and community interaction skills, for a more effective project management and implementation.

Public participation. Community participation and involvement helps facilitate project implementation, meet villagers' needs and address any local development issues. On the one hand, committee members or local seniors were given the opportunity to decide the scheme's infrastructure. On the other hand, it was just the committee members that were representing the whole village, instead of every individual villager having their say. This is also one of the major reasons why not all the families benefited from the project donated appliances. A greater public participation and more democratic decision-making process would have maximized the project's impacts.

Baseline data. Baseline data is crucial for comprehensive and accurate evaluation of any in-kind aid project. A lack of data for the pilot project assessment made it difficult to employ different evaluation methods and compare any precise changes both before and after receiving the donations. Valid household and community level baseline data is important for project design, implementation and monitoring, to achieve the expected results with the available and proper resources. Besides, water resources, quality mapping, and water shortage household mapping was not conducted, which led to an ineffective SPWP service delivery with poor water quality and restricted piping systems.

Institutional capacity. Capacity building of community based organizations or village committees is vital for the success of the project and its sustainability. Focus group discussions with the two committees found that the committees were relatively weak, as insufficient training regarding the committee's operation was given, and no terms of reference or regular meetings to support its operation were established. Moreover, the committees did not function well when it came to advocacy and fund raising. There is a strong need to build institutional capacity by setting rules and providing training.

User operation guidelines. There was insufficient information or instructions for beneficiaries on how to operate or maintain their appliances. Households ended up using SPL and ICS in a careless or inappropriate way, which meant they did not get as much out of the products and the product's life was reduced. The committee also could not operate the SPWP properly either when it came to the selection of the pump location, planning the pipe network, and repairing the pump when it was out of order. If rules and guidelines on how to operate and maintain the SPWP were given to beneficiaries or the committee, the households may have been able to enjoy greater benefits from the project.

Deforestation. Wood fuel consumption is not likely to decline unless the whole village switches from three-stone fire to clean or energy-efficient cooking stove. It is true that the ICS saves about 2/5 of wood fuel for cooking, however 73% of households still use their primary cooking method together with ICS, due to the small size of the ICS. Consequently, the majority of households still use an abundance of wood fuel when cooking. There is also a greater need to adopt energy efficient cooking stoves, as the distance and time to collect wood fuel is steadily increasing.

Benefits for vulnerable groups. Those who are better-off are often able to find ways to live a better quality of life and thus this rural development project expected to have a special focus on vulnerable groups. The survey results suggested that women benefitted from the pilot project through reduced drudgery. Children are also able to study longer at home since receiving the SPL, and poor households benefit the most from the time saved on water collection and longer lighting hours. However, women's participation is not equal to that of men, and some of the children who really needed the SPL were not able to receive it. Overall, the vulnerable groups failed to be involved in the decision-making process.

Limited household practices in income-generating activities. The use of donated appliances for income-generating activities has been very limited, but the potential to increase household income is relatively high. The interviews with the households suggested that only some of them were involved in income-generating activities, like weaving, opening a home shop, and making and selling traditional food by using SPL and ICS. The improved lighting and cooking devices have definitely improved households' productivity and income. A greater economic impact might be experienced if more households involved themselves in business activities using the appliances.

C. Recommendations

1) Establish a database of baseline studies and regulatory in-kind aid project evaluation mechanism.

Through this evaluative study, it has become clear that in most cases the data is inadequate or does not exist to meet even the basic requirements of the project evaluation. It is important to establish a database of individual, household and community level baseline data for each in-kind aid project. Baseline data should be able to identify valid comparisons of individuals, households, and communities in a "with and without" and "before and after"

scenario. Baseline data should also correspond to verifiable indicators in the project design and monitoring framework. This would allow for the database to assist with project target setting and activities in the project timeframe. Moreover, comprehensive baseline data could steer the project implementation towards the expected results, as well as facilitate its monitoring and evaluation.

Apart from baseline data studies of local communities, baseline targets of the project should also be set in order to conduct project monitoring and evaluation. Measurable, relevant and time bound objectives and the expected outcomes of an in-kind aid project should all be stated clearly in the early stages. A thorough monitoring and evaluation mechanism should be established to monitor periodic progress in achieving each target. In this case, the executing and implementing agencies could follow up the project in a systematic manner during the aid implementation and after its completion, as well as predict, correct and adjust any unexpected outcomes in a timely manner before it is produced. Through evidence-based and rigorous project evaluations, in-kind aid performance and impacts can be quantified, and results can effectively serve as a reference to strengthen future aid programming and operations.

2) Strengthen capacity building of local people, local committees and local implementing agencies.

In-kind aid should not be a one-off practice; consequent efforts are required after distributing the donated appliances to maximize the benefits to the locals. To ensure the sustainability of the aid benefits, there is a need to strengthen local communities and implementing agencies' capacity building. Households' capacity building includes appliance operation and maintenance training, as well as raising awareness around the use of renewable or clean energy appliances. Specifically, written instructions on the appliances in the local language and training on how to use and maintain them properly should be given to users. It also suggests that holding a workshop highlighting the benefits and opportunities associated with renewable energy, water and sanitation, as well as environmental protection would be beneficial.

With regards to capacity building of local committees, they should receive training on how to operate community-based organizations and how to organize community activities, as well as how to advocate people and conduct fund raising. To ensure community-based organizations can function independently and systematically, a regulatory committee operation framework should be established, including a regular meeting schedule, clearly defined committee roles and committee plans.

Regarding the local implementing agency, the project staff should also be trained and be equipped with a mix of skills, including technical, social and community interaction skills, in order to more effectively manage and implement. By building this comprehensive capacity for all local stakeholders, it could lead to the sustainment of the aid's outcomes and impacts beyond the project period.

3) Encourage greater public participation and give prominence to vulnerable benefits in in-kind aid projects.

Greater public participation should be encouraged when donating, selecting, distributing and operating the appliances. At the initial stage of the aid project design, the villagers' voice on the appliances and distribution of the services should have been considered. During the project implementation stage, villagers were encouraged to participate in all the project activities, includes training, device installation and distribution, as well as routing maintenance during the project operation period. To enhance the community involvement and sensible decision making by the villagers, workshops and training should be given.

Moreover, priority should be given to vulnerable communities involved with in-kind aid projects, under the idea of greater public participation. Women, children, the elderly and the poor should have priority over the selection and distribution of the donated products. Women are encouraged to actively involve themselves in making a decision at any stage of the implementation and operation, as well as playing a significant role in the community based organizations. This can be achieved through advocacy campaigns, gender empowerment training and working in the local communities. In this case, vulnerable groups can meet their needs through the project and empower themselves in community affairs, thus indicating that the in-kind aid could support itself in an equitable and sustainable manner.

4) Stimulate household demand for the donated appliances, and establish a local market for them.

Renewable and clean energy has tremendous potential to increase household income and the quality of rural life, whilst also reducing deforestation and carbon emissions. The TBK pilot project and the following USD3.3 million in-kind aid from the Chinese national government have both introduced energy-efficient appliances into rural areas of the beneficiary country. However, those appliances as a one-off donation are limited in terms of their impacts, and will not bring sustainable and tremendous benefits to all. Besides, donor communities in Myanmar are also concerned about the increased challenge for sustainable private sector provisions of SPLs, caused by Chinese aid donations. Therefore, the next step should help boost demand for those appliances and establish a local market for the appliances.

From the demand side, it is important to launch awareness programs to boost rural household demand for safe and efficient use of renewable appliances. Implementing various outreach activities and marketing campaigns to promote renewable and clean energy appliances through the radio and other programs could be fruitful. From the supply side, the Improved Cooking Technology Program in Haiti, funded by USAID, suggests that assistance should be given to manufacturers and or importers and retail companies to enable the expanded availability of energy-efficient appliances, particularly through project grants²². Financing solutions for households to

enable them to purchase appliances should also be provided. With all these efforts, a local demand is expected to be stimulated, as well as a local market establishment. This would contribute to a decrease in the consumption of polluting energy sources, and help eradicate villagers' stubborn behavior.

5) Strengthen stakeholders' coordination and partnerships to deliver in-kind aid.

The role of NGOs should be more than just social mobilization and the conducting of training. As a Chinese NGO, GEI could play a significant role in implementing foreign in-kind aid projects in beneficiary countries, starting from baseline data collection, appliance distribution and community capacity building, right through to post-project evaluation. NGOs have close functional relationships and collaboration at all levels among key stakeholders, including governments, private businesses and local communities, which could effectively guarantee the aid project implementation. In the studied pilot project, GEI partners with local NGO (Spring Foundation) to conduct baseline data collection and community training, as well as deliver renewable or clean energy services in a remote village. GEI has several contacts when it comes to SPL, ICS and SPWP manufacturing enterprises for product screening and purchases. It also spearheaded the signing of the "Supplementary Agreement to South-South Cooperation Donation", which helps Myanmar to improve its rural villages' livelihood through SPL and ICS. The role that GEI as a Chinese NGO is playing in this in-kind aid delivery process should be recognized by the Chinese national government. Moreover, the Chinese government and NGOs should strength their partnership when implementing climate change related in-kind aid. Chinese NGOs should also continue to partner with enterprises and local NGOs, as well as facilitate greater coordination between different stakeholders. With the joint efforts working towards delivering in-kind aid, it could result in a more effective aid project implementation and operation.

²² USAID (2015) *Haiti improved cooking technology program - final performance evaluation report*. Contract number AID-521-O-15-00026.

7. APPENDIXES

Appendix A

TBK Pilot Project Performance Evaluation Matrix

Performance	Questions	Information required	Data collection	Data analysis
Relevance	How relevant is the TBK project in light of Myanmar’s developmental policies or plans?	National policies or plans about Myanmar’s development priority	<ul style="list-style-type: none"> • Document review • Interview with key informants • Household survey • Focus group discussion with village committees 	<ul style="list-style-type: none"> • Content analysis • Descriptive statistics
	How adequacy of the project design in addressing identified development constraints?	The project results in addressing identified issues		
Effectiveness	To what extent is the project outcome, as specified in the project proposal achieved?	The anticipated and actual outcomes		
Efficiency	How efficient is the project cycle?	The planned and actual project schedule		
		Main factors that have been affecting the project efficiency		
Sustainability	To what extent has the project support a catalytic effect?	The potential of replication outside the project and scaling-up		
	Are institutional, financial and other resources sufficient to sustain the project’s outcome?	Situation of donated product maintenance and functioning of created committee		
	To what extent are the emerging results of the project sustainable in an environmentally, socially and economically way?	Sustainability of environmental, social and economic impacts		

TBK Pilot Project Impact Evaluation Matrix

1. Improved cooking stoves (ICS)

Impacts	Questions	Information required	Data collection	Data analysis
Economic impacts	Did the ICS increase people's financial security/income?	Saved expenditure on fuel per month		
		Increased income from income-generating activities using ICS		
	Did ICS reduce the time spent on cooking and collecting fuel?	Saved cooking time using ICS		
		Relative change of frequency and time spent on collecting fuel per week		
Social impacts	Did ICS improve people's health?	Relative change in incidence of eye irritation, cough, headaches etc. using ICS	<ul style="list-style-type: none"> Household survey Key user interview Field visit Cook stove testing report 	<ul style="list-style-type: none"> Content analysis Descriptive statistics
	Did ICS safer than the traditional one?	Perceived safety change using ICS, e.g. smoke, flames etc.		
	Did ICS reduce health impacts related to drudgery associated with fuel collection?	Relative change of drudgery' impacts on health, e.g. muscle strain, blisters		
	Did vulnerable people benefit from the ICS?	Proportion of the poor, children and women beneficiaries		
Environmental impacts	Did ICS help to reduce deforestation?	Relative change in the amount of wood fuel for cooking per time		
	Did ICS help to reduce greenhouse gas emission?	Amount of CO ₂ when cooking		

2. Solar power lights (SPL)

Impacts	Questions	Information required	Data collection	Data analysis
Physical impacts	Did SPL improve quality of lighting?	Perceived change of lighting quality	<ul style="list-style-type: none"> Household survey Interview with key users 	<ul style="list-style-type: none"> Content analysis Descriptive statistics
	Did SPL improve lighting hours?	Relative change in lighting hours		
Economic impacts	Did SPL increase people's financial security/income?	Increased income from income-generating activities by using the lights		
		Relative change in monthly expenditure on kerosene, candles, battery torches etc.		
Social impacts	Did SPL improve people's health?	Relative change in incidence of burns, cough, eye irritation, headaches etc. using SPL		
	Did SPL improve people's safety and security at night?	People experience increased feelings of security and control over their environment after sunset using SPL		
	Did SPL improve children's education?	Additional amount of time spent studying at home after sunset		
		Perceived improvement on pupils' academic performance, and motivation		
	Did vulnerable people benefit from the light?	Proportion of the poor, children and women beneficiaries		
Proportion of women in village committees				
Environmental impacts	Did SPL help to reduce greenhouse gas emission?	Amount of CO ₂ reduced when switch from previous lighting methods to SPL		

3. Solar power water pump (SPWP)

Impacts	Questions	Information required	Data collection	Data analysis				
Physical impacts	Did SPWP provide good quality of water?	People's perception of water quality	<ul style="list-style-type: none"> Household survey Focus group discussion with members of water supply committee 	<ul style="list-style-type: none"> Content analysis Descriptive statistics 				
	Did SPWP provide enough quantity of water?	Relative change in water consumption and frequency of fetching water						
	Did SPWP improve the accessibility for fetching water?	Relative change in time for fetching water						
	Did SPWP provide greater reliability of the services?	Service in seasons, peak hours, and under different weather condition						
Economic impacts	Does SPWP a cost-effective project?	Villagers' contribution to pump maintenance			<ul style="list-style-type: none"> Household survey Focus group discussion with members of water supply committee 	<ul style="list-style-type: none"> Content analysis Descriptive statistics 		
	Did SPWP increase people's financial security/income?	Relative change in monthly expenditure on water						
Shift in time spent on income-generating activities and extra income								
Social impacts	Did SPWP improve people's health?	Relative change in incidence of waterborne and water-related diseases					<ul style="list-style-type: none"> Household survey Focus group discussion with members of water supply committee 	<ul style="list-style-type: none"> Content analysis Descriptive statistics
		Relative change in frequency for hand washing, bath, laundry and toilet washing						
		Relative change of health impacts from fetching water, e.g. muscle strain, blisters						
	Did vulnerable people benefit from the SPWP?	Proportion of the poor, children and women beneficiaries						
		Proportion of women in village committees						