

Malawi

Data Collection Survey on Productive Use of Energy
(PUE) in Rural Area in Malawi
Final Report

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List of abbreviation

Abbreviation	Full term
DOE	District Agricultural Offices
EPA	Extension Offices
EaaS	Energy as a Service
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
JICA	Japan International Cooperation Agency
MA-SHEP	Project for Market-Oriented Smallholder Horticulture Empowerment and Promotion
MWK	Malawi Kwacha
NEEF	National Economic Empowerment Fund Limited
PAYGO	Pay As You Go
PUE	Productive Use of Energy
SHEP	Smallholder Horticulture Empowerment and Promotion
SHS	Solar Home System
SWIFT	Survey of Well-being via Instant and Frequent Tracking
TOR	Terms of Reference
TA	Traditional Authority
WFP	World Food Programme

1. Background

While the average electrification rate in sub-Saharan Africa is 50.6%, Malawi's electrification rate is 14.2% on average nationwide and 5.6% in rural areas, which is far below the sub-Saharan African average (World Bank, 2021). In addition, about 80% of the population is engaged in agriculture as small farmers (World Bank, 2020), and it is estimated that many live in un-electrified areas. JICA has been supporting the improvement of electricity supply in Malawi through Grant Assistance for projects such as the Electricity Substation Rehabilitation Project in Lilongwe. However, these projects have focused on infrastructure development in urban areas, and have not yet attempted to improve access to electricity in rural areas. Furthermore, even in farm households where the electricity distribution network is close to the house, there are many cases where the farmer has not signed a contract for electricity supply due to price obstacles. Given the current situation, future electricity access improvements will require not only an approach centred on infrastructure development in urban areas, but also an approach from the perspective of rural areas and support for improving incomes in rural areas.

JICA implemented a technical assistance project, the Project for Market-Oriented Smallholder Horticulture Empowerment & Promotion Project in Malawi (hereinafter referred to as "MA-SHEP"), from 2017 to 2023. The MA-SHEP project was implemented in Malawi to support small-scale horticultural farmers to increase their income through the SHEP approach. Some of the farmer groups whose income has increased through MA-SHEP have purchased solar panels and solar home systems (SHS) with their income. This is contributing to gradual progress in the use of energy in un-electrified areas.

On the other hand, the poverty rate in Malawi in 2020 is 73% (World Bank, 2022), and farmers remain in a difficult economic situation. To further increase farmers' income, it is necessary to further develop agricultural extension services based on the SHEP approach, as well as to promote the dissemination of small-scale irrigation equipment that contributes to an increase in productivity, and to promote the availability of transportation to improve market access.

In addition to SHS sales, many local solar companies in Malawi are currently seeking to develop products such as agricultural equipment and transportation that utilise solar panels to solve the above issues. This type of energy use is called Productive Use of Energy (hereinafter referred to as "PUE"). PUE promotes energy use in areas where electricity demand has not yet reached a level that requires the development of electricity infrastructure. For example, some of the farmer groups targeted by MA-SHEP have been identified as having individual or group ownership of small-scale irrigation pumps or treadle pumps using fossil fuels in areas where access to water is a challenge. For example, among the MA-SHEP farmer groups, in areas where access to water is an issue, about half of the farmers have small irrigation pumps which use fossil fuels, or treadle pumps. There is an estimated certain amount of latent demand for PUE equipment such as solar-powered pumps.

Considering the current situation, this survey examines the feasibility of promoting the use of PUE equipment by local solar companies in rural areas in Malawi.

2. Purpose and concept of the study

The objective of this work was to gather information to study the feasibility of promoting the use of PUE equipment in rural Malawi, and to implement new approaches to improve sustainable livelihoods of farmers through use of rural energy. Specifically to analyse changes in awareness of the use of solar pumps among target farmers by having a local company in Malawi

Specifically to analyse changes in awareness of the use of solar pumps among target farmers by having a local company in Malawi (henceforth referred to as ‘the sub-contractor’) carry out sales promotion activities on behalf of Solar Pumps with the aim of considering effective approaches to promote the use of PUE equipment (solar pumps) by farmers. The following information was collected with the aim of The main points to be verified through the survey and the conceptual diagram of the survey are presented in the next section.

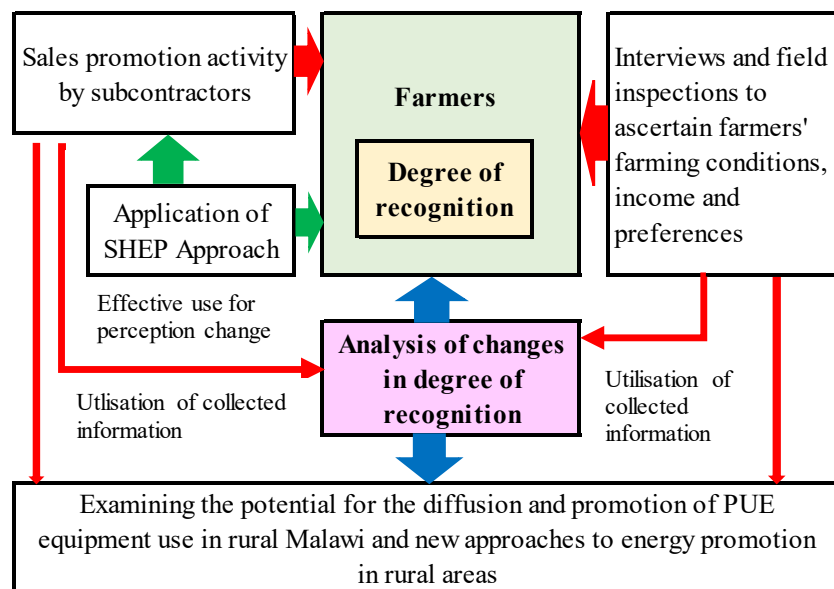


Figure 1: Concept diagram of the study

- 1) Information about farming and sales conditions and income to farmers and farmers' interest and situation of preparation to use solar pumps.
- 2) Solar pump promotion activities implemented by subcontractors and their effects on changes in farmers' degree of recognition and their decision-making.
- 3) Information on the effectiveness of activities based on the SHEP approach to promote changes in the perception of solar pumps

Based on the information above, the effect of the SHEP approach represented by the farmers' meetings on the awareness and decision-making of the target farmers regarding the purchase of solar pumps and the effect of the sales promotion activities by the subcontractors, and other positive impacts on the decision to use solar pumps were considered, activities were analysed, and specific factors were examined. Based on the results of those analyses, approaches that are considered effective in promoting solar pumps and energy promotion in rural Malawi were examined.

The characteristics of interest and situation of preparation by target farmers to use solar pumps are discussed in Chapters 9.2 and 9.3. The effects of the study's activities on changes in farmers' recognition degrees on solar pump and decision-making are described in Chapters 9.4 and 9.3, while the effects of the implementation of activities related to the SHEP approach, the farmers' meetings, are described in Chapters 7.4 and 12.2.

3. Framework of the study

3.1 Activity period

The activities were implemented from November 30, 2023, to November 29, 2024.

3.2 Target sites and target farmers

Results of the analysis based on SWIFT (Survey of Well-being via Instant and Frequent Tracking) developed by the World Bank and the situations of the target farmers who received support by MA-SHEP show that Ntchisi, Mchinji, and Dowa West near Lilongwe.

Basically, this study targeted farmers who received support by MA-SHEP, but never used a solar pump. The details of the interview items in the table below are explained in detail in chapter 4.2, “Gathering detailed information on target farmers”.

3.3 Target PUE equipment and implementing agencies

Based on the results of the analysis from the preliminary study conducted by JICA, some challenges in access to water were found. Therefore, **the PUE equipment targeted in this study was determined to be solar pumps**. The relevant agencies for implementation of the study were the District Agricultural Offices (DOEs) and Extension Offices (EPAs) in the three target districts, and the subcontractors handling solar pumps.

The study outsourced the solar pump promotion activities to subcontractors, which was an important pillar by considering effective approaches, possibilities and challenges for promoting energy use and rural development by farmers mainly implemented by the private sector. The effects of the setting in this study are specifically explained in Chapters 14 in this report.

4. Principles and methods for implementation of the survey by consultants, and schedules

4.1 Basic principles of the study

Based on the aforementioned background and the widespread use of solar pumps, the study was conducted according to the following basic principles.

Table 1 : Basic principles for the study and contents

Basic principles	Contents
Basic technical principle 1	While conducting research, carrying out analysis, and implementing sales promotion activities from the perspective of Malawian farmers, Japanese consultants will take the lead in collecting information in order to collect necessary information. The survey activities and sales promotion activities by the subcontractors, as well as the analysis of changes in awareness and the study of approaches to promote the use of solar pumps based on the results, should also be analysed and studied from the perspective of the target farmers, giving due consideration to their characteristics. Information on the target farmers of this work will be collected with the cooperation of DOE and EPA extension workers in each target district, but the Japanese consultant team will take the lead in collecting information.
Basic technical principle 2	The degree of recognition of solar pumps is divided into phases, and the situations of the target farmers in each phase are taken into account for implementing survey activities and sales promotion by local subcontractors. The objective of the work by the subcontractor is to conduct sales promotion activities to encourage or increase the likelihood of the target farmers purchasing solar pumps, and discussions will be held with the subcontractor to ensure that the sales promotion activities take into account the target farmers' level of awareness. For a degree of recognition, sales promotion are an initial activity to help farmers understand the functionality, price and operation of solar pumps. Then, if farmers can then deepen their understanding of the functions and use of the solar pumps through demonstrations and trial use, it can be expected that this will have the effect of changing their attitudes towards the solar pumps before they make a purchase. Thus, demonstration of solar pumps are suggested to be conducted to the subcontractors.
Basic technical principle 3	The SHEP approach that may be useful in facilitating the purchase of solar pumps by target farmers are confirmed, and consider effective ways to promote the purchase of solar pumps. The effectiveness of the implementation of the agricultural stakeholder meetings in promoting the purchase of solar pumps by target farmers, the state of cultivation and sales in line with market needs, and whether the action plan has been updated will be checked. The implementation of SHEP activities, which are considered to enhance the

Basic principles	Contents
	effectiveness of this study, will be checked to ascertain their effectiveness in relation to the purchase of solar pumps.
Basic technical principle 4	Provide support to target farmers and subcontractors in conducting farmer interviews and monitoring activities to promote the use of solar pumps, but analyse farmers' decision-making processes and issues from as neutral a position as possible, rather than encouraging them to buy a specific pump from a specific subcontractor. To ensure that the survey team understands that they are not in a position to purchase solar pumps during information gathering and monitoring activities, the purpose of the visit is only information gathering, monitoring and coordination, not to provide agricultural materials or solar pumps, and monitoring visit activities from a neutral position, and thus, the monitoring visits were conducted from a neutral standpoint. Care was taken to ensure that farmers were able to speak honestly by clearly communicating to them that the aim was not to force them to buy a particular solar pump, but also that if there were any issues, the farmers would like to work together to see what measures could be taken to address them.
Basic operational principle 1	Employ staff familiar with the local situation to carry out smooth and appropriate survey activities. Malawian staff and others who have worked for MA-SHEP in the past will be employed to accompany the Japanese consultants when they visit target farmers and conduct interviews, and to provide interpretation and make necessary arrangements in advance. When Japanese consultants cannot conduct survey in the field, these two Malawian staff conduct the survey activities instead.

4.2 Gathering detailed information on target farmers

Interviews began in the second half of the first field trip to ascertain the detailed situation of MA-SHEP groups in the three target districts. In the subsequent second round of field work, interviews with the target farmer groups were conducted mainly by Japanese consultants with the cooperation of extension workers.

The interview topics were mainly categorised as follows:

- 1) Basic information of interviewed target farmers, including gender, role within the group, family composition, type of land ownership, and main livelihood.
- 2) Farming and sales information covering cultivated area and yield per crop, sales prices, costs, revenue, profit, sales destinations, group sales potential, savings status, and challenges related to farming.
- 3) Interest in solar pumps, including the most appealing product and the reasons for such, whether they have decided to purchase, reasons for purchase or non-purchase, payment methods, payment periods, and if undecided, the reasons for indecision.
- 4) Water usage including the type and distance of water sources, prior experience in purchasing or using irrigation equipment such as engine pumps or treadle pumps, and the presence of other irrigation systems.

JICA study team also visually checked the condition of the fields and water sources and asked questions about how solar pumps, if purchased, could be used. (See Appendix 1 for the questionnaire to understand target farmers' situations.)

For item 3) above, the expert team focused on confirming farmers' interest in solar pumps, their decision to purchase, and the approximate timing before and after agricultural stakeholder meetings and on-site demonstrations by solar pump companies. The expert team aimed to understand shifts in purchasing intent and the factors influencing these decisions. For item 4), the expert team conducted on-site inspections to verify the approximate distance between the farmland and water sources of group

members. The expert team also examined the areas where groups planned to use solar pumps and the water extraction points to accurately understand their solar pump utilization plans.

When conducting interviews with target farmers, the expert team selected one farmer per group under the condition of an average income level to accurately capture overall trends within each group. Additionally, considering that most groups were likely planning to purchase solar pumps collectively rather than individually, the expert team invited group representatives or members who were knowledgeable about the group's overall situation to participate in the interviews. This enabled information collection concerning the decision-making process for group purchases, preparations such as fundraising, and other relevant factors. Furthermore, to avoid disrupting interactions between farmers and subcontractors during the survey, the expert team explained the following points at the start of each interview.

- 1) The purpose of the survey is not to provide free solar pumps, but to confirm farmers' interest in and decision regarding solar pumps through stakeholder meetings and demonstrations.
- 2) The expert team does not coordinate communication between groups and solar pump companies, and responsibility for communication and purchasing rests with the farmers.

Each interview was accompanied by one or two extension officers or agribusiness officers, who provided supplementary information about the group's previous purchase experiences and explained the purpose of the survey project. The expert team also ensured the officers would understand the need for follow-up regarding the purchase of solar pumps and improvement of their livelihood after the survey. The information gathered was interpreted by the local staff hired for the project.

4.3 Methods of conducting monitoring and items to be interviewed

The monitoring activities were conducted at slightly different dates from those of the aforementioned interviews to the extent possible within available resources. Monitoring activities were conducted to assess the situation and issues, focusing on farmer groups that have purchased solar pumps or decided to use them in some way, and groups that have taken time to make decisions on their use. Monitoring activities focused on groups that had already decided to purchase solar pumps or had not yet decided whether or not to purchase them, among others. During the visits, interviews focused on the following information.

- Whether farmers already purchased a solar pump or are using a loan service
- If farmers have neither purchased nor rented a solar pump, their decision-making status regarding pump use
- If farmers have purchased or decided to purchase a solar pump, the type of solar pump and the reasons for their choice
- If farmers have decided to purchase or rent a solar pump, the state of their preparations, including collecting money and contacting the subcontractors
- How to share the use of the pumps
- Challenges in using the pumps and possible measures to overcome them

As a point of attention during the visits, efforts were made to ensure that not only the project team but also government officials were accompanied by the agricultural extension officers or agribusiness officers in charge of the groups concerned, so that they could clearly understand the activities of the study and the situation of the farmers. Originally, it was hoped that these monitoring activities would be carried out by government officials, but without transport and daily allowances, they did not seem to act on their own, so the project team took the lead in carrying out monitoring activities, and when the Japanese consultant was not in Malawi, the project staff were asked to visit and monitor the project.

To avoid giving farmers the wrong impression during these activities, it was communicated to each farmer group during the interviews and monitoring visits that the survey team's visits were only for information gathering, monitoring and coordination, and not for providing agricultural materials or solar pumps.

4.4 Work schedule

The schedule for this work is shown in the following chapter. All activities from [1] to [17] in the table were carried out without problems.

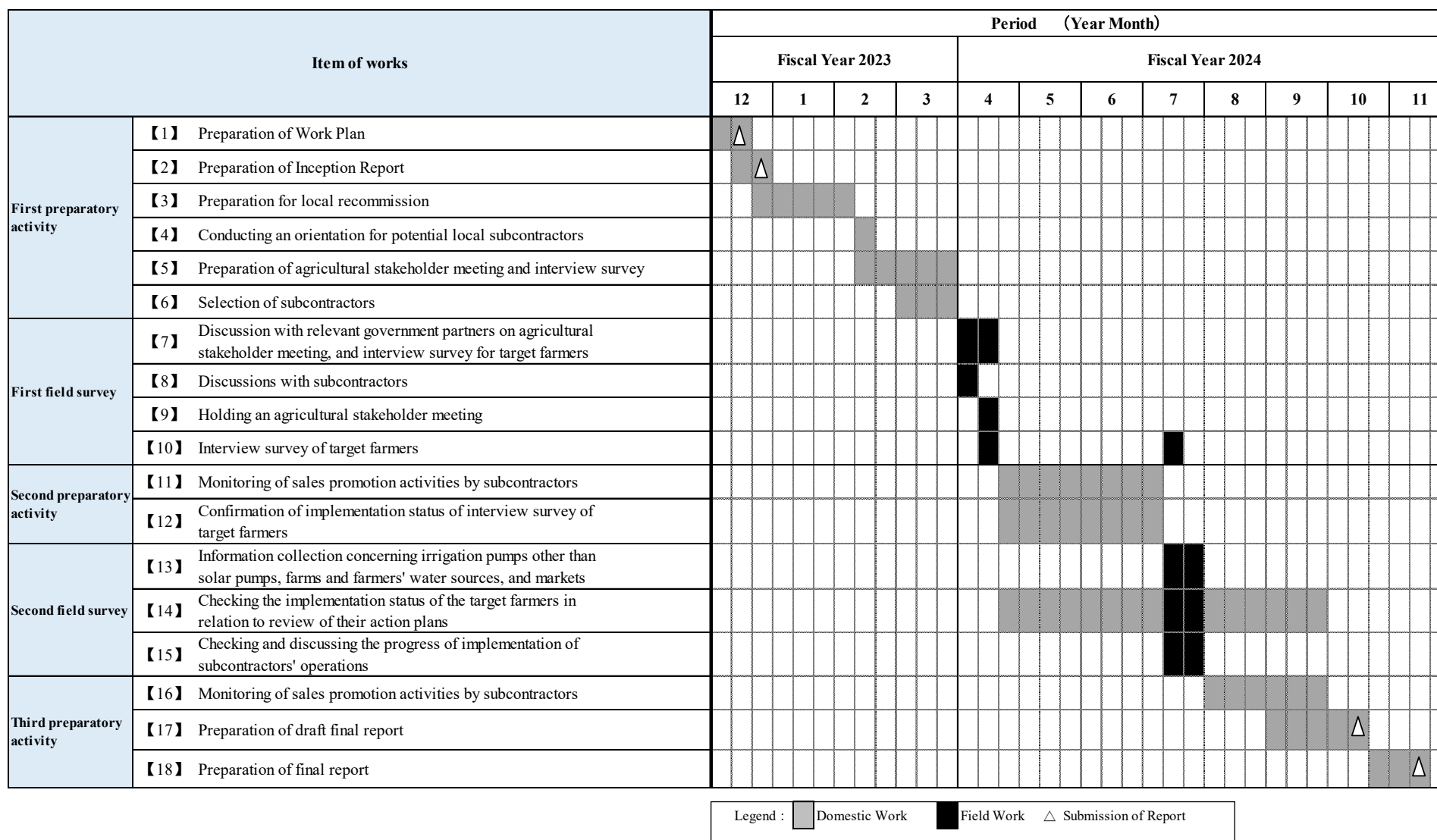


Figure 2: Work schedule

5. Selection of subcontractors and preparation of activities

5.1 Preparation of subcontracting work

The study of the specific work content and draft selection criteria for local recommissioning partners started in December 2023, and in preparing the work content (TOR) and draft selection criteria for local recommissioning partners from January 2024, the list of potential subcontractors shared by JICA was contacted to confirm basic points. In addition to the draft work description, draft selection criteria for the subcontractors were prepared and both documents were sent to the Infrastructure Management Department of JICA.

The JICA study team developed a guideline based on the Request for Proposals for the selection of the subcontractors and reference materials on the selection process shared by JICA, and taking into account the content of this study and the work implementation capacity of the subcontractor to which the work is planned to be outsourced. The candidate subcontractors were contacted regarding a briefing session for the candidate operators on the proposal preparation and selection process.

In March 2024, three contractors were selected as subcontractors to carry out solar pump promotion activities for MA-SHEP farmers. The names of each subcontractor and a summary of their organisation and projects are described in the table below.

Table 2: Profiles of the selected subcontractors

	Subcontractor	Organisation and business overview
1	Vitalite Malawi 	- A pioneering company in the solar power equipment sector in Malawi. It operates mainly in the central and northern parts of the country, providing a range of solar equipment and services, including solar home systems (SHS) and solar pumps, for rural and peri-urban residents. https://vitalitemw.com/ - Key partner organisations include USAID and the World Bank. The main capital providers are social investors. - When selling solar equipment, including solar pumps, the instalment sales method, known mainly as 'Pay As You Go' (PAYGO), is applied in instalments over the period of use. - To date, it has sold more than 36,000 solar equipment units in 12 concentrated national regions, with 35 full-time staff and more than 300 sales representatives.
2	SunnyMoney 	- A social enterprise founded by SolarAid, a UK-based international NGO. It has 18 years of experience in the business of selling solar home systems (SHS), mainly solar lights, in Malawi. For about two years, it has also focused on selling solar pumps for irrigation. https://sunnymoney.org/ - Sales of solar equipment, including solar pumps, are mainly conducted mainly leasing as part of an 'Energy as a Service' (EaaS) model. - SolarAid has worked in Kenya and Tanzania in the past and is also operating in Zambia (SunnyMoney Zambia). It also has partner organisations in Senegal and Uganda. https://web.archive.org/web/20200416231232/https://solar-aid.org/ - Its activities are carried out in cooperation with a financial institution called FEBCO-SACCO (registration required).
3	MAEVE Project 	- A local Malawian NGO established in 2013. - The main goal is to improve access to clean energy technologies for the rural population, and they implement project activities for various development partners, including the World Bank and GIZ, in the dissemination of clean improved cooking stoves and solar equipment. In recent years, the company has also focused on promoting solar irrigation systems, applying the PAYGO system when selling solar pumps. - The main aim is to raise awareness and stimulate demand for clean energy technologies in rural communities and promote linkages with distributors in the private sector.

5.2 Selection method

The selection of the subcontractors for the recommissioning of the project was based on a nominated proposal method, whereby applications were invited from pre-selected candidate contractors and a decision was made based on a comprehensive evaluation of technical proposals and prices. The first condition for the selection of candidate contractors was that they must have a proven track record in the solar pump business in Malawi or have new business plans for the future. Based on the results of the questionnaire, a total of 7 organisations were identified as candidates.

In March 2024, online briefings were held for these contractors on the implementation of the recommissioning work and the selection process. As a result, proposals were submitted by four contractors, and after conducting interviews with each contractor, the top three contractors with the highest overall evaluation scores based on the selection criteria prepared in advance were selected as subcontractors.

5.3 Contract contents

The contracts with the three subcontractors were for a period of approximately eight months, from the beginning of April to the end of November 2024, and the contract amounts were all set at approximately 500,000 Japanese yen. The specific period of work was for approximately six months, from early April to early October 2024, and mainly included the following tasks.

- (1) Preparation prior to agricultural stakeholder meetings and cooperation by JICA expert team in carrying out surveys.
 - Considerations of solar pumps for sale
 - Review of the plan of promotional activities for solar pumps and discussions with the survey team
 - Introduction of farmers using solar pumps and their cooperation in interviews by the JICA study team
 - Accompanying the JICA expert teams on pre-surveys for MA-SHEP farmer groups upon necessary
- (2) Implementation of sales promotion activities at agricultural stakeholder meetings.
 - Participation in meetings of agricultural stakeholders in the three target districts and implementation of sales promotion activities for solar pumps to the participants
- (3) Implementation of sales promotion activities after agricultural stakeholder meetings, and cooperation by JICA study team in conducting surveys.
 - Conduct promotional activities such as solar pump demonstrations or technical explanations in MA-SHEP farmer group communities
 - Provide necessary information and assistance in response to requests and queries from MA-SHEP farmers
 - Provide cooperation to government officials and financial institutions as required (prompt delivery and installation of pumps when farmers purchase solar pumps)
 - Submission of progress reports and mid-term reports to survey teams

5.4 Discussions and sharing information with subcontractors

Face-to-face meetings were held with MAEVE Project, Vitalite Limited and SunnyMoney separately in the first week of April 2024. Main topics of explanations and discussions at the meetings are as follows;

- The subcontractors were briefed on the objectives and plans of the project's activities and the tasks required of the subcontractors, and their views were exchanged.
- The upcoming activity, the agricultural stakeholder meeting, was explained in detail and the role of the subcontractors and what they should do at the meeting was confirmed.
- The subcontractors were asked to review the information to be confirmed with the participating MA-SHEP farmers during the agricultural stakeholders meeting, which was later shared with them.
- The SWIFT data shared by the JICA study team during the meeting and the information on MA-SHEP

farmers shared by the Ministry of Agriculture were also shared with all subcontractors to be used in future promotional activities.

After the agricultural stakeholder meeting, we asked each subcontractor to submit a progress report to confirm the progress of the sales promotion activities, and held online meetings based on the contents of the reports. Meetings were also held with subcontractors between May and the beginning of October to confirm necessary information and exchange opinions.

5.5 Discussions for reporting to JICA's Infrastructure Management Department

Consultations and reports were held with JICA's Infrastructure Management Department on a monthly or as-needed basis, either in person or online, to discuss and report on the implementation of activities.

5.6 Discussions with relevant organizations on agricultural stakeholder meetings and interview surveys for target farmers

Before travelling to Malawi, several online meetings were held with officials from the Ministry of Agriculture and the three target districts to explain the content of the study and to obtain their consent to cooperate.

5.7 Services and solar pumps introduced by the subcontractors

Detailed information on the solar pumps presented by the subcontractor at the stakeholder meetings was indicated below.

Table 3: Comparison of information on solar pumps handled by subcontractors

Subcontractor	SunnyMoney	Vitalite		Maeve	
Manufacturer	Lorentz	SunCulture		Futurepump	Lorentz
Pump name	PS2-100	ClimateSmart Direct	RainMaker2C Kubwa	SF2	PS2-100
Type of pump	Submersible	Submersible	Submersible	Surface	Submersible
Pump power	150 watts	150 watts	500 watts	120 watts	150 watts
Maximum flow rate	50 L/min	18 L/min	66.7 L/min	47 L/min	50 L/min
Weight (including panel)	7 kg	46.5 kg	71 kg	20.8 kg	7 kg
Hose length	75 m	200 m	200 m	50 m	75 m
Price (when paid in cash)	4,000,000 MWK	1,830,600 MWK	3,567,300 MWK	1,800,000 MWK	3,800,000 MWK
Price (when paid via PAYGO)	4,500,000 MWK	3,322,560 MWK (24 months)	4,793,300 MWK (24 months)	1,800,000 MWK (18 months)	3,800,000 MWK (18 months)
		3,108,000 MWK (18 months)	4,489,200 MWK (18 months)		
		2,914,500 MWK (12 months)	4,200,745 MWK (12 months)		
Payment period under PAYGO	36 months	12-24 months	12-24 months	18 months	18 months



Source: SunCulture.io

Rainmaker 2C Kubwa



Source: Futurecpump.com

Futurepump SF2



Source: Lorentz partnerNET

Lorentz PS-100

The three subcontractors in this study introduced a Pay As You Go (PAYGO) system for all solar pumps, whereby after an initial down payment, the customer pays a monthly amount divided by the number of months in the contracted period. Payment periods range from 12 months up to 36 months, depending on the subcontractors, but payments are generally completed after around 18 to 24 months. Unlike borrowing from financial institutions, this method does not incur interest and does not require collateral, making it more accessible to small-scale farmers such as MA-SHEP. However, the system has the ability to remotely shut down the solar pumps if monthly payments are not paid in time, so monthly payments are essential, whether the purchase is made by an individual or a group of farmers. Some subcontractors increase the price of solar pumps if the payment period is longer, taking into account that the longer the payment period by PAYGO, the longer it takes for subcontractors to obtain the cash, which increases the risk and operation costs.

Of the three companies, SunnyMoney is the only one that has made its solar pumps available not only for sale but also for rental (Energy as a Service). SunnyMoney's philosophy is to make solar pumps widely available to farmers, and the decision was made not only to sell them but also to rent them out on a daily basis. The decision was made based on the idea of testing how it would help the farmers utilize solar pumps, if it was rented out, rather than making a profit from sales. The service was made available to the target farmers at 3,000 MWK per person per day, subject to negotiations with SunnyMoney by interested groups. If all group members are interested in using the service and agree on payment and how the pumps will be managed, the service will be rented out. However, it is also a condition of the loan that several members per day is required to use the solar pump on a daily basis, and SunnyMoney may pull the solar pump if it is deemed to be used infrequently. SunnyMoney expects that even if several farmers use the renting service on a daily basis, it will take five to six years to recover the cost of purchasing the pumps, as they are rented out for higher priced pumps such as the Lorentz.

6. Situation regarding target farmers and relevant local organisations

6.1 Current status of MA-SHEP farmer groups and solar pumps in the target area

In the farmer surveys conducted, information was collected and tabulated in the form of the rainy and dry seasons separated by the periods indicated in the following figure. Based on the survey results, the characteristics and circumstances of the target MA-SHEP group farmers are described below.

6.1.1 Climate of the three target districts

The climate in the three target districts can be divided into two main seasons: the dry season (May-November) and the rainy season (December-April) (Figure 3). During the hottest part of the dry season, around October, temperatures often exceed 30°C. Rainfall is scarce and the air is dry. In the rainy season, on the other hand, heavy rain falls for short periods of time, followed by sunny days, and the temperature tends to rise easily. During the sunny season, the area is exposed to strong direct sunlight, and because of the inland climate, the temperature tends to vary widely from one day to the next.

Dry Season												
Rainy Season												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Figure 3: Changes in the rainy and dry seasons in the three target districts

6.1.2 Gender, household size, occupation and income

All target farmers were interviewed in the farmer survey interviews, one male and one female, on the condition that the general cultivation and average income and expenditure levels within each group were met, with one of them providing the main answers and the other providing supplementary answers. With the above in mind, the results of the interviews were positioned as the average income and expenditure and cultivation details of the group to which the respondent belonged. Of the 15 groups interviewed, 10 were answered by men and the remaining 5 by women. All of the men who responded were the head of the household, and two of the female respondents were widows who were now leading their households. The other three female farmers are headed by their husbands, male farmers.

The number of the target farmer group members is shown in the chart below. Some groups have seen a significant increase compared to the number of target groups pre-obtained from the Ministry of Agriculture in March 2024, indicating a trend for expanding group sizes. The average size of the 15 groups is approximately 107 members, with farmer groups in Dowa West being relatively large. Notably, the Chiyambi group more than doubled in size between July and August. The primary reason for this growth is the group's active promotion of solar pump use during this period and their decision to utilise SunnyMoney's solar pump renting services (EaaS).

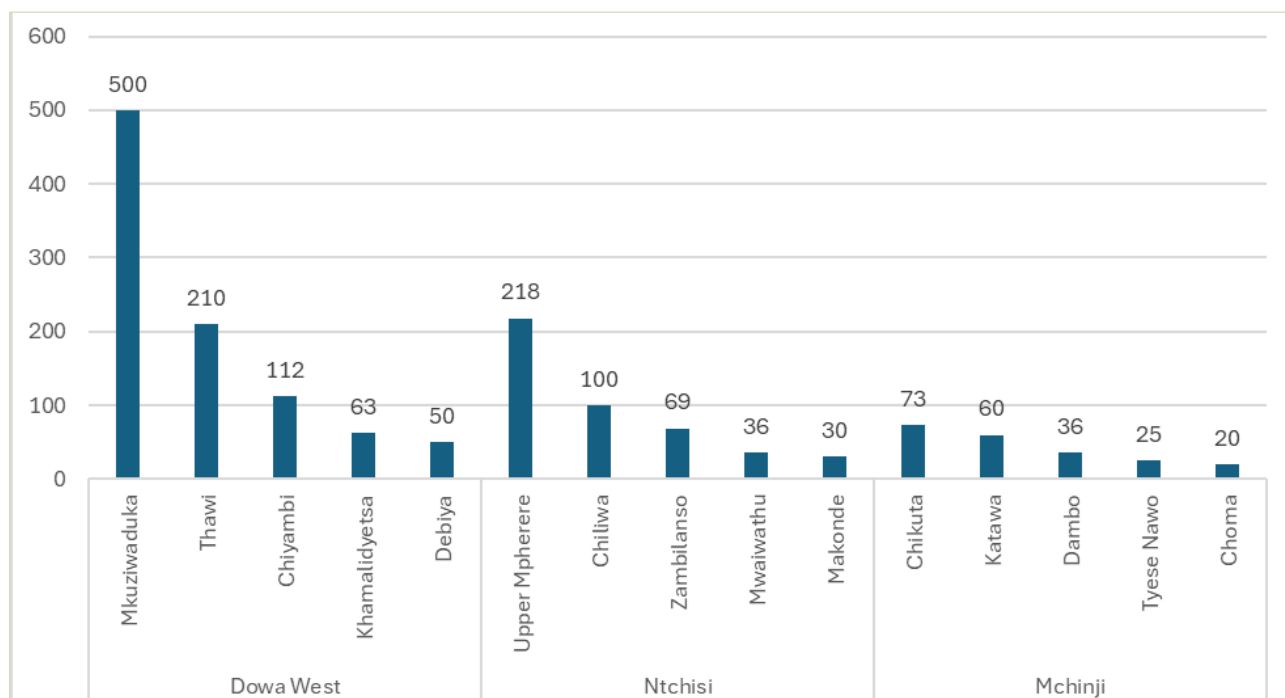


Figure 4: Number of each target farmer groups members

As shown in the figure below, most of the farmers interviewed were in their 40s and 50s, with 10 to 30 years of experience in farming. The average family size for the group as a whole was 7, and the majority of the interviewees had 3 or more children.

14 of the interview respondents reported agriculture as their main source of income, while only 1 respondent reported livestock sales as his main source of income. The average cash balances for each month in each group and the overall average amounts are shown below. As shown in the figure below, the farmer groups in Mchinji

district have relatively large average cash balances, while the majority of the groups in Ntchisi district have considerably lower-than-average savings of groups in other districts.

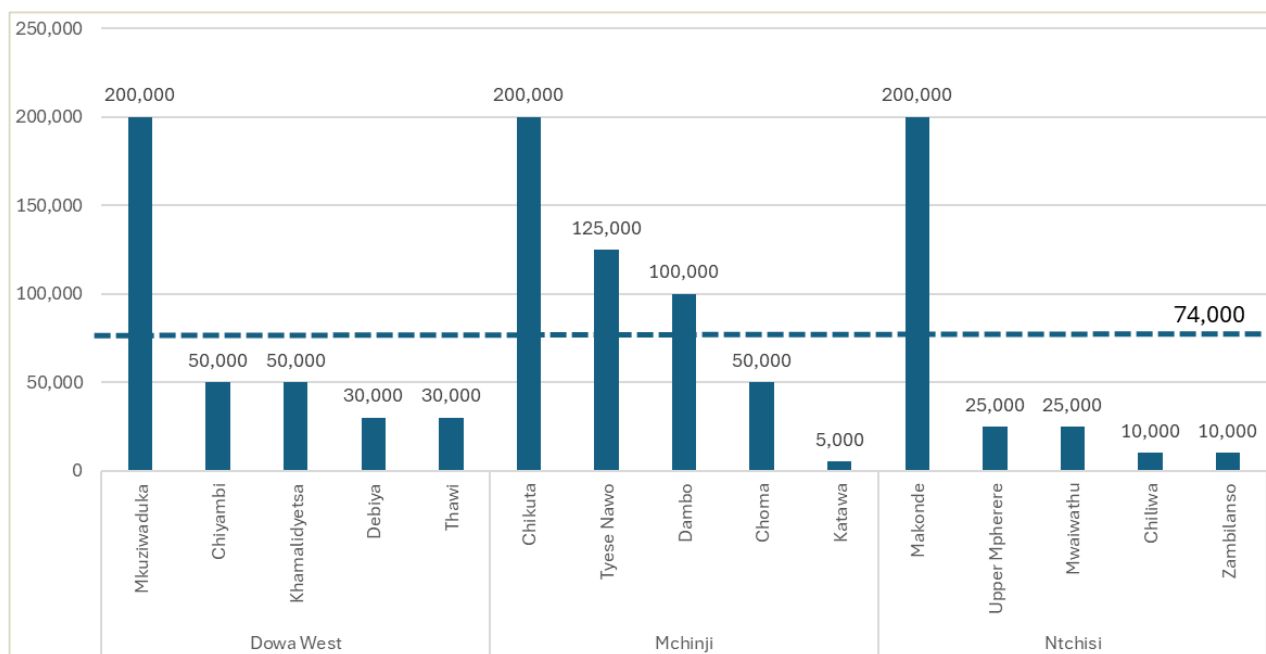


Figure 5: Average cash balances of target farmer groups in each month (MWK)

Regarding the outlook for their future savings situation, respondents of 14 farmer groups indicated that their savings situation was smaller before MA-SHEP began compared to their current situation. Some farmers responded, “I had almost no savings before starting MA-SHEP and did not know how to manage income and expenses to save”, or “I only had about one-fifth (about 2,000 MWK) of what I currently have in savings”. Regarding the outlook for future savings given the current situation, all farmer groups indicated that their savings would increase.

Many of the interview respondents have purchased livestock, a new house that has already been built, including an iron roof and brick walls, and furniture and appliances such as a TV, chair, and desk. Some farmers were identified as considering investments to further increase their incomes, such as purchasing vehicles to access markets and transport crops, and motorcycles to access distant water sources.

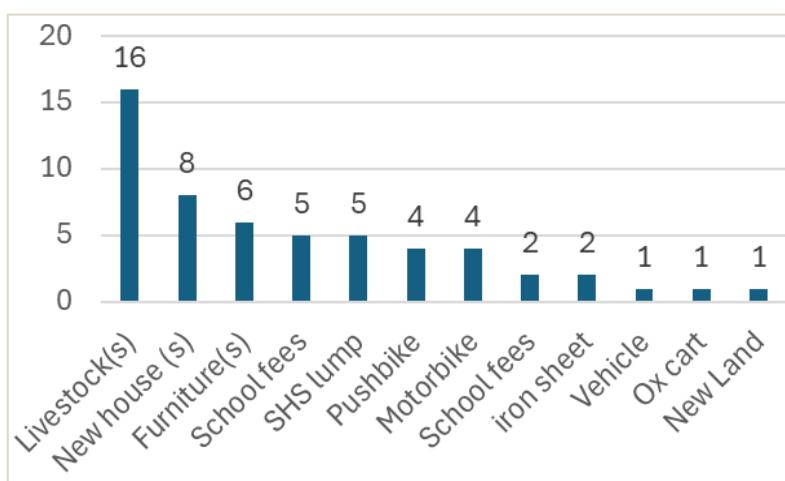


Figure 6: Past purchases by interviewed farmers (number of responses)

Table 4: Photos of items purchased in the past to improve livelihood



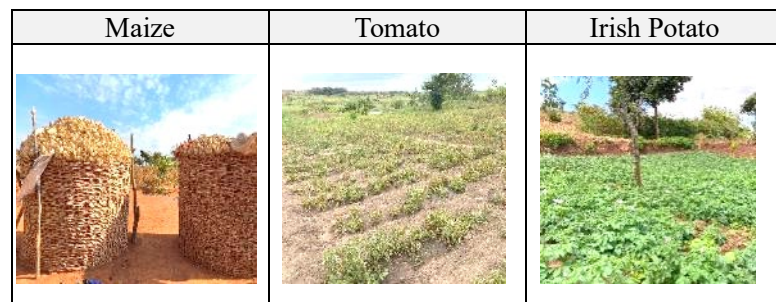
6.1.3 Agricultural crops

All respondents cultivate four or more crops in the dry and rainy seasons, with an abundance of subsistence and cash crops. For the group as a whole, maize, tomatoes, and potatoes were selected as the main crops grown.

Table 5: Top 5 crops grown by target farmers

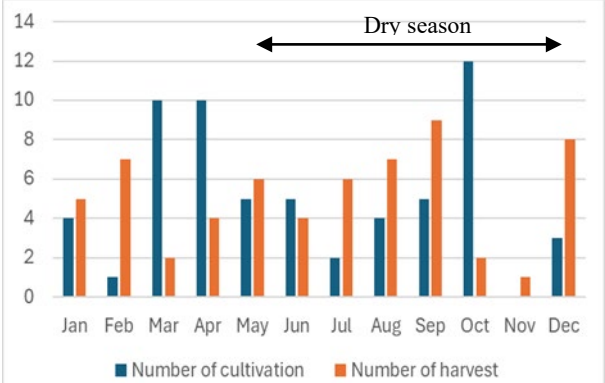
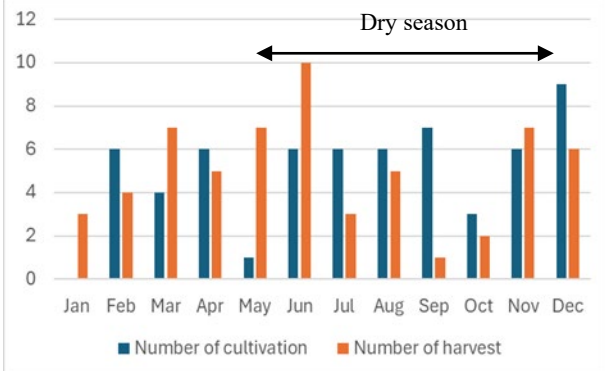
Crops	Number
Maize	14
Tomato	11
Irish Potato	9
Soybean	7
Leafy vegetable	7

Table 6: Crops grown in the field



The start of cultivation and harvest times in each district are shown in the following table.

Table 7: Cultivation and harvest time for target farmer groups by prefecture

Summary	Figure
Target farmer groups in Dowa West district: Sowing of food crops such as maize and leafy vegetables (Leafy vegetables) mainly takes place around the end of the dry season, with leafy vegetables being harvested as early as December and maize in February and during the rainy season. Maize and leafy vegetables are grown several times a year, including in the middle of the dry season (June-August), and some farmers grow tomatoes and other vegetables at the beginning of the dry season in May. As a result, many of the groups have a large harvest around October.	 Figure 7 Planting and harvest times in Dowa West
Target farmer groups in Mchinji district: There are several farmer groups that start growing potatoes and onions in June in the middle of the dry season. Since then, many groups have continued planting maize, tomatoes, leafy vegetables and pulses, with a large harvest around December. Many groups start planting the above crops in the rainy season after dry-season cultivation, which allows them to harvest a large crop in the middle of the dry season, six months later.	 Figure 8 Cultivation and harvest times in Mchinji

Target farmer groups in Ntchisi district:
Farmers started planting maize, potatoes and beans around November in line with the start of the rainy season, with the addition of onions, which are widely grown in the district, in December, marking the peak of planting. Thereafter, farmer groups were observed to start sowing tomatoes in addition to maize and potatoes in April and May, in line with the start of the dry season. All groups planted one variety only once or twice a year, a relatively low number of times compared to other districts.

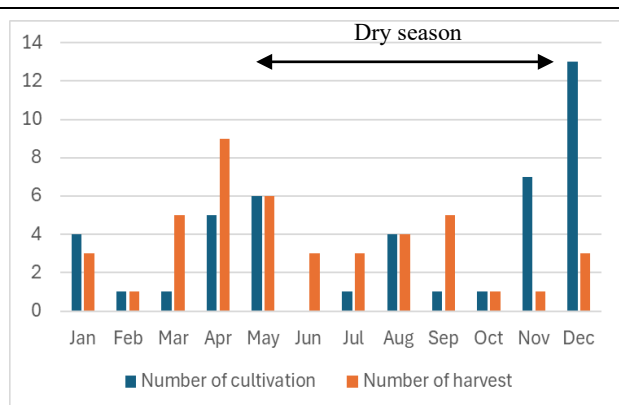


Figure 9 Cropping and harvest times in Ntchisi

6.1.4 Market and sales conditions, land ownership

The following table shows the ownership of land among the interviewees and whether or not the MA-SHEP farmer groups they belong to sell together as a group: two-thirds of the farmers own their own land, while the others rent land from their landlords in addition to their land, and one respondent rents 2 acres of land and pays 50,000 MWK/year/acre for it. One respondent rented 2 acres of land and paid a rent of 50,000 MWK/year/acre. There were some variations among the groups in terms of whether or not joint sales were involved, and some groups did not necessarily consider joint sales as part of their activities in the group.

Table 8: Land ownership

Land owned	# of Respondents
Yes	10
No	5

Table 9: Group sales

Group Sales	# of Respondents
Yes	9
No	6

Groups that do not conduct joint sales tend to have a relatively small number of markets and buyers. For example, Debya group, which does not conduct joint sales, sells to nearby local markets and schools, as well as to members of the group or farmers outside the group who live nearby, making proximity and accessibility a prerequisite for selling to them. Similarly, with the exception of Ponera, a large town in Dowa West, Chiyambi group, their sales destinations are limited to nearby communities and that they are beaten down by vendors, resulting in lower actual sales prices compared to the other groups (see "6.1.6 Income status of targeted farmer groups"). Similarly, in Zambilanso group, where there are no communal sales, the main selling points are only within the group due to its location and limited access to markets, which makes it difficult to drive in and out of the area.

On the other hand, we also identified some groups that are effectively practicing joint sales against the buying and selling practices, such as Upper Mpherere group, which conducts joint sales and negotiates prices with vendors, despite the fact that their production and marketing activities are conducted on a steep gradient under difficult geographical conditions. In addition, there were a number of groups that were selling to urban areas such as Lilongwe and Blantyre, such as Chiliwa group, and others that had secured multiple markets, including hotels, lodges (Linde Hotel and Thope Lodge), and Zareka refugee camps, through large shipments by joint sales. There were also a number of groups that had secured multiple markets, including hotels, lodges (Linde Hotel and Thope Lodge) and Zareka refugee camp.

6.1.5 Geographical situation, including distance from water sources

The main water sources in the dry season can be broadly classified into three categories - (i) naturally formed main rivers or tributaries, (ii) diverted rivers, and (iii) artificially dug wells to pump up groundwater - and the target farmers have one or more of these water sources, depending on their agricultural land.

Most of the target farmer groups have farmland within a few metres around the main river during the dry season. In some cases, farmers irrigate their farmland away from the main river by diversion of water using gravity due to the natural difference in gradient or by adjusting the volume of water using sandbags (see the green shaded area in the figure below). Agricultural lands that are far from major rivers, tributaries, or diverted rivers, or have steep gradients, are not used during the dry season, but are used as farmland during the rainy

season when rainwater can be used for farming (yellow shaded area in the figure below). Even within a few dozen metres of major rivers, the difference in gradient makes it very difficult to bring water from the source to farmland using jowls, plastic containers, etc., and many farmlands are not used during the dry season. For agricultural land with these gradients, it is considered possible to pump water from the source with a solar pump with a strong output, depending on the distance. A map showing the distance and gradient between the water source and farmland of the target farmer group is shown below as an example for reference.

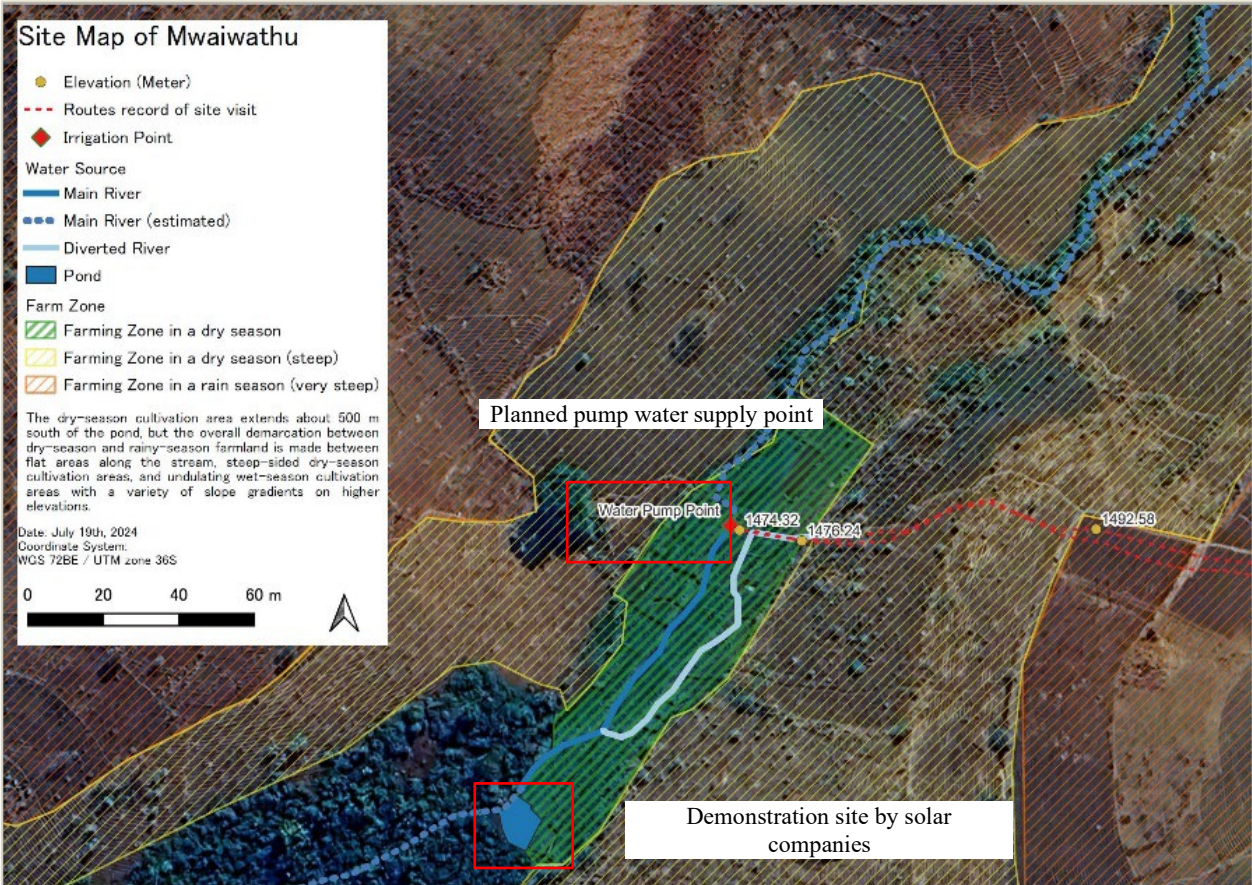


Figure 10: Mwaiwathu group site map

Table 10: Mwaiwathu water source

Planned pump water supply point	Major river	Diverted river
		

Meanwhile, there are also groups of farmlands that are already more than a few metres away from the main river and the overall size of the farmlands they own, as well as their steep slopes. As shown in the figure below, in the case of the Zambilanso group, there is a large cliff between the main river that runs through the centre and the farmland, creating an elevation difference of about 7 metres. Even if the distance from the main river is within 10 metres, it takes a great deal of effort to pump water from the farmland by oneself using a jigger. The highest elevation farmland is about 200 metres away from the river, creating an elevation difference of

about 30 metres. For this reason, Zambilanso uses diversions from other water sources for irrigation, but to a limited extent. Many of the MA-SHEP groups cultivate crops in areas where there is a significant difference in altitude and gradient from the water source to the dry season cultivation area.

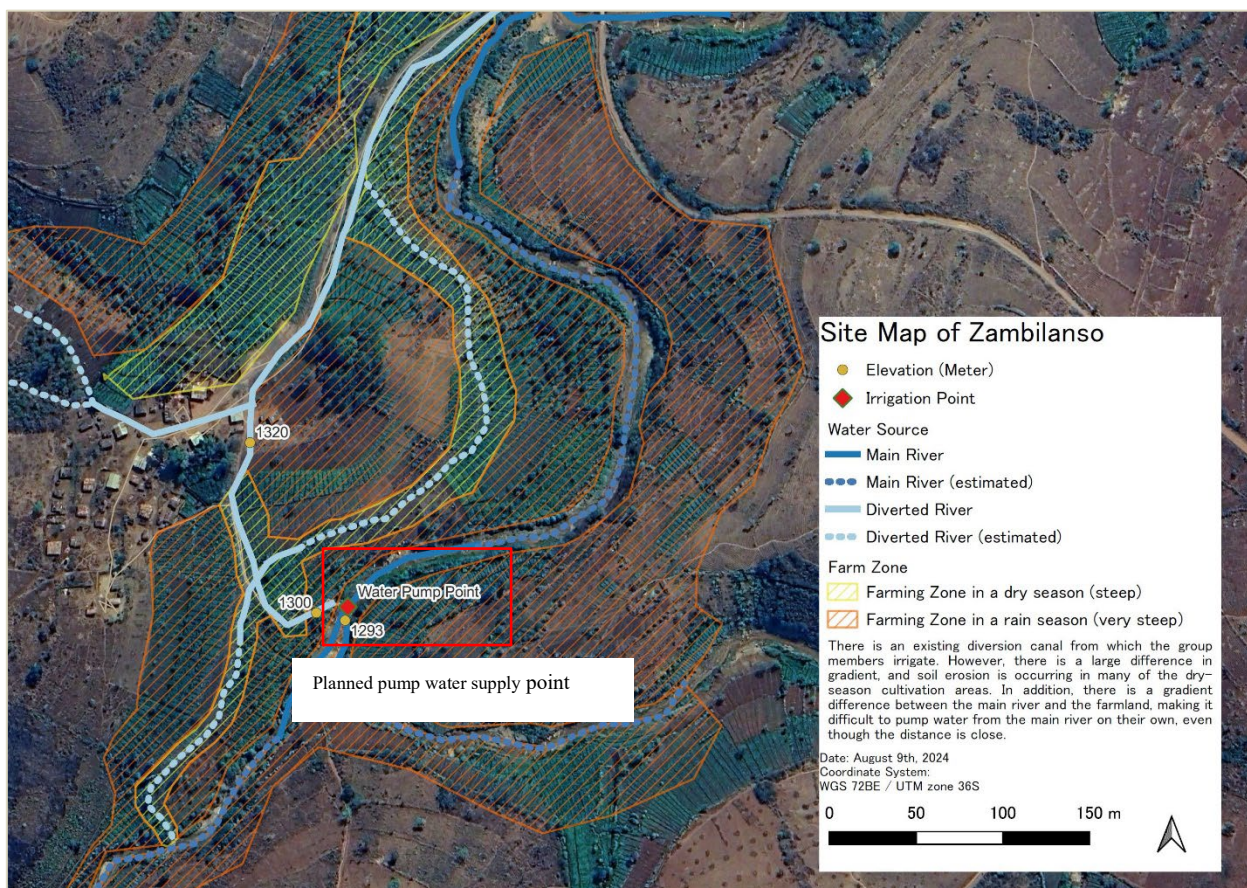


Figure 11: Zambilanso group site map

Table 11: Zambilanso water source

Planned pump water supply points / Major rivers	Planned pump water supply points / Cliffs between major rivers and farmland	Diverted river
		

On the other hand, some groups have experience with irrigation schemes that have been in place for some time, with moderate gradients and abundant water sources from major rivers at multiple locations. For instance, Khamaldyesta, had previously utilised solar irrigation through a project supported by the World Bank. Although they are no longer using it due to water blockage in the pipes and the loss or theft of the solar panels, it is identified that they had some knowledge of solar and irrigation.

In the group, a major river flows in the southern part of the area, and water is currently brought to the farmland from a tributary of the river using a jawpipe. Some farmers took advantage of the gradual difference in gradient and pumped groundwater from wells they drilled at several points to water their fields. However, In an interview, they answered that it takes a great deal of effort to carry two jowls, which together weigh around 50 kg, in both hands.

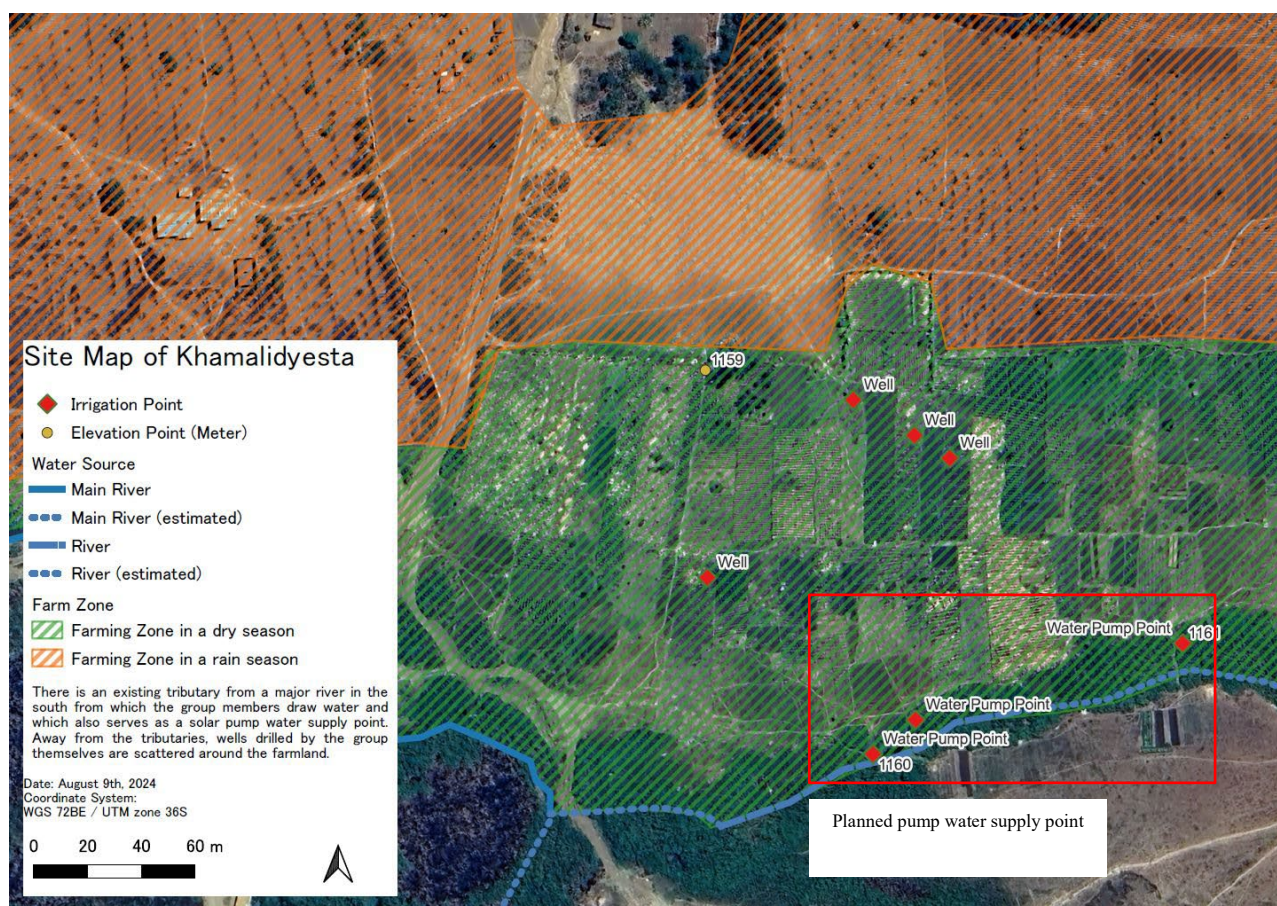


Figure 12: Khamalidyesta group site map

A situation common to almost all target farmers is that, as shown in the diagram above, farmland further from the water source is also used during the rainy season (brown shaded areas), but during the dry season they tend to grow on farmland closer to the water source (green shaded areas). The farmlands of the target farmer group members are generally located next to each other, so the use of solar pumps by the group is considered feasible. (See Appendix 4 for site maps of the remaining 12 farmer groups)

Table 12: Khamalidyesta water source

Major river	Tributaries / Planned water supply points	Wells created by hand drilling
		

A few groups have not been able to divert water adequately because the sandbags used to hold back, bulk up and divert water have broken down. There are also several groups where water levels in water sources, including reservoirs, have fallen since September and there is not enough water to irrigate with solar pumps.

6.1.6 Income status of target farmer groups

This chapter summarises the information on farming collected. In order to summarise the results of the interviews, for analysis of awareness and purchase factors in other chapters of the report, each group is colour-coded according to its stage of development, from purchasing a solar pump to preparing for or considering the purchase of a solar pump.

Table 13: Classification of group status for purchasing solar pumps (colour)

Colour classification	Status within the group for purchase
	Purchased
	Decided and preparing to purchase
	Renting
No colour	Considering within the group

The average annual income (net profit) calculated from the crops grown, number of crops planted, yield and sales per cropping season and sales price per wet and dry season collected from each interview respondent is shown in the table below. Costs associated with production per crop (labour, seed and pesticide costs) were also interviewed and income was calculated after deducting these costs.

Table 14: Total annual income of interviewed farmers (MWK)

Group	Total annual income (MWK)
Dambo	38,661,500
Mkuziwaduka	22,094,000
Tyese Nawo	12,813,750
Chikuta	12,060,200
Makonde	10,890,000
Khamalidyetsa	5,620,000
Katawa	5,254,500
Chiliwa	3,671,168
Choma	3,590,000
Mwaiwathu	2,207,000
Thawi	2,204,800
Upper Mpherere	1,660,500
Zambilanso	1,305,000
Debiya	1,040,000
Chiyambi	617,000

Of the 15 target groups, interviewees in the Dambo group, which has the highest income, own four houses, including one with an iron roof, and have many livestock and fertilizer holdings on their brick-walled property. Therefore, the above annual income figures for the Dambo group are likely to be above average income figures within the group.

In Mukziwaduka, in addition to maize, cultivation of vegetables such as tomatoes, cabbage, and peppers, which have relatively high unit prices, is conducted twice during the rainy season and once during the dry season, and the high harvest volume is one of the factors leading to high income. In Tyse Nawo and Chikuta, the relatively high-income level is supported by the fact that they produce and sell beans multiple times throughout the year, as well as conducting potato production in both the dry and rainy seasons.

Khamalidyesta, which has already decided to purchase the land, maintains a relatively high-income level due to its cultivation of crops including vegetables and grains in both the dry and rainy seasons, while the lower production volume compared to the above groups is a factor that maintains a certain level of income. The Zambilanso and Debiya groups, which are at the lower end of the income scale, earn income from the cultivation of crops such as potatoes and tomatoes, but their income is lower because they produce sugarcane, which has a low yield, and papayas, which take several years to grow and sell. In some cases, income was also limited because they produce corn and other crops only for their own consumption and cannot recover the

costs associated with cultivation and production.

Chiyambi, which is at the lowest income level, sells cash crops including potatoes and leafy greens and beans in addition to corn, but the selling price is lower than the other groups, and price suppression from buyers is one possible reason for the group's lower income level.

As shown in the table below, the average cultivated acreage per crop for the group as a whole is about 0.7 acres, with five of the groups having above-average or relatively large acreage under cultivation (groups above the red line in the table on the left below). The average land area per crop and average profit per unit area (MWK/acre) for all crops grown in one production cycle are shown below. Zambilanso, while having a relatively large land, does not generate high profits. Khamalidyesta, on the other hand, has implemented vegetable cultivation on limited land, but earns more from the average area planted per cropping season.

Table 15: Average area per crop (left table) and profit (right table)

Group	Average size of land per crop (acres)	Group	Profit (MWK/Acres)
Chikuta	1.46	Dambo	9,202,300
Katawa	1.33	Makonde	3,702,500
Mwaiwathu	0.90	Mkuziwaduka	2,234,600
Makonde	0.88	Choma	945,000
Chiliwa	0.75	Khamalidyetsa	918,611
Zambilanso	0.71	Thawi	799,460
Mkuziwaduka	0.70	Chikuta	755,295
Chiyambi	0.65	Chiliwa	701,207
Upper Mpherere	0.63	Tyese Nawo	663,056
Tyese Nawo	0.63	Katawa	568,789
Khamalidyetsa	0.54	Debiya	364,167
Thawi	0.52	Mwaiwathu	241,400
Dambo	0.50	Chiyambi	202,417
Choma	0.46	Upper Mpherere	150,083
Debiya	0.29	Zambilanso	6,667

6.1.7 Cash flow situation of target farmer groups

The cash balance of the target farmers for each month of the year is very important information when considering the use of solar pumps. In order to assess this situation, several groups were asked to cooperate and a cash flow calendar was created for the entire year, after selecting farmers within the group whose farming and income were considered to be average. The calendar was prepared within a limited timeframe, with farmers being asked to answer questions about their income and expenditure as far as they could remember, so it may not always be completely accurate, but it gives a rough idea of trends. Due to time constraints, the calendar was prepared that the respondents were asked to state only the total amount of expenditure, rather than the amount of each expenditure item. The calendar gives an idea of how much cash balance is left on hand at the end of the month after deducting the amount of expenditure from the amount of income each month, which is important information for analysing the solvency of a solar pump purchase.

An example of the cash flow calendar prepared with a few of the members of Mwaiwatsu group in Ntchisi district is shown below.

Table 16: Example of cash flow calendar 1 (Ntchisi district, Mwaiwatsu group)

	1	2	3	4	5	6	7	8	9	10	11	12
Balance from previous month	300,000	20,000	20,000	10,000	200,000	190,000	180,000	240,000	250,000	570,000	580,000	590,000
Income												
Sales from crop productions	0	20,000	0	100,000	0	0	50,000	0	500,000	0	0	100,000
Sales from other sources	0	0	0	100,000	0	0	20,000	20,000	20,000	20,000	20,000	20,000
Total income	0	20,000	0	200,000	0	0	70,000	20,000	520,000	20,000	20,000	120,000
Expense												
Total expense	280,000	20,000	10,000	10,000	10,000	10,000	10,000	10,000	200,000	10,000	10,000	200,000
Savings (available cash)	300,000	20,000	20,000	10,000	200,000	190,000	180,000	240,000	250,000	570,000	580,000	590,000

The women who helped to create the calendar shown above has no income in some months, but it is important that having income through sales from crop cultivation throughout the year.

The following is an example of the Khamalidyesta group in Dowa West, which has already started to use a solar pump.

Table 17: Example of cash flow calendar 2 (Dowa West, Khamalidyesta group)

Month	1	2	3	4	5	6	7	8	9	10	11	12
Balance from previous month	30,000	40,000	20,000	50,000	120,000	170,000	140,000	120,000	100,000	80,000	90,000	50,000
Income												
Sales from crop productions	40,000	0	30,000	80,000	200,000	250,000	40,000	40,000	60,000	40,000	20,000	40,000
Sales from other sources	20,000	10,000	20,000	40,000	50,000	70,000	20,000	60,000	50,000	50,000	40,000	60,000
Total income	60,000	10,000	50,000	120,000	250,000	320,000	60,000	100,000	110,000	90,000	60,000	100,000
Total expense	50,000	30,000	20,000	50,000	200,000	350,000	80,000	120,000	130,000	80,000	100,000	120,000
Savings (available cash)	30,000	40,000	20,000	50,000	120,000	170,000	140,000	120,000	100,000	80,000	90,000	50,000

The graph on the right, based on the cash flow calendar above, shows that in Dowa West, planting is carried out in the middle of the dry season, around June to August, so production costs, including labour and seed costs, increase from around May at the beginning of the season, and savings peak in June. In addition, farmers who have prepared cash flow calendars are harvesting tomatoes and leafy vegetables from May onwards, having started planting around March. Income is expected to peak in June as they are able to sell at higher prices at that time of year compared to the rainy season.

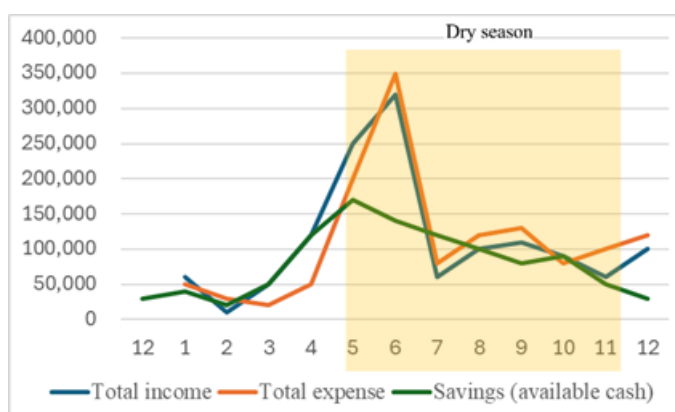


Figure 13: Cash flow of Khamalidyesta group (Vertical axis: MWK, Horizontal axis: Month)

As shown in the figure above, the amount of savings in the cash flow calendar for the previous year and the following December remained unchanged at 30,000 MWK from the previous year. Farmers who responded to the interviews stated that their average monthly savings were 50,000 MWK, and the cash flow calendar in the above figure is considered to reflect the average level of this group.

Finally, the example of the Makonde group in Ntchisi district, which has decided to purchase Vitalite's solar pump (Kubwa) and has started collecting money are presented in the following table.

Table 18: Example of cash flow calendar 3 (Ntchisi district, Makonde group)

Month	1	2	3	4	5	6	7	8	9	10	11	12
Balance from previous month	288,000	14,000	314,000	512,000	1,006,000	1,172,000	1,243,000	2,065,000	2,418,000	2,913,000	2,994,500	3,301,500
Income												
Sales from crop productions	225,000	0	300,000	150,000	195,000	50,000	160,000	30,000	500,000	28,000	0	0
Sales from other sources	240,000	510,000	90,000	648,000	0	72,000	720,000	864,000	648,000	408,000	864,000	720,000
Total income	465,000	510,000	390,000	798,000	195,000	122,000	880,000	894,000	1,148,000	436,000	864,000	720,000
Total expense	739,000	210,000	192,000	304,000	29,000	51,000	58,000	541,000	653,000	354,500	557,000	577,000
Savings (available cash)	288,000	14,000	314,000	512,000	1,006,000	1,172,000	1,243,000	2,065,000	2,418,000	2,913,000	2,994,500	3,444,500

Makonde started growing potatoes and pulses mainly in the rainy season. Revenues from products harvesting appearing around April. In addition, the efficient production and marketing of tomatoes on the limited land available may have contributed to higher revenues from August onwards. As a result, the high-income levels and productivity maintained throughout the year have resulted in total income exceeding total expenditure throughout the previous year, except in January, with a significant improvement in savings.

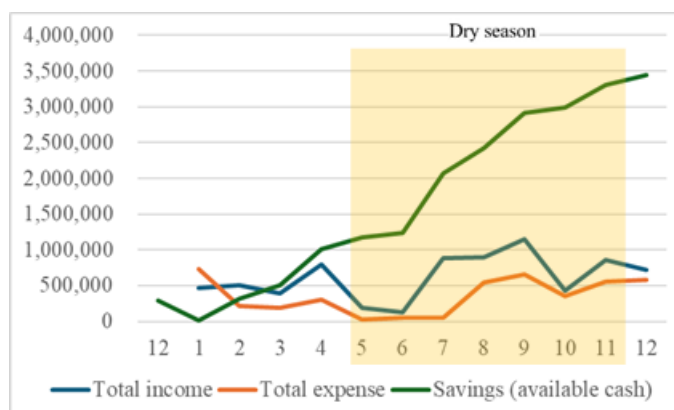


Figure 14: Cash flow of Makonde group
(Vertical axis: MWK, Horizontal axis: Month)

The groups with its high annual income levels, members interviewed indicated that they have already made further investments to improve their livelihoods, such as purchasing a new house with an iron roof, a bicycle, and paying school fees. Some other farmer members of the group are planning to purchase a Climate Smart from Vitalite privately around March 2025, after paying school fees for their eight children.

6.2 Use of irrigation equipment other than solar pumps

Irrigation equipment can be broadly classified into three types: small-scale irrigation pumps using fossil fuels (engine pumps), foot-operated pumps (treadle pumps), and solar pumps. The characteristics of the three types of irrigation equipment are compared in the table below.

Table 19 Main features pertaining to means of irrigation

	Engine pump	Treadle pump	Solar pump
Price	Relatively high price (190,000 to 900,000 MWK) ¹	Relatively low price (120,000 to 180,000 MWK) ²	High price (180 million to 400 million MWK) ³
Maintenance cost	Maintenance (petrol) costs are high	Maintenance cost is low	Maintenance cost is low
Dissemination status	More farmers use it	Widely used at present	Very few users

A comparison of the prices of engine pumps and solar pumps in the table above shows that, depending on the product, there is a difference of more than three times, indicating that solar pumps are a high hurdle to purchase. On the other hand, engine pumps have a low initial cost but require fuel costs after purchase, and fuel prices are rising in Malawi. Therefore, farmers with more financial resources are likely to be better placed to purchase solar pumps.

In 2023, the official petrol price was changed to 2,530 MWK/L and diesel to 2,734 MWK/L by the Malawi

¹ Price survey conducted in April 2024 with engine pump suppliers in Lilongwe city (prices vary widely and depend on size and fuel; the table above shows prices for pumps with connecting pump diameters of around 2 to 3 inches).

² <https://www.facebook.com/p/Money-Maker-Pump-100054470770239/> (Source: Price on the use of the Money Maker Pump, accessed 11 October 2023).

³ Average price of solar pumps handled by three local re-commissioning companies (the cheapest sold for 1,800,000 MWK and the most expensive for 4,000,000 MWK).

Energy Regulatory Authority, which plays a key role in setting official fuel prices in Malawi. This resulted in a 44.9% increase in the price of petrol and 42.4% increase⁴ in the price of diesel compared to the prices before the change. Through interviews with target farmer groups in the second farmer survey, it was confirmed that as of July 2024, groups in each district were still forced to pay for fuel at the official price post-increase. In addition, some target group farmers were found to be obtaining fuel through informal channels due to the distance and inaccessibility of official fuel access points, such as petrol stations. In such cases, the price of both petrol and diesel was 3,000 MWK/L which is more expensive than the ones in the official prices.

Therefore, several farmers who had used engine pumps in the past during this study were asked about the benefits of using engine pumps, and almost all said that they had stopped using them because of the high maintenance costs and lack of profit.⁵ Some of the farmers had to buy 5 litres of fuel a day at unofficial prices to use engine pumps, and they had abandoned the use of engine pumps in the past. As for the treadle pump, there was no maintenance cost after purchase, but they required a great deal of labour involving physical exertion for a certain amount of time in order to irrigate, so some farmers used these pumps for about two years but became unable to continue and discontinued them.

All the farmers who had used those irrigation devices also wanted to buy or use solar pumps, and those farmers who were already using solar pumps all said that the initial cost was high, but once the payment was made, there were no further costs, so it was very good. Farmers are under pressure to reduce costs due to inflation and the rising cost of fuel and agricultural inputs (fertilisers, pesticides, etc.), and petrol and diesel are not easily available in rural areas. The high cost of living in Malawi is corroborated by the following information.

Between October 2023 and October 2024, the exchange rate of the Malawi Kwacha (MWK) against the dollar depreciated by approximately 37.73%⁶. In particular, between November 2023 and December 2023, the exchange rate of the MWK against the dollar depreciated by 32.17%, and the value of the MWK has remained depressed since then. This is likely to have been influenced by the 44% devaluation of the national currency against the dollar implemented in Malawi in November 2023. This depreciation of the exchange rate has led to higher domestic prices and import prices in Malawi, with domestic year-on-year inflation at 30.3% in 2023; year-on-year inflation in 2024 is expected to be 27.89%⁷, and it is likely that domestic prices and import prices will continue to rise.

Due to this situation, the price of solar pumps has also doubled since the beginning of this study, and so are not irrigation equipment that even farmers with a fair degree of income, such as MA-SHEP farmers, can easily afford. However, in view of the results of the interviews, including the cost of other irrigation equipment and the labour involved in its use, it can be said that the use of solar pumps offers small farmers in rural areas the potential to cultivate more efficiently during the dry season and to meet their needs.

6.3 Information gathering and analysis of financial institutions

6.3.1 Overview of financing services provided by different financial institutions

One of the main barriers to the dissemination of solar pumps for small farmers is the high pump prices. To address this issue, information on financial institutions geographically accessible to MA-SHEP group members was collected from Ministry of Agriculture officials and sub-contractors in each district, and five of these institutions were briefly interviewed on an individual basis to ascertain the availability of financing services and an overview of their terms and conditions when farmers need to borrow for solar pump purchases. A summary is provided in the table below.

Table 20: Major financial institutions and financing services

	Financial institution	Organisational features and financing services
1	National Economic Empowerment Fund Limited (NEEF)	www.neef.mw Public microfinance (MF) institution established by the Government of Malawi • Loan use: Purchase of materials needed for irrigated agriculture, such as pumps, generators and irrigation equipment (Micro Irrigation and Farm Implements Loan). Loans for solar pumps are also available.

⁴ <https://mera.mw/2023/11/09/review-of-prices-of-petrol-diesel-and-paraffin-for-the-month-of-november-2023/> (Source: Malawi Energy Regulatory Authority, accessed 3 October 2024)

⁵ Among the farmers interviewed, only one farmer with a relatively large operation said he still uses an engine pump occasionally, while all others said they do not currently use them because of the cost.

⁶ <https://www.facebook.com/p/Money-Maker-Pump-100054470770239/> (Source: Price on the use of the Money Maker Pump, accessed 11 Oct 2023).

⁷ <https://www.statista.com/statistics/520536/inflation-rate-in-malawi/> (Source: statistical data platform, Statista, accessed 3 Oct 2024).

	Financial institution	Organisational features and financing services
		• Loan amount: 1,000,000 MWK - 250,000,000 MWK • Interest rate: 2.2% per month. Commission: 4.5% of the loan amount. • Repayment period: Up to 12 months (including a 5-month grace period) • Eligibility: Farmers or groups of farmers with at least 5 acres of agricultural land (rented land also acceptable). Proof of land ownership and collateral (e.g. farmland, real estate, livestock) required. Loans of up to 50% of the value of the collateral are available.
2	NBS Bank	https://nbs.mw/ • Private commercial banks offering a wide range of financial services to individuals, small, medium and large enterprises, and public institutions • Loan use: Purchase of pumps, aquaculture equipment and other agri-related materials. Loans for solar pumps are also available. Conditions for agricultural loans are not uniform, as they are considered and set according to the characteristics of the borrower (e.g. membership of an association, support from external organisations, etc.) and the harvesting cycle of the produce. The following are examples of general terms and conditions: • Loan amount: From 100,000 MWK (no upper limit) • Interest rate: 36.1% per annum (2.1% per month). For businesses with external support, the interest rate is 9% per annum. • Repayment period: Usually 6 months (can be set according to the cash flow of the farm)
3	MicroLoan Foundation Malawi	https://www.microloanfoundation.org.uk/ • Social microfinance institution providing business loans and training for impoverished women • Loan use: Purchase of fertilisers and materials for irrigated agriculture (Irrigation Farming Loan) • Loan amount: Up to 200,000 MWK • Interest rate: 6% per month • Repayment period: 6 months (upon completion of repayment, the next loan can be granted) • Eligibility: Only socially vulnerable women are eligible for loans. Applications must be conducted in groups (15-50 people). Ownership of irrigated farmland required. The group must be jointly and severally liable for repayment.
4	VisionFund Malawi	https://www.visionfund.org/where-we-work/africa/malawi • Established in Malawi in 2000 by VisionFund International, an international microfinance organisation; VisionFund International is a subsidiary of World Vision, a Christian international NGO. • Loan amount: (For individuals) 300,000 MWK - 3,000,000 MWK (For groups) 300,000 MWK - 2,500,000 MWK • Interest rate: 5.8% per month (for individuals and groups) • Repayment period: 4-6 months • Eligibility: Men and women who make a living from business (not by agriculture)
5	FEBCO SACCO	• Credit union specialising in business in the renewable energy sector. The founding organisation is SolarAid, an international NGO. • Provides deposits and low-interest loans, mainly to low-income members of businesses in the renewable energy sector, such as solar light sales. • Loan use: Implementation of sales and purchase of solar equipment (solar lights and solar pumps) • Loan amount: Loans of up to twice the amount of the investment in shares obliged to purchase as a member of the cooperative are possible • Interest rate: 3% per month

	Financial institution	Organisational features and financing services
		• Repayment period: 12 months (early repayment is possible) • Eligibility: Members who own a share

Of the above financial institutions, MicroLoan Foundation, VisionFund Malawi and FEBCO SACCO were limited to women, business loans, and cooperative members only, respectively, in terms of eligible clients or loan applications. It was not possible to ascertain the general terms and conditions of NBS Bank's loan services for solar pump users, as the theme of NBS Bank loans varies according to the characteristics of the clients (e.g. union membership, support from external organisations, etc.) and the harvesting cycle of their produce.

In view of the above, the JICA expert team invited National Economic Empowerment Fund Limited (NEEF), a government-owned microfinance institution that provides low-interest loans to smallholder farmers in various parts of the country, to the agriculture stakeholder meeting on a trial basis. The terms and conditions of the Micro Irrigation and Farm Implements Loan (see table below) for small-scale farmers were introduced to participants at the meeting, and it was explained that the cost of purchasing a solar pump could be included in the loan.

Table 21: NEEF's Micro Irrigation and Farm Implements Loan

Item	Terms and conditions
Funds to be financed	Irrigated agriculture requirements. Funds for the purchase of irrigation equipment and other farm machinery (pumps are also eligible).
Eligible client	Individual farmers and sole traders, farmer groups
Loan amount	1,000,000 MWK to 250,000,000 MWK
Loan period	Up to 12 months (grace period: up to 5 months)
Interest rate (per month)	2.2%
Fees and administration costs (per month)	4.5%
Insurance premium	1.5%
Collateral and guarantee requirements	Assets (e.g. real estate, vehicles, agricultural equipment) Crops and livestock Personal guarantee (individual) / joint guarantee (group)
Agricultural land conditions	Minimum of 5 acres of agricultural land Proof of land ownership/lease agreement
Main application documents	Business plan, business profile, credit history, national ID, applicant's accreditation letter by local leader, guarantor's agreement/ID, bank statements, financial statements (for existing businesses), quotations for agricultural equipment and materials, evaluation report by agricultural extension officers (AEDO/AEDCs)

6.4 Status of existing solar pump users

6.4.1 Purpose and target for collecting information from solar pump users

The study also interviewed eight non-MA-SHEP group farmers who were already using solar pumps. The aim was to collect information from existing solar pump users on the background and motivation behind the introduction of the pumps, the use and conditions of the pumps, irrigation methods, the income and expenditure status of their farming operations after the introduction of the pumps, and the impact on their livelihoods, in order to obtain suggestions and lessons learned for the dissemination of solar pumps.

6.4.2 Current status of solar pump users and pump usage

The main aspects of the eight solar pump-using farmers are as follows.

- The pumps used by the eight people surveyed were either Lorentz submersible pumps or Futurepump surface water pumps.
- Irrigated area: Exact figures are not available, but farm sizes ranged from 0.5 acres to over 30 acres, and the scale of farming operations varied from small farmers to plantation owners.
- Irrigation method: There were farmers who used water pumped up by solar pumps and stored in storage tanks for drip irrigation, farmers who used hoses to send water directly to the field for sprinkling, and farmers who used sprinklers.
- Price and payment methods: As the selling price of solar pumps has increased over the years in line with rising prices and currency depreciation in Malawi, the purchase price of pumps by farmers has varied significantly from year to year, even when they are purchasing the same product. The payment method for pumps was mainly the PAYGO method of payment in instalments over a period of time, which was accepted without any major complaints by the farmers who were clients of the subcontractors in this study; WOTA's clients who had not adopted the PAYGO method purchased through lump-sum payment or payment in two instalments. SunnyMoney's EaaS scheme saw some farmers utilising the pumps on a rental basis, paying a lease fee of 3,000 MWK per day, rather than buying them.
- Type of ownership/use: The eight target farmers who were using the pumps on a rental basis through the EaaS (renting) system explained that they had just started using the system as a group (25 farmers) in a communal, sequential manner. The remaining seven farmers had all purchased and used the pumps as individuals rather than as a group.
- Usage-related issues: The problem raised was that “the pump does not work on cloudy or rainy days, so it is weather-dependent”. A solar battery and water storage tank were mentioned as necessary items in such cases. The standard pipe hose attached to the pump is 50 metres long, but some farmers said it was too short for irrigating a larger area and therefore extended the length of the hose to 100 metres.

6.4.3 Background and motivation for introducing pumps

- How the farmers became aware of solar pumps: In rural areas, one common way for solar pump vendors to promote their products is to first reach out to traditional leaders, known as Traditional Authorities (TAs), and then share the information widely with the population via the TAs. In this way, information is shared with the population at large via the TAs. Some farmers became aware of solar pumps after being introduced to them via the TAs, while others became interested after seeing their acquaintances or other farmers actually using solar pumps, or after receiving information through the internet or TV programmes.
- Reasons for using solar pumps: The most common reason given by farmers for purchasing solar pumps was the cost and labour savings associated with pump irrigation. Farmers with experience of using engine pumps decided to switch to solar pumps due to the high-cost burden caused by rising fuel prices, and were satisfied with the actual reduction in running costs. Farmers with no experience of using engine pumps or foot-pumps also appreciated the cost advantages of solar pumps and decided to purchase them when considering dry-season cropping and increasing their irrigated areas. Three of the eight farmers interviewed had used engine or foot-operated pumps in the past and cited the significant savings in fuel costs and labour as reasons for switching to solar pumps. The farmer who had previously used a foot-operated pump cited the strain of using a foot-operated pump and was very labour-intensive as the main reason for switching.
- Solar pumps are also easier to carry than engine pumps. Regular engine pumps weigh more, including fuel, and are difficult for women in particular to carry to the field and use, but this is possible with the small, lightweight, portable solar pumps. Several farmers cited the ease of carrying it by a single woman as another major advantage.
- All of the farmers were either paying off their solar pumps or had secured payment resources by generating income from the sale of high cash crops such as tomatoes, potatoes, cabbages, onions, bananas and sugarcane, and were satisfied with the functionality and effectiveness of the solar pumps and felt that they would be able to continue using them in the future. There was a commonality in that they were satisfied

with the functionality and effectiveness of the solar pumps and did not see any particular challenges in continuing to use them.

6.5 Cooperation policy and activities of development partners for the dissemination of solar pumps.

6.5.1 Global Energy Alliance for People and Planet (GEAPP)

The Malawi office of the Global Energy Alliance for People and Planet (GEAPP) is primarily involved in the following activities:

- Supporting and advising development partners in their activities to promote the productive use of energy in Malawi
- Conducting and organising platform meetings of energy sector stakeholders
- Preparing a draft master plan for Malawi's energy sector, etc.

When the JICA study team explained the study, the representative of GEAPP said that the initiatives from this study could serve as a model in the dissemination of solar pumps in rural areas. He also asked for an understanding of the situation on the part of the beneficiary farmers as well as the challenges on the part of the solar pump providers, and to also consider possible support for them, what kind of support would be appropriate, and how farmers could access the necessary funds to purchase solar pumps.

6.5.2 GIZ

In April 2024, a JICA survey team met with GIZ.

GIZ is implementing a pilot project on solar pumps in Mchinji district, which includes the following features:

- Farmer groups which will purchase solar pumps receive 30% subsidies of the market price.
- The project is being implemented by outsourcing the technical validation work to a person with expertise in solar pumps, to check the technical appropriateness of the project design and activities.
- The target farmer groups have already been selected and divided into small groups of 10 members each to ensure effective sharing of the pumps.
- The project team selected the solar pumps to be used by the farmers based on the farmers' situation and other factors, rather than the farmers selecting the pumps themselves.
- The project has also tried to financially support these companies by providing a subsidy of 10% of the cost of the solar pumps to the solar pump suppliers.

However, at the time of additional interviews with stakeholders in July of the same year, the procurement of pumps had not yet been completed as a project and the target farmers had not been able to purchase solar pumps. The effectiveness of GIZ's support approach to providing solar pumps at subsidised prices is therefore unclear. The project is scheduled to continue until December 2024, and an extension of the project is requested.

6.5.3 World Bank

In April, the JICA consultants met with Michael Chipalaule Gondwe, Senior Specialist in Energy at the World Bank. The JICA consultants asked him about the World Bank's activities related to solar energy and was briefed on the major policies. The JICA consultants asked Mr Gondwe to check with the relevant people in the organisation about the Bank's work in the agricultural sector in relation to solar energy. A person in charge of the agricultural sector in relation to solar energy was contacted by Mr. Gondwe and finally had the opportunity to meet with Mr. Time who is in charge of agriculture sector online in early October.

The World Bank does not exclude the use of solar pumps by farmers from its support, but it also does not have any specific support programmes for the use of solar energy. The existing programme that is considered to be the most suitable for supporting farmers using solar pumps is the 'Agricultural Commercialisation Project', which provides financial support to groups of farmers who farm as a business. The project provides financial support to farmer groups that farm as a business. Farmer groups develop a business plan and, if it is satisfactory, the project provides up to 70% of the funding required for the business plan. The remaining 30% has to be raised by the farmer groups themselves. However, 20% of the funding can be raised in-kind by the farmer group members themselves to cover the labour costs (e.g. hiring people) required for their activities. The maximum amount of financial support is approximately USD 25,000 for each group, but there is no strict ceiling. The project has a budget of USD 265,000,000 and will be implemented from this year for the next five years. Due to the high level of need, the intention is to increase the size of the project by an additional USD 65,000,000.

There are no programmes to assist operators of solar pumps or other solar equipment with financing, etc., and

at present, with regard to PUE promotion, only the agribusiness projects mentioned above are considered suitable for assisting farmers who are considering using solar pumps. The World Bank's agriculture sector representative also commented that operators dealing with solar equipment should make an effort to lower the price of solar pumps. They also commented that the JICA initiatives being implemented in this study are very important for farmers in Malawi and they would like to see them continue.

6.5.4 World Food Programme

According to an interview with Chauncy Masamba, Policy Officer, Integrated Livelihood Programme, WFP Malawi Branch, WFP runs an Asset Creation programme for farmers who have difficulty securing adequate food and part of its activities is the provision of solar pumps. Unlike GIZ, WFP provides the pumps free of charge due to the very low income levels of the target population. In addition, as the programme targets areas where natural water sources are scarce, wells are drilled as necessary and the water obtained from these wells is used to encourage target farmers to increase their income through dry-season cultivation. Although the pumps have improved farmers' livelihoods, they are still not being used to their full potential. He further analysed this as being due to the fact that the awareness and knowledge of the target farmers regarding business orientation and farming and marketing activities based on market needs is not yet sufficient. Although the WFP approach differs from the model and target farmer population considered by this study, it contains a lot of specific information, which was helpful in considering specific details in the study of effective approaches to solar pump utilisation.

7. Implementation and effectiveness of agricultural stakeholder meetings

7.1 Confirmation of the purpose of the agricultural stakeholder meetings and implementation method, and the roles of the parties involved, including the subcontractors

The main purpose of the agricultural stakeholder meetings is to help target farmers gain a better understanding of solar pumps and for stakeholder to form contacts and consider the next actions to be taken. The meetings are held three times in total, one in each district, using DOE facilities in each district. While the normal effect of inviting a wide range of market actors to agricultural stakeholder meetings is to enable the target farmers to gather more information and form contacts with a wide range of stakeholders, the main objective of these meetings was specifically to help the target farmers gain a better understanding of solar pumps and form contacts with local suppliers and organisations that sell the pumps, so the project was limited to invite only the following participants to the meetings.

District government officials, Agricultural extension officers, Subcontractors, National Economic Empowerment Fund (NEEF, financial institution), Local market dealers, Farmers who are using solar pumps, and MA-SHEP farmers (5 farmer representatives of 5 MA-SHEP groups for each district)

As for the market players, MA-SHEP farmers already had market information and sales outlets, but when dry-season cultivation was implemented in earnest, it was considered necessary to collect more detailed information on the market situation during the dry season, so market players who were engaged in sales activities throughout the dry season were invited in each district.

During the meeting with officials in each district regarding participating farmers, it was confirmed that many farmer groups were practising dry-season cultivation using nearby water sources and that all MA-SHEP farmer groups were very interested in using solar pumps. The farmers who are already practising dry-season cultivation are also irrigating by gravity and would like to explore the possibility of using solar pumps for pumping water. As all groups were deemed to meet the requirements for participation at the farmers' meeting in principle, it was decided to invite five representatives from each of the MA-SHEP farmer groups to participate in the meeting. However, to ensure that the target farmer groups could consider the use of solar pumps taking into account the position of women, the condition was that at least two female members should be included among the representatives attending the meetings.

7.2 Methods and innovations for conducting agricultural stakeholder meetings

Agricultural stakeholders' meetings were held in Mchinji, Ntchisi and Dowa prefectures in April 2024, each for half a day, and all meetings were held in conference rooms or training facilities in each district. The number of participants at the meetings in each district is a little more than 50 people.

The agricultural stakeholder meetings were conducted in a format where each stakeholder set up a booth with a table, etc., which was visited by different farmer groups, where the stakeholders gave explanations and shared information within the allotted time and the farmers asked questions. At all meetings, each subcontractor was enthusiastic about explaining of the solar pumps. The explanations and Q&A sessions were very active at all the booths on all the days, and it was confirmed that a lot of information was shared by the stakeholders. (See Annexes 5 and 6 for a description of the specific programme and instructions to participants, including the layout).

Based on the experience of the first meeting in Mchinji district, the method of conducting the remaining two meetings was modified. Initially, each subcontractor spent 30 minutes explaining the solar pumps, including their functions and how to use them, and exchanging views with the farmers, but it was observed that there was not enough time. Some subcontractors spent most of the time explaining the solar pumps and did not have enough time to listen to the farmers' situation and exchange opinions, which led to concerns that they did not have enough information to make plans for effective sales promotion after the meeting. Therefore, from the second meeting in Ntchisi and Dowa West districts, each subcontractor was given an opportunity to explain to all participants for 30 minutes the functions, usage and payment methods of the solar pumps they handle, and then the participating farmer groups were given 20-30 minutes each to visit each vendor's booth. to exchange more specific opinions and hold discussions. As a result, the local subcontractors commented that they were able to exchange more information and views with the participating farmers.



Vitalite staff explaining one of the submersible pumps



Maeve staff explaining their surface pump to the farmers



NEEF officers explaining their loan products to the farmers

7.3 Effectiveness of initial linkage forms

Initial linkage forms were developed at the agricultural stakeholder meetings and were completed by the participating members of the target farmer groups after the agriculture stakeholder meeting. The purpose of using the form was to understand (i) what information the participating target farmers had obtained and learnt through the agricultural stakeholder meeting, (ii) what they had negotiated with the stakeholders, and (iii) what actions they planned to take after the meeting, so the form was designed to be structured to focus on the three points mentioned above. (See Annex 7 for the format of this form.)

The purpose of the survey was not only for the consultants conducting the survey to understand the content of the forms, but also to encourage the farmers themselves to take the forms home, remember the content and think about and decide on their next course of action. The contents of the initial linkage forms completed by each group identified the following main commonalities.

- (1) The main (key) information collected from stakeholders:
 - The functions and features of the solar pumps and how to use them were understood.
 - The solar pumps can be purchased in cash as a lump sum or in monthly instalments based on the Pay-As-You-Go (PAYGO) mechanism.
 - The price of the solar pumps introduced and the monthly instalments when paying by PAYGO were understood.
 - The service provided by each solar pump vendor was understood (e.g. repair warranty period).
 - A low-interest loan is available from NEEF.
- (2) Details of opinions exchanged or negotiated with relevant parties:
 - The project team was able to obtain the names and contact details of the persons in charge of each vendor, and will continue to keep in touch with them.
 - The names and contact details of the contact persons were obtained and will continue to be communicated with.
- (3) Plans for future meetings or next actions to be taken.
 - We would like to purchase solar pumps and will take action to do so.
 - We are considering taking out a loan from a financial institution.

The above were common to many of the initial linkage forms completed by groups that participated in the agricultural stakeholder meetings, but there was a tendency for the content of (1) and (2) to be written without distinction, for the content to be very vague and lacking in specificity, and for some groups to have no or insufficient content for (3). Although the time available to fill in the form was limited, it was possible to understand what the participating farmer groups understood as new and important information and exchanged views with the participating traders, and although the form helped farmers to think about their next actions, the impression was made that the use of the form did not necessarily strongly facilitate the farmer groups' decision-making on the use of solar pumps.

7.4 Reactions of participating MA-SHEP farmers and questionnaire results

The level of awareness and interest in solar pumps among participating farmers improved significantly after the meetings. The results of the questionnaire showing the changes are shown in the table below.

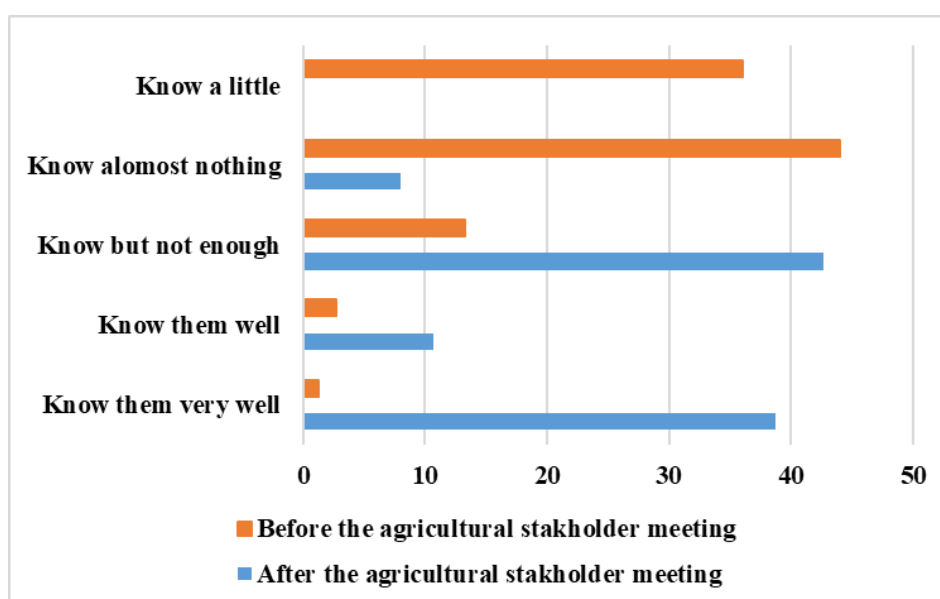


Figure 15: Changes in awareness of solar pumps (aggregated across the three districts)

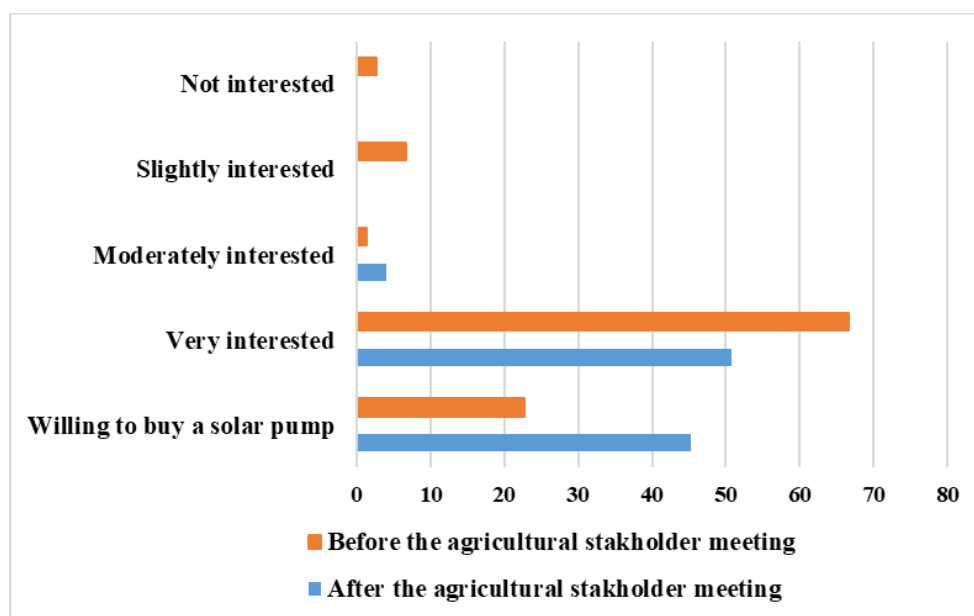


Figure 16: Changes in interests in solar pumps (aggregated across the three districts)

As shown in Table 22, the proportion of farmers who said they understood solar pumps well increased from 2.7% to 10.7% before the meeting, while those who said they understood them very well increased from 1.3% to 38.7%. Table 23 shows the level of interest in solar pumps; the proportion of farmers who said they would like to buy a solar pump also increased from 22.7% to 45.3%. The results indicate that the agricultural stakeholder meetings were very effective in terms of increasing understanding and interest in solar pumps.

7.5 Feedback from subcontractors

Feedback from all subcontractors was that the agricultural stakeholder meetings were a very useful activity in getting to know farmers who were looking for solar pumps and in gaining a better understanding of the pumps. In particular, the fact that farmers who were interested in solar pumps were present, which is unusual, saved a lot of marketing effort, and also provided on-the-spot information on the status of each farmer group, their contact details and what kind of pumps they were interested in using, which was very useful for solar pump sales. The feedback we received from the companies was that this was very beneficial in terms of marketing the solar pumps. Such comments indicate that the farmers' meetings were effective in the initial stages of the solar pump promotion activities.

8. Solar pump promotion activities by subcontractors

8.1 Policies and strategies for each subcontractor's promotional activities

Promotional activities for the solar pumps were carried out by each of the subcontractors based on the information they collected at the farmers' meetings. The characteristics of their visits to the target farmer groups were as follows.

Table 22: Characteristics of visits to target farmer groups by subcontractors for sales promotion activities

Subcontractors	Features related to targeted farmer group visits	
Vitalite	From early May onwards, visits were made from Mchinji, where many of the target farmer groups have shown stronger interest in the company's products and services; in late May, sales promotion activities were conducted with groups in Dowa West; during June, all farmer groups all three districts were finally visited.	

Subcontractors	Features related to targeted farmer group visits
Maeve Project	Sales promotion activities through on-site demonstrations were conducted by visiting all but two target farmer groups in Mchinji and Ntchisi districts over a short period of time from late April to early May. During the first demonstrations, it was not possible to demonstrate the surface water pump (Futurepump) because some of the pumps and panels were inadequate. Subsequently, in September, another visit was made to some of the target farmer groups to demonstrate the surface water pump and the submersible pump (Lorentz) respectively. 
SunnyMoney	The number of groups visited was limited because priority was given to farmer groups that had contacted SunnyMoney for sales promotion activities. Priority was also given to Dowa West, which has a large number of groups with a high interest in pump rental, for promotional activities. 

The above-mentioned differences in the promotional policies of the companies resulted in a significant impact on the companies and pumps that each target farmer group was willing to purchase, which will be discussed in more detail in the chapter on the drivers of farmer groups' decisions to purchase solar pumps.

SunnyMoney's proposal of daily renting of solar pumps could be an attractive option for farmers using the loan service on a trial or infrequent basis, as they would not have to own the pumps and would not have to take on the risk of a breakdown. With this in mind, SunnyMoney focused its activities on the Dowa West District, where a number of farmer groups had expressed more interest in the rental service. Farmers' responses to the daily rental service are discussed in the next chapter.

After the demonstrations, each company conducted follow-up calls to check the progress of purchase decisions and answered further questions remotely. Two Malawian staff members hired by the JICA study team accompanied Vitalite and MAEVE Project during one of their farm visits respectively, to monitor their sales promotion activities. The local staff confirmed that all companies provided farmers with the necessary information and conducted demonstrations without any issues. Feedback and comments from farmers indicated that the demonstrations significantly contributed to their understanding of the solar pumps and their consideration of making a purchase.

9. Analysis of decision-making and degree of recognition of the use of solar pumps by target farmers

9.1 Current status of the use of solar pumps by MA-SHEP farmers

The situation regarding the purchase of solar pumps by each target farmer group, as ascertained from previous interviews through interventions such as agricultural stakeholder meetings and sales promotion activities by the subcontractors, is shown in Figure 17.

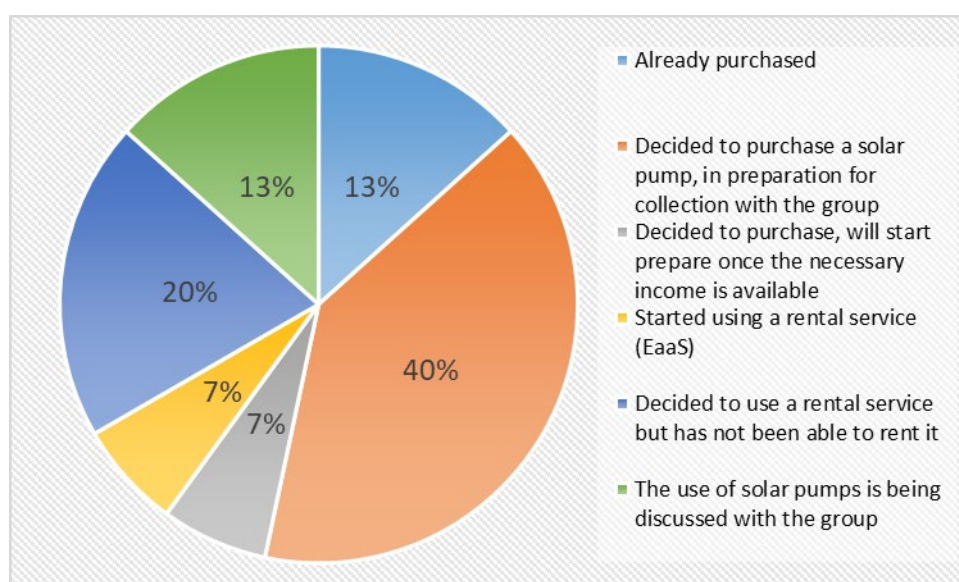


Figure 17: Current situation regarding the use of solar pumps by target farmer groups

The above table is based on the situation in the Appendix 8 concerning each group. Two groups have already purchased and begun utilising pumps, and one group has started using the pump rental service. In addition, there are two other farmer groups that have requested to use the rental service, but the water level in their water source has dropped from August to September, making the requested submersible pumps unavailable. With each passing month, there is progress in the status of solar pump purchases, and several groups expect to harvest their growing crops in October/November, so new developments regarding purchases are expected by December 2024.

9.2 Characteristics of target farmers and examples of farmer groups using solar pumps

Based on the results of interviews and monitoring of the target farmer groups on solar pump use, the main characteristics of the target farmer groups are described as follows.

- Several groups have started to use the pumps through purchase or loan, while many groups have finished making decisions on the use of solar pumps and are making preparations, such as collecting money to pay upfront for the purchase.
- In principle, solar pumps are considered for purchase or rental use by groups of farmers rather than individual farmers.
- Many farmer groups are interested in purchasing solar pumps from Vitalite, but there are also farmer groups who prefer to use the rental service provided by SunnyMoney.
- Some groups have not made decisions on the use of solar pumps due to issues such as access to water sources, and consultations are pending. When a group purchases a pump, whether all group members have equal access to the water source and whether the use of the pump will benefit all members is very important in the decision-making process.
- Many farmer groups are willing to buy but take several months (even six months or longer) to collect the advance payment. This could be for multiple reasons, such as other prioritised expenditures or lack of easy consensus among members, or insufficient surplus income to spend on pump utilisation.
- Only a limited number of groups are considering taking out or borrowing a loan from a financial institution to purchase a solar pump, with the majority preferring to purchase through Pay-As-You-Go. The main reason for this could be that loan application documentation is not easy to complete, making it difficult to obtain a loan.
- Many farmer groups were considering using the daily rental service in the immediate aftermath of the farmers' meeting, but when all farmer groups were visited and surveyed in July, fewer groups wanted to use the rental service and more wanted to purchase pumps.

Supplementary information is provided below as a case study on a group of target farmer groups that have started purchasing solar pumps or using the loan service, or whose members have purchased pumps.

Case study 1 on the use of solar pumps:

The Khamalidyetsa group in Dowa West, which purchased a solar pump from Vitalite, confirmed that all group members used the purchased pump without any problems until July and that members were satisfied. However, in September, the group's treasurer passed away and the group members had to pay for his funeral, which was an unexpected expense, which resulted in many group members being unable to pay for continued use of the pump, and the group has not been able to use the pump since then as of the end of September.

As for the Khamlidyetsa group, as of the first week of October, payments have not yet resumed and Vitalite is considering taking back the pump. The group's members' cash flow is not in bad shape. However, it was found that members' finances are not always in a comfortable position, and they risk not being able to meet monthly payments when unexpected large sums of money are spent, such as on funeral offerings. On the other hand, the group has had repeated switch box failures since they started using the pumps they purchased, which Vitalite has repaired or replaced on each occasion, and while Vitalite has done all it can to address such failures, some technical challenges are also revealed.

Case study 2 on the use of solar pumps:

The Tyese Nawo group in Mchinji district initially wanted to use a submersible pump named Lorentz, consulted SunnyMoney and paid an advance for the purchase, but SunnyMoney was unable to procure Lorentz through PAYGO due to circumstances on their part, so the advance paid was returned to the group. The reason for this was that a financial institution for farmers called FEBCO SACCO, with which SunnyMoney is linked, was asked to shoulder the monthly payments for the solar pumps mentioned above, and the Tyese Nawo group became a member of FEBCO SACCO and planned to make monthly payments to this financial institution. SunnyMoney proposed instead to lend Lorentz to the group, which accepted the proposal and the group had started using the pumps on loan.

On the other hand, the group was also keen to purchase and utilise a solar pump, so they contacted MAEVE to consider purchasing a surface water pump called Futurepump. Through a demonstration in the community, group members agreed to purchase the pump and the pump was procured and put into use in early September.

Thus, both the farmer group and the operators have arrived at the purchase of solar pumps and the use of solar pumps on loan in a twisting and turning manner with efforts to meet the farmers' needs. During the process, the agricultural extension officer in charge of the group made several contacts and visits to the farmers' group and assisted them in liaising with the two operators. The project also checked the progress to the extent possible, and shared information and liaised with all parties concerned to ensure that the farmers could use the desired solar pumps as much as possible without any major inconvenience.

While in some groups, as in the two cases above, a decision was made early on to purchase the pumps, in other groups the opinion of the group changed two or three times before the pumps were utilised, and it was found from interviews with the target farmer groups and follow-up that the farmers were sometimes troubled, discussed the matter with the relevant people, and made a decision.

The following is an example of the Chiyambi group in Dowa West, where different opinions and information on the use of solar pumps are shared with concerned stakeholders, making it difficult for both the Japanese consultant and the subcontractors to accurately understand the current situation.

Case study 3 on the use of solar pumps:

Regarding the Chiyambi group in Dowa West province, which had reported the purchase of a submersible pump from SunnyMoney in early June, when the JICA survey team visited the group, the group leader replied that they had not yet placed the order to apply to NEEF for a loan. Direct confirmation was made, but the application had not yet been submitted. A group leader replied that he had not yet placed any orders. After both subcontractors contacted the group several times to confirm, it was clarified in a later interview with MAEVE that the confusion was caused by a farmer outside the group who contacted the subcontractors posing as a group member because he wanted a solar pump. The group then asked SunnyMoney to use their pump renting service and the submersible pump was provided and put into use in early September.

As a result, the group used the pump rental service from SunnyMoney, but the process was complicated, and in addition to SunnyMoney, MAEVE spent a lot of time explaining and visiting the group. The group's explanation of the loan service from NEEF was also opaque, so it was difficult to get an accurate picture of the current situation.

Farmers may only give good replies and information to external parties, which needs to be taken into account, and if farmers outside the group express interest in solar pumps and get involved in the process of purchasing etc., decision-making becomes complicated and it is difficult for pump suppliers to know how to respond. As such, it is important to clarify the contact point for the group at the outset, to avoid contact with anyone other than that person, and to always use clear language when confirming the group's current thinking and preparations, etc.

9.3 Key factors in the decision to use solar pumps

The main features of the results of the interviews with target farmers have been described in the previous chapter, and the trends and possible reasons for the use of solar pumps are explained below.

Table 23: Tendencies and possible reasons in the use of solar pumps by the target farmer groups

	Tendencies of solar pump use	Possible reasons based on interviews with target farmers
1	Many farmer groups (53%, 8 out of 15 groups) buy or want to buy Kubwa from Vitalite	• Only Vitalite visited all farmer groups in the three target provinces to demonstrate the pumps. This enabled members who were not present at the farmers' meetings to learn more about the solar pumps. All of the target farmer groups commented that the demonstration visits were integral to their decision-making on the use of the pumps in their groups. • Although simple, demonstration through site visits was considered by the target farmer groups to be an essential prerequisite in their decision to purchase a pump for their group. • Kubwa was able to pump a sufficient amount of water even in cloudy weather and received good feedback from the farmers.
2	Some groups using the daily rental service shifted to wishing to purchase a pump	• At the time of the agricultural stakeholder meeting in April, many groups were interested in SunnyMoney's daily rental service, but those who are interested in renting a solar pump decreased between June and July. • The main reasons for this were that they had a better understanding of solar pumps and also that it was possible for the group to purchase them in terms of price, and that they thought it would be better to purchase them and not have to pay after a certain period of time.
3	Several groups want to use SunnyMoney's daily rental service	• Of the 15 groups, three groups prefer to use the service on a daily rental basis. • Reasons for the above exist partly because they can utilise solar pumps at a lower cost and do not have to make long-term payments, and partly because they want to understand the functioning of the solar pumps first.
4	No farmer groups expressly wished to buy a solar pump from MAEVE, but	• Maeve's main recommendation for the Futurepump is the cheapest of the pumps presented in this study, but it has a weak output. This could be the main reason why it pumped less water than Vitalite's Kubwa when demonstrated under the same conditions.

	Tendencies of solar pump use	Possible reasons based on interviews with target farmers
	they have sold two pumps	However, resultantly Maeve did sell two surface water pumps. The main reasons for this may have been that the price of the same pump was cheaper than the other pumps, and the company was able to persistently contact the farmers and respond quickly when contacted about the purchase.

Based on the above tendencies and reasons, additional analysis is described below.

- They are likely to see the right features for their situation as a more important decision factor. Although the price of the solar pump is important to MA-SHEP farmers, it can be inferred from the fact that many farmer groups prefer to buy the more expensive Vitalite Kubwa rather than the cheaper Maeve Futurepump that it is important to purchase a pump with features and functions that meet their needs based on their situation.
- Some groups of farmers want to buy Vitalite's smaller Climate Smart pumps. In addition to the low price, it was found from the interviews that women often irrigate the fields, so they wanted to purchase the above-mentioned small pump, which is easy for them to carry. Thus, the target farmers tend to choose solar pumps that meet their needs based on their own situation, and different groups have different desired pumps and different forms of purchase and utilisation. It is important to understand or assume the differing situations and needs of each farmer group and provide various options to meet these.
- One additional factor that could have influenced farmers' decision-making is the following. Where farmers already had information on solar pumps, e.g. from extension workers or members of the same group, and had previously shared this information or encouraged their use, the group made faster decisions to purchase or use the rental service (e.g., Khamalidyetsa and Tyese Nawo Group).

9.4 Effective activities related to changes in farmers' degree of recognition of solar pumps and pump use

9.4.1 Considerations based on the results of the implementation of the Agricultural Stakeholder Meeting

When the aim is to promote understanding of solar pumps to the participating group representatives, the agricultural meeting is an effective activity in terms of information gathering and networking, but the agricultural meeting alone does not necessarily lead to a purchase by the group. It was identified that it is important that this is done in conjunction with a post-meeting sharing session for all group members, as the information and understanding of the pumps gained at the meeting does not permeate the whole group. This was mentioned by almost all the farmer groups interviewed, who said that they always had to have a meeting with other group members after the farmer meeting to share information, and that it took (or is taking) time to share information and form opinions on purchases, etc.

A demonstration of the solar pump was given by the subcontractors in the form of a visit to the target farmer group after the farmers' meeting had taken place, and understanding of the pump was spread throughout the group members. Subsequent interviews with farmers revealed that it was important for them to see for themselves whether or not to purchase the pumps and why they decided to purchase them. While the agricultural stakeholder meetings were very effective in increasing understanding of the target farmers' solar pumps and forming contacts with stakeholders, they also need to see the performance of the pumps in order to gain understanding from the rest of the group members about the purchase of the pumps.

Based on the above information, it is considered that information sharing and pump demonstrations for the remaining group members would be more effective if done in conjunction with the agricultural stakeholder meetings after these have been held. The SHEP project for horticultural crops also recommends that information sharing and discussion sessions with other members be held as early as possible after the stakeholder meeting in order to select a crop, and that a series of such activities be mandatory for group decision-making as a whole. Although information sharing sessions and demonstrations by dealers after the farmers' meeting were not made mandatory activities this time, they should be combined if farmers are considering using the pumps in their groups.

An earlier analysis based on the cash flow situation would be an effective tool for pump use, as it would help each group to make decisions about purchasing a pump at an earlier stage and to plan how to prepare for the purchase. It is also considered to be an effective tool for pump utilisation.

The table below summarises the activities from the above that were considered to be particularly effective in changing the perceptions and decision-making of target farmers up to the purchase of solar pumps or use of

rental services by farmers.

Table 24: Characteristics of activities that influenced farmers' perceptions and decisions to use solar pumps

Month	Activity	Effects on solar pump use	Issues or points to note
April	Agriculture stakeholder meeting	• A very useful activity as an incentive to consider using the pumps, as it deepens the understanding of solar pumps by the representatives of participating farmer groups, motivates them to purchase, and clarifies the contact details of the distributors. It is also an effective activity for solar pump suppliers to get to know potential pump users at the same time. • The Initial Linkage Form was filled by farmers at the end of the agricultural stakeholder meeting. In addition to the fact that farmers were able to understand for themselves what they had ascertained at the meeting, and the external stakeholders were also able to understand the content, it was useful to have the participating farmers describe it, as it helped them to think about what actions they should take next.	• Although there is a greater understanding by representatives of the participating farmer groups, it is difficult for the other group members to understand at the same level as the participants, which makes group decision-making difficult. • For the Initial Linkage Form, the effect on 'Did we clarify and strongly encourage the group to take the next action as a group?' is not considered to be high.
April to May	A sharing session with other group members	It is important to ensure that this activity is carried out, as the information gathered at the agricultural stakeholder meeting was passed on to other group members, which increased the understanding of solar pumps among all members.	In this study, the implementation of the activities listed on the left was left to the farmers' own initiative, so the method and timing of implementation are unknown. Considering their importance, it would be desirable for the extension officer in charge or others to provide support for their implementation.
May to June	Pump demonstration activities by distributors in the communities	All group members have a better understanding of solar pumps, which has the effect of motivating all members to buy one. It has facilitated discussions within the group on the use of the pumps and facilitated decision-making. It also has the effect of creating trust between the distributor and farmer group members.	Some pump suppliers may not visit all target farmers and conduct targeted promotional activities, so that groups that do not receive visits are very unlikely to choose the pumps handled by the suppliers concerned.
June to Sept.	Monitoring visits by outsiders or government officials	The situation of each group can be clarified and, where issues are raised, opinions can be exchanged and advice given, facilitating decision-making on pump use. Cash flow calendar making for some groups as part of the monitoring activities was also conducted, which proved to be effective.	Visiting farmers is time-consuming and costly. In addition, it may take time before the target farmers are willing to exchange their honest opinions and share their challenges, which requires advanced communication skills. Cash flow calendar making is considered to be more highly effective if it is carried out in the first half of the survey.

All of the activities listed in the table above were effective, but there are also shortcomings or points to be considered, and the selection of activities and specific implementation methods should be considered based on a thorough understanding of the characteristics of each activity to promote pump use.

On the other hand, even if the supplier provides a demonstration, if there are other challenges within the group, decisions may not be made immediately and may take a long time. For such groups, an outsider, such as a government official or a member of the project implementation team, can visit the group to confirm the progress of discussions within the group on pump use and the challenges, if any, and thus facilitate the decision-

making process. While it is up to the farmer groups themselves to resolve issues, providing objective advice, information-sharing and lateral support does not impede farmers' self-determination and is common and effective in SHEP and other agricultural and rural development projects. For farmer groups that have challenges and appear to be taking longer to make decisions, monitoring visits and exchanges of views by outsiders are sometimes necessary.

9.5 Changes in target farmers' degree of recognition of solar pumps and effective activities

Below is a chart of changes in farmers' perceptions based on the situation of the target farmers regarding the use of solar pumps and the effects of the activities implemented, together with the activities considered to be particularly effective in influencing their decision-making, which are also included in the chart below.

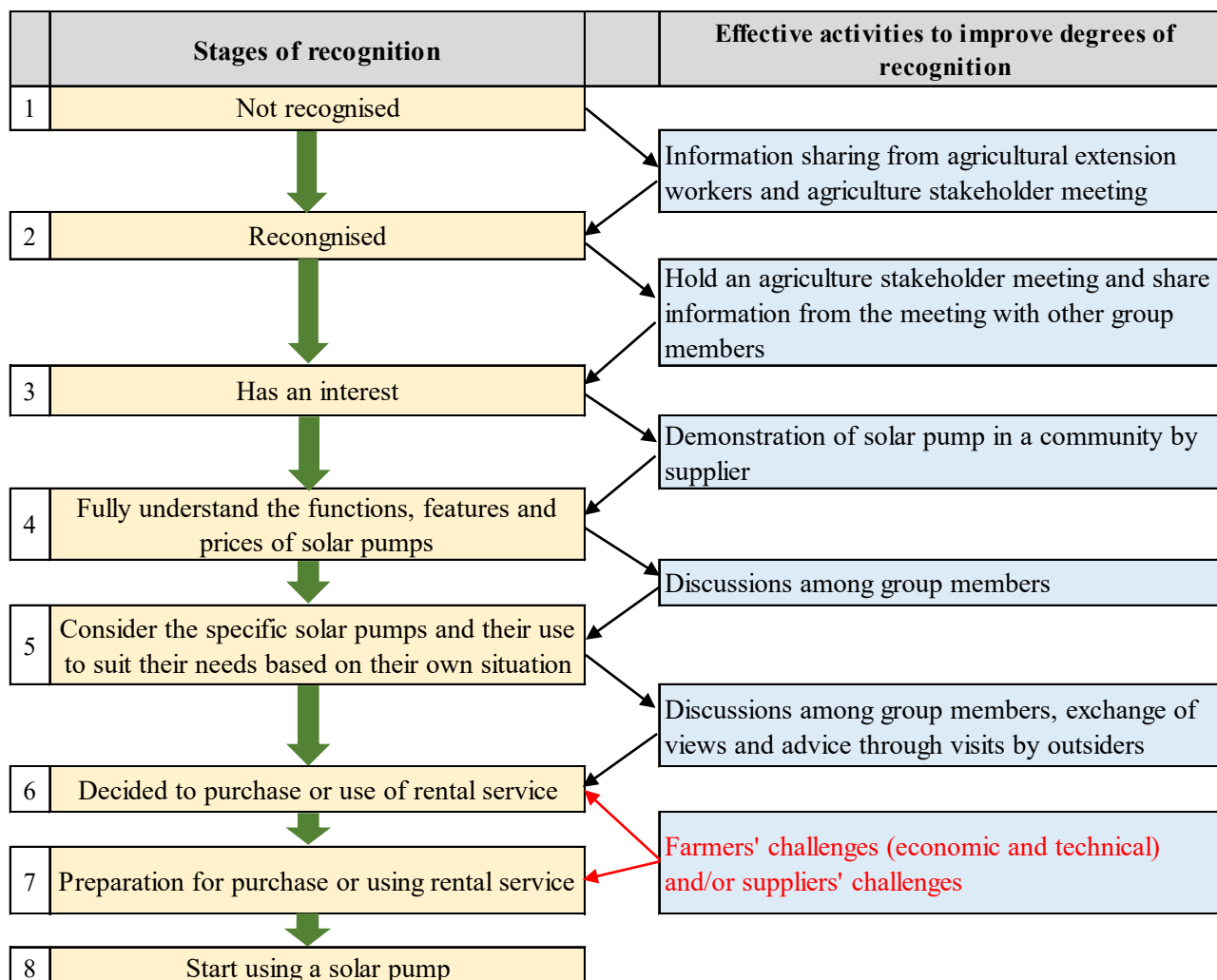


Figure 18: Changes in recognition degree of solar pumps and effective activities among target farmers identified from this survey

Through this survey activity, the changes in farmers' awareness of the purchase of solar pumps were close to what was assumed before the survey was conducted, but there were some differences. It was initially assumed to be the next stage from the degree (3) "Has an interest" to (4) "Fully understand the functions, features and prices of solar pumps" and (5) "Consider the specific solar pumps", with the farmer group with strong interest contacting the supplier and meeting with agricultural stakeholders. However, it was found that before proceeding to the stage of concrete consideration, there had to be a step where all group members have a better understanding of pumps. It was also found that by the time farmers moved to the next stage, "Decided to purchase or use of rental service", there were barriers to not only understanding solar pumps, but also issues of access to water sources, financial viability to pay, and how many farmers would share a pump.

While awareness of the purchase of solar pumps varied over the stages described above, It was found through interviews with target farmers and discussions with subcontractors that when considering the use of solar pumps in stages 4 and 5 of the above diagram, they consider and make decisions on various factors, not just price. In the case of MA-SHEP farmers, the point that higher income levels do not necessarily mean that they

are buying solar pumps can be seen in Table 14 and the information in Annex 8. The groups that have already purchased pumps are the Tyese Nawo group and the Khalidyetsa group, both of which are at the higher end of the 15 target groups in terms of income level, but not the highest. Conversely, the Dambo group, which ranks first in income level, has not yet purchased a solar pump; the Mkuziwaduka group, which ranks second, has a high-income level but would like to use a solar pump rental service; and the Chikuta group, which ranks fourth, has not yet decided on a policy for using its pump. Although sufficient income is necessary to use a solar pump, the level of income is not necessarily proportional to whether or not a pump is purchased, how quickly a decision is made, or how long it takes to prepare for such a decision. Rather, the priority given to spending by members of each group and the availability of solar pumps to meet group demand are likely to influence the decision-making factors.

There were some cases during the study where farmers' economic and technical challenges as well as challenges in the capacity of the distributors (especially in terms of finance) affected their use of solar pumps at stages 6 and 7. These challenges are of great significance for the current use of solar pumps and are therefore discussed in more detail in the next chapter.

10. Challenges in the use of solar pumps and the possibilities and challenges faced by various stakeholders

10.1 Technical challenges for solar pump use

10.1.1 How to share solar pumps

All target farmer groups in this study considered using solar pumps in groups. Therefore, if a solar pump is purchased, the way in which the pump is shared after purchase is very important. However, two issues arise here. One is the need to ensure that the water requirements of each crop are met. As each crop has a recommended water requirement from sowing to harvest, it is important that the amount of water able to be irrigated by each person sharing the solar pump meets or is close to the recommended crop water requirements.

The water requirements of crops commonly grown in the target districts and information on irrigation frequency⁸ were referenced from FAO information, with water requirements calculated based on the average area under cultivation where each crop is grown. The time required to irrigate each crop was determined based on the maximum water volume of the Sun Culture submersible pumps that were of most interest to farmers in relation to that water volume. A summary of the results is given below.

Table 25: Water requirements of crops commonly grown in the three target districts, time required for irrigation, etc.⁹

Crop	Daily water requirements during the growing season ¹⁰	Time required to irrigate the amount of water shown on the left	Irrigation frequency
Maize	6,199 litter	1.55 hours	Once every 3-4 days
Tomato	1,746 litter	0.44 hours	Once every 2-3 days
Potato	5,010 litter	1.25 hours	Once every 3-4 days
Onion	5,899 litter	1.47 hours	Once every 3-4 days
Bean	5,247 litter	1.31 hours	Once every 2-3 days

The frequency of irrigation depends on the crop grown, but it is necessary to irrigate approximately every three to four days. According to the results of a survey of farmers, it is common to grow about two crops at the same time during the dry season, often three. Depending on the crop combination, a second crop grown at the same time of year may need to be irrigated continuously for two to three hours. Solar pumps can only be used when sunlight is available. Even if there are eight to nine hours of sunlight in a day, the actual time the pump can be used is expected to be around seven hours, as time is needed to set up the pump, clean it up and hand it over to the next person in turn. In that case, if up to two people can use the solar pump per day and irrigate once every four days, the pump should be shared by a maximum of eight members. Of course, the number of people

⁸ Discussions were held with the irrigation officer of Mchinji district, one of the target districts, on the use of solar pumps in a way that would meet the water requirements of each crop, and information on Crop Water Requirements was later shared by the irrigation officer.

⁹ A more realistic daily water requirement for MA-SHEP farmers in the target area was calculated with reference to the average cultivated area for each crop for all target farmers interviewed for this study, based on the general daily water requirement for the crops during the growing season. Specific figures for the average area under cultivation for each crop in the table are omitted.

¹⁰ Reference: FAO, Chapter 2: Crop Water Needs, <https://www.fao.org/4/s2022e/s2022e07.htm> (accessed 25 September 2024).

who should share a solar pump depends on the performance of the pump, the type of crop grown, the area cultivated by each member and soil type, but based on the above conditions, it would be reasonable to set up small groups of eight people each to consider purchasing one.

For these issues, there was not enough information on the actual farming situation of the farmers in advance of the implementation of this study, and it was difficult to incorporate guidance that took these issues into account during the limited time available for the study. Therefore, the study did not consider these issues in advance, but rather collected information on specific issues that emerged in the process of sales promotion activities by the subcontractor in this case, and examined the causes of these issues.

Another issue is the financial challenge of whether eight people can afford a solar pump. This point is explained in the next chapter, where the income and savings required to purchase solar pumps for eight people each are calculated and explained.

10.1.2 Selecting the appropriate type of solar pump

The solar pumps introduced by the subcontractors in this study can be divided into two types, submersible and surface water, between which there are differences in performance and functionality. Following this, it is possible to ascertain to some extent which solar pumps are appropriate for each target farmer group by checking their water source and distance from cultivated land. However, in the setting of this study, if the farmer group wishes to do so and the distributor agrees, the selected solar pumps will be sold even if they are not appropriate given the situation of the target farmers' water sources.

On the other hand, many farmer groups prefer to use submersible pumps with more horsepower, but it appears that some groups should opt for surface water solar pumps instead due to lower water levels in water sources during the dry season. One of the re-consigners, SunnyMoney, has been careful in some respects in making this choice, but others appear to be promoting the pumps without careful checks. This is important because if the appropriate solar pump is not selected, the use of the pump may be less effective, or it may not work in the first place. This may have been demonstrated or otherwise promoted by the solar pump supplier without sufficient confirmation, and it is recommended that district irrigation officers or others provide advice on the appropriate type of solar pump based on the farmers' current situation.

10.1.3 Methods of releasing irrigation water from solar pumps

None of the subcontractors have specifically considered the impact on crops in terms of the way water from the solar pumps is discharged, which needs to be improved. All of the subcontractors currently sell solar pumps with a hose to discharge the pumped water directly, which is a very crude method that risks damaging the crops. There are several effective ways of releasing water, such as through sprinklers or by storing in tanks and drip irrigating from there, and we exchanged views on these points with officials from the provincial Ministry of Agriculture.

Being economically unfeasible to ask MA-SHEP farmers to purchase sprinklers and other applicators along with solar pumps from the outset, it is realistic to first ask farmers to purchase solar pumps and then gradually ask them to upgrade to more effective solar pump irrigation. It was agreed with officials in each district that information should be collected and organised so that technical advice can be provided when there are noticeable challenges in the use of pumps with direct water discharge from hoses or when there are requests from farmers.

In addition, one of the farmers already using solar pumps who was visited during the second field survey in July was using a sprinkler system. The farmer was interviewed for more details, including the amount of money and the method of use, and it was confirmed that irrigation using sprinklers is possible even with a solar pump, which in this case is a surface water type and does not have a very high output.

As there are several sprinkler vendors in Lilongwe, the types and prices were investigated. The types and prices of sprinklers that were considered most appropriate, based on the area under cultivation and prices, were as follows.

Table 26: Types and prices of sprinklers available in Lilongwe City

	Irrigable radius	Diameter of hose	Price with a stand
1	15 metres	1 inch	45,000 MWK
2	10 metres	0.75 inches	40,000 MWK
3	5 metres	0.5 inches	12,000 MWK

As they only need to be moved from place to place over time, one or two sprinklers would be sufficient for

irrigation coverage in view of the MA-SHEP farmers' situation. According to the owner of a shop selling them, if they happen to break down, they can be replaced free of charge. It is recommended that agricultural extension officers and others provide guidance on how to utilise solar pumps in a more appropriate manner so as not to damage cultivated crops, and encourage eligible farmers to introduce sprinklers after purchasing solar pumps.

10.2 Farmers' financial situation in relation to purchasing solar pumps

In terms of the household financial situation of MA-SHEP group farmers, in order to continue to use the solar pump, they have to pay for the purchase of the solar pump every month in addition to their daily expenditure. On the other hand, the purchase of a solar pump would increase crop size/production of the land during the dry growing season, and thus additional revenue could be expected. Based on the water requirements of the crops grown by the target MA-SHEP farmers as described above, the amount of water released by the solar pumps and the frequency of solar pump use per person, the optimal group size was eight people mentioned in the previous chapter. The following are the estimated payments considered based on the savings and additional earnings of each farmer, assuming the same number of people making payments from the purchase of solar pumps and using the pumps, not considering the use of financial institutions, and assuming a process of expanding the irrigated land for cultivation by 0.25 acres per person after the purchase of solar pumps.

Based on the productivity already discussed in chapter 6.1.6 and the cash flow calendar already discussed in chapter 6.1.7, the specific financial information for the purchase of a Kubwa pump from Vitalite, using the Mwaiwathu Group as an example, is as follows. The table below is prepared separately for 1) the available cash already secured before the purchase of the solar pump and the increase per year (baseline), and 2) the additional expenditure and expected revenue that would be incurred as a result of the purchase of the solar pump (scenario A).

Table 27: Financial table per farmer for Vitalite/Kubwa in Mwaiwathu

Current situation (without having purchased a solar pump)			
Savings as of December 2023	Annual expense	Annual profit	Increase per year
300,000 MWK	780,000 MWK	990,000 MWK	210,000 MWK
Scenario A			
Expenditure arising from the purchase of solar pumps			
Deposit (down payment)	Monthly payment	Payment period	Total amount
62,500 MWK	15,625 MWK	24 months	375,000 MWK
Additional profit per year associated with the purchase of solar pumps			
67,056 MWK			

The conditions for achieving continuous payments for solar pumps based on the above financial tables are as follows:

- 1) At the time of the down payment, they have sufficient savings to cover the down payment (62,500 MWK).
- 2) After the down payment, they have sufficient cash to cover the total monthly payment (62,500 MWK) for four months, after which they can secure additional revenue through solar pump use.
- 3) After securing the first revenue resulting from solar pump use, productivity is adequate to secure sufficient revenue from the enlarged cultivated land to cover the total payments (312,500 MWK) for the remaining 20 months.

In order to fulfil conditions 1) and 2) above, the Mwaiwathu group would need savings of approximately 190 000 MWK. The group will be able to achieve sufficient savings and purchase a solar pump in April 2024. Their cash flow situation is shown in the table below. If the payment timing were accelerated, the savings would be negative at the time of the down payment due to pressure on expenditure other than the down payment and solar pump purchase costs, as they do not have sufficient savings. In addition, during the four months until additional revenue can be secured through the use of the solar pump, household finances are most under pressure and monthly savings are tight. Therefore, meeting payments for solar pumps is likely to be more difficult when irregular expenses such as money for funeral, medical expenses, and school enrolment fees are incurred. Thus, in order to be able to pay for the solar pump, the customer is required to have sufficient savings prior to the start of paying for the solar pump.

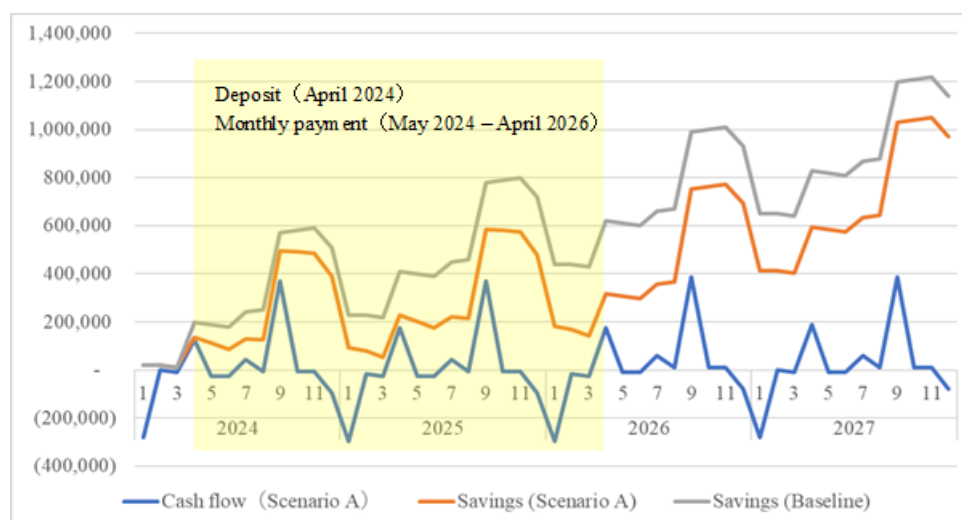


Figure 19: Cash flows and savings without (current situation) and with (scenario) solar pumps (Vertical axis: MWK, horizontal axis: Year and month) for the case of Mwaiwatsu group

The Mwaiwatsu group is the tenth from the bottom in terms of income level among the MA-SHEPs in this study, but because of their low expenditure, they are able to save a certain amount of money and are in a relatively better position than the other groups in terms of savings. Another example is the Makonde group, whose cash flow situation is shown in Figure 18 (page 23), who have not yet purchased a solar pump but are in a position to be able to purchase a Kubwa right now because their cash flow situation is very good.

On the other hand, the Khamalidyetsa group, whose cash flow situation is also shown in Figure 17 (page 23), has a higher income level but lower savings due to higher expenditure. The group has already purchased a solar pump, but the payments have been halted by the cost of incense money, which all members are believed to have paid when one of their members died. It is assumed that the same calculations in the above two forms may show that there may be more months in the future when payments become difficult. Therefore, it was found that the amount of savings, including monthly income as well as expenditure, and the cash flow situation over the next two to three years had a significant impact on the decision to buy or not to buy and the appropriate timing of such a purchase.

The above example of the Mwaiwatsu group is just barely in a position to purchase a solar pump, judging from their existing cash flow situation. The level of Mwaiwatsu's average annual income is 2,207,000 MWK, which can be considered as a borderline for the immediate purchase of a solar pump. The average annual income level in Mwaiwatsu is 2,207,000 MWK, and considering this as a borderline guideline, it would be difficult to purchase a solar pump immediately unless the group has an average annual income of 2,000,000 MWK or more, and below that it would be advisable for the group to save and prepare for one to two years to purchase a pump. However, as in Khamalidytsa, even with an average annual income of 5,620,000 MWK per farmer per year, payment can become difficult, so the above figures are only a guide and the higher the average annual income, the better.

In addition, if a group has sufficient savings prior to purchasing a solar pump and can expect a certain increase in savings in the future, it is possible that in the short term the savings after accounting for the expenditure and revenue associated with the purchase of a solar pump may be lower than the savings without the purchase of a solar pump. There is a possibility that the savings will be lower in the short term than the savings without the solar pump. In the case of the financial tables above, in the current situation, the payment burden associated with the purchase of a solar pump is reduced and an income of 210,000 MWK per year is expected without the use of solar pumps.

Therefore, assuming that the most expensive submersible pump, Kubwa, is purchased, the assumption is that the savings from not purchasing a solar pump will exceed the savings from Scenario A for multiple years from the start of solar pumping in April 2024 (see table below). After April 2026, when the solar pump has been paid for, the payment burden will be eliminated and further additional revenue can be expected from the continued use of the solar pump. As a result, in 2030, the savings in Scenario A will exceed the savings if no solar pumps are purchased, and it will take a further six years to recover the investment related to the purchase of solar pumps, which also needs to be taken into account. Thus, in addition to the prior savings, the use of solar pumps should ideally increase productivity and output and generate additional revenue following purchase. As it is important to inform farmers in advance and encourage them to consider the purchase of a solar pump in light of this information, we suggest in Chapter 14 of this report the areas in which activities could be implemented.

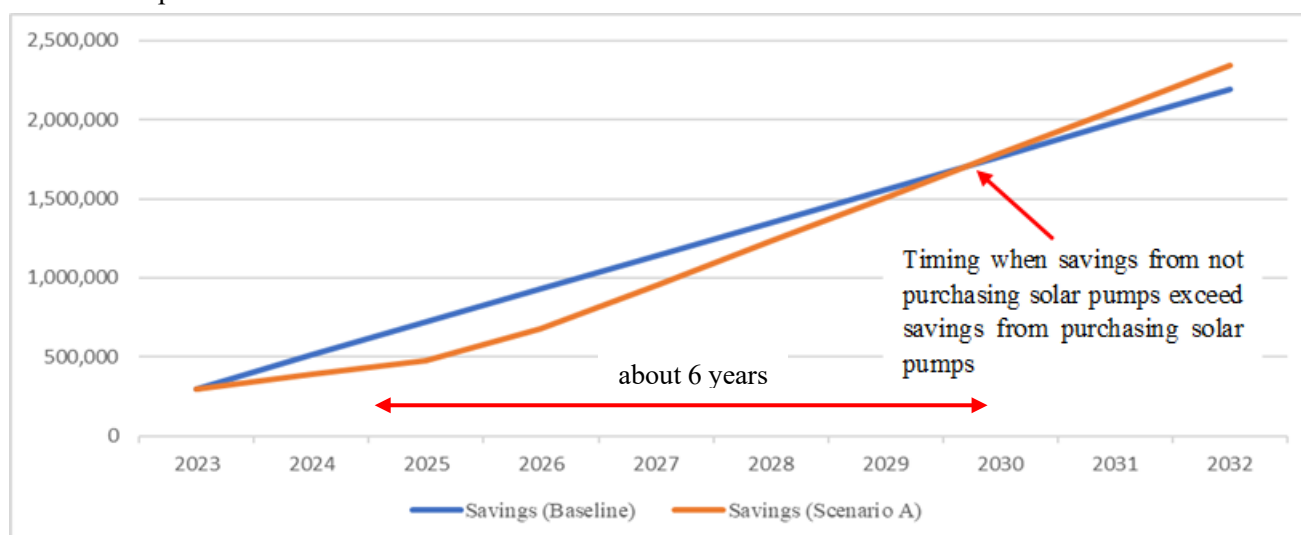


Figure 20: Predicted changes in savings with and without the purchase of solar pumps

11. Challenges faced by subcontractors

11.1 Financing and solar pump procurement methods of subcontractors

As no solar pumps are manufactured in Malawi, basically, except when purchasing from other domestic distributors, distributors purchase solar pumps from overseas manufacturers in foreign currencies such as US dollars. When purchasing, they not only decide on the type of pump but also on the number of units to be purchased, and then negotiate a price. It is also important to ensure that the pumps are linked to the PAYGO system, so the conditions are decided through communication with overseas distributors, taking into account the farmers to whom the pumps are sold and the purpose of the sale. In the case of Vitalite, profits from past sales are used to finance the purchase of new solar pumps, while in the case of Maeve, when the company started dealing in solar pumps, it sold the pumps using funds obtained from a development partner through another project and used the payments from farmers to purchase the next pump. MAEVE, being an NGO, tries as much as possible to buy pumps from solar pump distributors located in Malawi so as to avoid Maeve's activities affecting the private market.

In any case, the three subcontractors in this study are not financially large and the number of solar pumps they can handle at any one time is limited. However, the aforementioned Maeve has relatively ample funds due to the fact that it has carried out many project activities with development partners such as GIZ in the past, and can purchase up to 20 solar pumps at a time when ordering a combination of submersible and surface water pumps. On average, they have procured twenty solar pumps each year so far and they procure four times in a year. This means that approximately 80 solar pumps are sold per year, which is also considered to be a larger number of solar pumps than the other two companies deal with. In the case of Vitalite, the organisation stated that it procures approximately 35 solar pumps once a year. Both organisations were told that this figure was a combination of all pump types.

11.2 Challenges in procuring solar pumps by subcontractors

Several challenges exist in the sale of solar pumps by subcontractors. Even if these distributors hold sufficient Marawi Kwacha, transactions with overseas manufacturers are conducted in foreign currency such as US

dollars, which must be done through domestic banks, and if the banks do not have sufficient foreign currency, they may not be able to purchase solar pumps at all, which is a hindrance to solar pump business operations. This is a hindrance to the operation of the solar pump business. The same challenge was mentioned by WOTA, a solar pump distributor who helped us with our research, apart from the re-consignor, and one of the reasons MAEVE buys solar pumps from domestic distributors is to avoid the negative effects of this lack of foreign currency.

Another impact is due to the depreciation of the Marawi Kwacha. The devaluation of the Marawi Kwacha currency, which is discussed in chapter 3.4 of this report, has increased the price of solar pumps, making procurement and generate profits difficult. Vitalite increased the price of solar pumps during the period of this study, which had been set when the farmers' meeting was conducted in April 2024. Upon learning of this, one of the target farmer groups stopped purchasing pumps from Vitalite and switched to a policy of considering purchasing from other subcontractors. It was found out from interviews that this was due to the farmer group's impression that they had been offered a different price from the original one, which Vitalite considered to be an unavoidable response to increase profits, but which could also have had the above-mentioned consequences.

The funds for procuring solar pumps is limited, and while SunnyMoney procured three expensive Lorentz solar pumps for rental, there was a group of farmers who wanted to buy the same variety of pump from the company, but due to lack of funds the company was unable to procure this. Securing sufficient funds to purchase solar pumps is a very important and serious challenge.

At the same time, inflation in the country has made life difficult for farmers, so not many farmers can afford to buy expensive solar pumps immediately, and it takes a lot of time to prepare for the purchase of pumps. Even when solar pumps are rented out, it is necessary to procure these initially and it is difficult to procure a large number of solar pumps at once, which limits the number of farmers to whom these can be rented.

11.3 Technical and operational challenges of the subcontractors

The challenges faced by subcontractors are not only economic but also technical: the switch failure problems that have occurred repeatedly in the Khamalidyesa group can likely be attributed to the fact that the distributor, Vitalite, does not yet have sufficient knowledge of the pumps it currently sells and is still trying to work out what to do with them. It is also considered necessary for the subcontractors to increase their experience in selling solar pumps and repairing them after sales in the future.

Furthermore, the management structure of the organisation can also be a challenge. For example, as an NGO, MAEVE has a limited number of staff, with only two people carrying out and managing all field operations. Therefore, when the timing of the implementation of other projects overlapped with the implementation of this study and the preparation of the report, it was not possible to conduct field activities in a timely manner or to meet deadlines.

12. Lessons learned through this study

12.1 Benefits and challenges of using private subcontractors in this study

The setting of this study was a very effective approach in terms of connecting dealers with target farmers, giving farmers the opportunity to consider using solar pumps and facilitating the process of purchasing or renting out pumps for use. It is not easy for suppliers to purchase expensive solar pumps and sell them to farmers in rural areas due to the declining value of currency in Malawi, but information and communication between the pump dealers, which are private organisations, and farmers has led to the use of solar pumps, although still limited in number. Therefore, it can be said that there is a need for solar pumps and that the approach introduced in this study, using private distributors, has great potential.

In addition, three subcontractors were selected and asked to carry out their own sales promotion activities, which gave them a choice in the types of solar pumps they handled, their prices, whether they were sold or rented, and other services offered. The target farmers were therefore able to consider, discuss and make their own decisions on the use of solar pumps that suited their situation. This process is important because it respects the farmers' freedom to make their own decisions and is the basis for responsible handling of the solar pumps after their use. Furthermore, competition between the three suppliers led to farmers choosing pumps with better conditions or that suited them in terms of price and service, and in some cases, where one supplier was unable to procure a particular pump immediately, the other supplier sold the pump that the farmer group wanted. Those could be considered as advantages of the format of outsourcing the work to multiple suppliers in this

study.

Furthermore, the three subcontractors this time had different characteristics. While Vitalite is a general solar equipment distributor with a focus on profit, MAEVE has a mission to spread solar pumps to rural areas across the country, but not to generate profits. SunnyMoney, on the other hand, is a social enterprise and therefore needs to generate profit, but at the same time aims to make solar pumps available to farmers with low-income levels in rural areas. To this end, it has invented the method of renting out pumps, which is being implemented on a trial basis in this study.

The rental scheme developed by SunnyMoney is useful for farmers and farmer groups who cannot immediately purchase a solar pump and who would like to use the loan service first before deciding whether to purchase a solar pump or not, and to give them time to prepare for the purchase. This is a convenient method. On the other hand, there were other companies, such as Vitalite, who were purely focused on profit through the sale of solar pumps and whose priority was to provide products and services that met the needs of their customers. MAEVE responded quickly to new orders with prices that were slightly lower than those of other companies. The relationship between the solar pumps and services handled by the three locally recommissioned companies, the MA-SHEP farmers' savings levels and their decision-making on the purchase of solar pumps can be organised as follows.

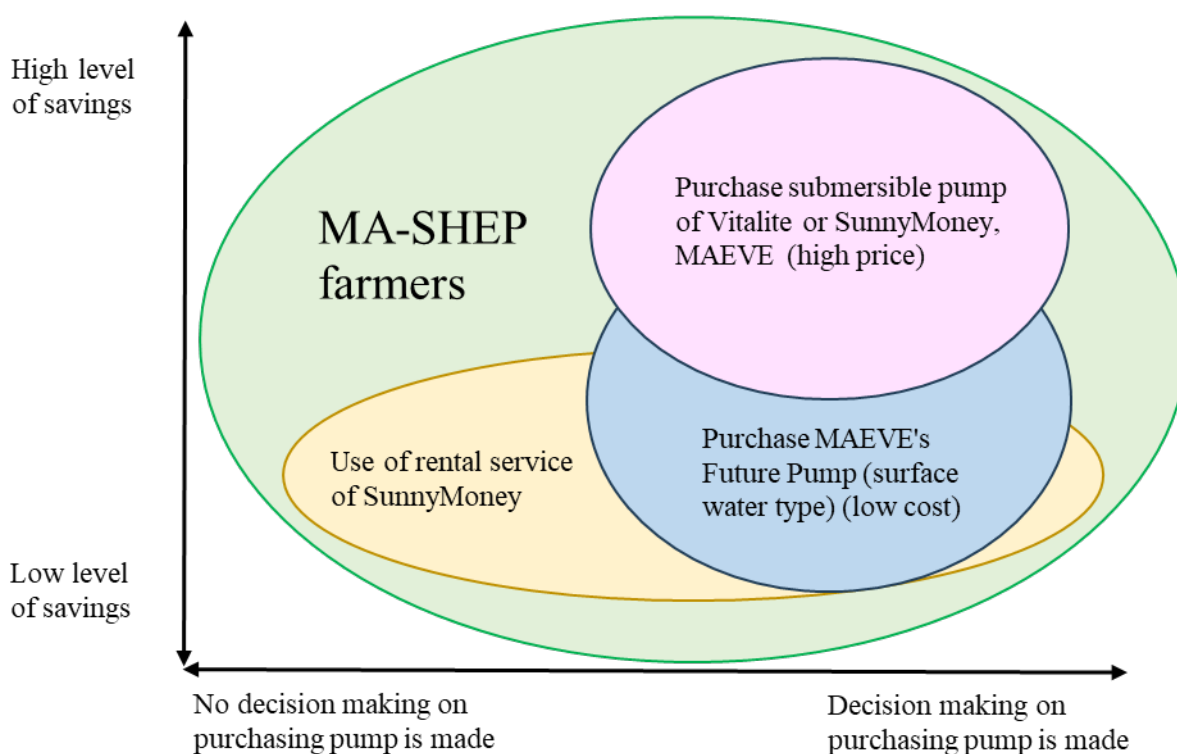


Figure 21 : Relationship between solar pumps handled by each subcontractor, farmers' savings levels and pump purchase decisions.

While not necessarily all of the relationships in the diagram below apply, it can be said that the different characteristics of the three companies were useful in subcontractors operations to contractors who could respond to different farmers' situations and needs, giving farmers a choice and promoting their consideration of using solar pumps.

12.2 Effectiveness in the use of the SHEP approach

The farmers' meetings that were piloted in this study as a representative of the SHEP approach were particularly effective in that they provided farmers with a better understanding of solar pumps, increased their willingness to purchase pumps, and helped farmers and dealers to understand each other's characteristics and contact details. This is a useful activity that can embody the fundamental idea of the SHEP approach of bridging the information gap between farmers and pump distributors. On the other hand, as almost all farmers were forced to buy the pumps as a group, the sharing of information with the remaining group members after the meeting and the demonstration of the pumps by the vendor facilitated the group's overall understanding of the pumps and their decision to use them. Therefore, although the farmers' meeting was very effective as an initial activity,

the need for the above activities to also be carried out was identified.

In addition to the above, there are other activities related to the SHEP approach include baseline surveys, market research and crop selection, action plan development and updating, crop growing calendar development, farming plan development, household management and end-line surveys. These activities could not be carried out during this study due to the limited dates and budget for the Japanese consultants to be engaged in. The farmer groups visited were advised to reflect their group plans for the purchase of solar pumps in their action plans, which several groups indicated that they would update. (The details of the updates of action plans were not confirmed due to time constraints.) In addition, if training could be provided to develop new markets and market research could be conducted, this could lead to increased income for the target farmers.

Furthermore, as the first activity, it may be necessary to conduct a baseline survey with the aim of first selecting or categorising target farmer groups. Asking suppliers to promote solar pumps and expecting them to use the pumps without understanding the farming situation, income situation, and challenges of the target farmers is wasteful from a marketing perspective and is likely to take more time until the completion of sales. Two of the farmer groups that decided to use the pump rental service were not able to use the pumps immediately due to insufficient water in their water sources during the dry season, and work is required to drill deeper into the water sources. Addressing these issues could have been done before the decision was made or before the subcontractors provided the solar pumps, if the situation of the target farmers had been known in advance.

It was also determined from the cash flow calendars prepared that there are many groups which are financially able to make a down payment but soon thereafter fall into a deficit, making it difficult to make monthly payments. Understanding the cash flow situation is essential for making reasonable payments, and there are several SHEP projects that provide training in household budget management. The cash flow calendars prepared for a limited number of farm households on a trial basis are part of the household budget management training for farmers, but even if information is limited to the preparation and simple analysis of these calendars, it would be useful for the target farm households in developing payment plans, and would contribute to appropriate decision-making by the group for purchasing a pump. Although the above has helped to understand the effectiveness and challenges of the farmers' meetings, there are several other activities of the SHEP approach that could still be effective. Therefore, a concrete proposal for a recommended approach, including project activities, is introduced in the next chapter.

12.3 Implications and lessons learned for the dissemination of solar pumps based on the situation of existing solar pump users

All of the farmers interviewed, with the exception of those using rental pumps under the EaaS system, had purchased and used the pumps as individuals rather than as a group. Solar pumps have the advantage of reducing fuel costs and labour, but they are also more expensive than engine pumps, which is a greater burden for individuals, but although some expressed concern about this, not many were asked.

This is likely because it is not perceived as a major challenge, since these solar pump farmers originally met certain necessary conditions such as relatively large farm size and farming operations, with sufficient financial resources to finance the procurement of the pumps; living near Lilongwe and having income or savings from other sources of income outside agriculture; investing in additional equipment such as drip irrigation or sprinkler irrigation, with capital investments also made and income generated from selling high value-added crops; and farmers sharing the burden between parents and siblings and using the farm cooperatively. In particular, 'the size of farmland and farming operations is relatively large compared to general MA-SHEP farmers and these solar pump users have enough financial resources to finance the procurement of pumps' was a common trend among almost all of the pump users interviewed and visited, so the income level is higher than the general MA-SHEP farmers covered in this study and their purchasing and payment methods are unlikely to be informative, as their situation is different in this respect.

On the other hand, the majority of MA-SHEP farmer groups in this study plan to purchase and use the pumps collaboratively by group members rather than individually. When small-scale farmers with insufficient capital capacity are planning to introduce solar pumps, sharing the purchase costs amongst the group can be an effective measure to reduce the financial burden per individual, but if the rules, conditions and maintenance responsibilities of the joint use of the pumps are not clearly agreed among the members in advance, and the pumps are not operated properly, this could lead to problems and make it difficult to sustain their use. If solar pump distributors are mainly targeting individual farmers in their business and lack experience in selling to groups, proper consideration and attention to this aspect during pump installation may be one key to successful solar pump dissemination.

12.4 MA-SHEP farmers' possibility of purchasing solar pumps

The study analysed changes in perceptions regarding the purchase of solar pumps among MA-SHEP farmers. The characteristics of MA-SHEP farmers in the three target provinces are explained in detail in section 6.1 'Current situation in the surveyed areas regarding MA-SHEP farmer groups and solar pumps', but as they have attended MA-SHEP training, they understand the importance of the market and grow and sell vegetables based on market needs which is a major difference from other ordinarily farmers. They also have a certain level of knowledge and experience in vegetable cultivation, which enables them to sell vegetables of a certain level of quality. farmers (non-MA-SHEP farmers), but they are considered to have better marketing and cultivation techniques and higher income levels than non-MA-SHEP farmers.

On the other hand, most MA-SHEP farmers find it difficult to buy solar pumps individually and have to purchase them jointly with other group members or use rental services, as there are high hurdles, mainly financial, for MA-SHEP farmers to purchase solar pumps, which is a deviation from the situation described in the previous section, where existing solar pump users purchase solar pumps individually and without instalments. Given the rising price of solar pumps, it will continue to be less easy for MA-SHEP farmers to purchase pumps in the future, and they will have to purchase them as a group or use a loan service.

It is considered possible that farmers with financial resources, such as existing solar pump users, could purchase their own pumps on their own. In this context, the use of solar pumps is suited to a small number of well-funded farmers, and promotional activities are the most efficient way of doing business. They are unlikely to even be triggered to buy unless they have the opportunity to share information and meet with subcontractors. In addition, even if they acquire information on solar pumps, it is likely to take time to prepare for their use and they may not be able to use them immediately.

However, as there are likely to be a certain number of farmers in other parts of Malawi who have marketing know-how and a certain level of cultivation skills, such as MA-SHEP farmers, it is considered that conducting solar pump promotion activities for MA-SHEP farmers is a more meaningful approach in terms of promoting solar equipment to more farmers in rural areas of Malawi. This is a more meaningful approach in terms of promoting solar equipment to more farmers in rural Malawi.

The fact that most of the groups have purchased or started using solar pumps on loan or made concrete preparations for their use, even in such a short period of time as in this study, suggests that MA-SHEP farmers and farmers at a similar level have the potential to utilise solar pumps and that, over time, pump use is considered likely to be realised. Therefore, targeting MA-SHEP farmers in this study was useful in examining the future potential for solar pump dissemination in rural Malawi.

From the perspective of conducting the survey, the characteristics of MA-SHEP farmers were similar in all groups, which made it easier to make selection decisions for participation in farmers' meetings, consider information items to be collected and points to be supported, and analyse the survey results. One point to consider in the future is which farmers, including non-MA-SHEP farmers, should be targeted by the approach used in this study.

12.5 Potential use of financial institutions in the dissemination of solar pumps

With only the very limited range of information collected here, it is difficult to ascertain how many loan services there are in total that can be accessed by small-scale farmers wishing to use solar pumps, and in what way and to what extent loan services can contribute to the promotion of solar pumps by farmers.

It is believed that there are a number of microfinance institutions, including NEEF, that provide loans to farmers engaged in small-scale irrigation. During the interviews conducted for this study, it was explained by the institutions that they could provide loans for solar pumps, but it was not possible to identify any institutions with experience of actual loan provisions for solar pumps. In the three districts covered in this study, NEEF, which offers relatively low-interest loans and has a nationwide network, was considered to be the most accessible institution for MA-SHEP farmer groups seeking solar pump loans, but the screening criteria for loan approval were unclear, and as identified in the case of the MA-SHEP farmer group, preparing the necessary application documents is not easy and can prove a barrier to farmers applying.

As of implementation of the agricultural stakeholder meetings and subsequent promotion of solar pumps to MA-SHEP farmer groups by the subcontractors, at least two groups are planning to apply for loans from NEEF to purchase solar pumps: one group (Chiyambi) has been falsely reported to have already applied. The group is planning to apply through an agricultural extension officer, as one of the requirements for applying to NEEF

is an assessment by a government agricultural extension officer. However, as this will be the group's first application to NEEF for a loan, they have been encouraged by NEEF to start with loans for normal agricultural inputs (fertilisers, seeds, etc.) rather than loans for pump procurement, so the future is uncertain. As a public institution, NEEF has incurred significant losses in recent years as a result of high loan default rates, and its poor screening and credit management capacity has been called into question.

Even if loan services were available, buyers who wish to purchase a solar pump do not currently have to pay the full pump price at the time of purchase if they utilise the PAYGO system. The system is designed to ease the payment burden on users with limited capital resources, as they can pay in instalments over a certain period of time while using the pump each month. On the other hand, different selling prices are generally set for purchasing a pump with a lump sum payment and for making instalment payments through PAYGO, and when using PAYGO, the price is higher as a result of a certain interest rate being effectively added to the price.

If such schemes are already in place and loans are used to finance further instalments and reduce the burden, the advantage is that the necessary funds can be obtained immediately and the pumps can be introduced quickly, but the total amount of payments and monthly repayment burdens are higher. If agricultural production or income is unstable, the risk of repayment difficulties also increases. It is therefore considered more important for farmers to fully consider how they will secure repayment resources, as well as their income and cash flow projections and repayment plans before taking out a loan.

12.6 Additional activities beneficial to pump utilisation based on insights gained through the survey

12.6.1 Creation and effectiveness of cash flow calendars with target farmer groups

As of June 2024, there were several groups of target farmers who were not able to make decisions on pump purchases immediately; based on the JICA study team's experience in agricultural and rural development such as market-oriented agriculture implemented in other countries, there were several groups who believed that they could not make decisions until they had financial prospects. In view of the possibility that there may be several groups that consider that they cannot make decisions without financial prospects, additional visits were made to seven farmer groups that had not been able to make decisions as of June. If necessary, the method and concept of preparing cash flow calendar was introduced, and work was carried out with farmer groups to prepare and analyse the cash flow situation of members in average farming and sales situations, using an annual calendar approach. Due to time constraints, the calendar was prepared in such a way that the respondents were not asked to state the amount for each expenditure item, but only the total amount of expenditure. An example of a cash flow calendar is presented in chapter 6.1.7.

It was ascertained that most of the farmer members' households who helped to prepare the cash flow calendar were in the black throughout the year. During the preparation of the cash flow calendar, discussions were held with several group members, including agricultural extension workers, on what could be done to stabilise and increase savings. The participants agreed that it was possible to eliminate months with zero or negative savings balances by increasing the number of crops with higher cash flow potential, gradually shifting the sowing of crops in the rainy season, making efforts to increase the amount of income from non-crop cultivation, and reducing expenditure through thrift. An additional point was made that, especially after the purchase of solar pumps, cash flow conditions could be improved by increasing the amount of land under cultivation and growing cash crops during the dry season, which would increase yields during the dry season.

Some groups had months where savings were zero or negative due to the lack of a steady monthly income. In such cases, careful consideration should be given to whether or not to purchase a pump, including whether the status of annual cultivation, harvest and sales prices were better or worse than in previous years. It is also important to ascertain which expenditure the group members consider a high priority, as well as the number of group members and the amount they pay each month. It is not easy to say that all groups on average have sufficient income to purchase a solar pump, as there are many groups that have less savings at the end of the year than at the beginning, but there are farmer groups that may be able to allocate a certain amount of money each month to pay for a solar pump. The cash flow calendar has shown that there are groups of farmers who are able to allocate a certain amount each month for solar pump payments.

Although it was not possible to create the calendar for all the farmer groups due to time constraints, the response from the farmer group members who created the calendar was positive and the activity helped the farmers themselves to understand the cash situation available to them each month. All seven groups that produced cash flow calendars indicated that they would share the contents with other members of the group and discuss them again with the group as a whole, as it would make it easier to consider the purchase or rental

use of solar pumps.

Analysing the financial situation of the target farmers through the preparation of cash flow calendar, etc. is effective in facilitating decision-making by helping to determine their ability to pay monthly for the use of solar pumps, and to better predict their future financial situation, including changes in income through pump use. If target farmers are interviewed in advance, the results of the financial analysis can be shared with each target group at the farmers' meeting.

12.6.2 Other effective activities

In addition to the above, agricultural stakeholder meetings and demonstration activities by solar pump distributors have been described as particularly effective, but based on the information collected, other activities that could be considered effective or necessary are listed below.

- 1) Prepare solar pumps and services that meet the needs of farmer group members:** According to the interviews with target farmers, it was confirmed that farmers generally prefer to purchase solar pumps with strong functionality, but the needs of each target farmer group may differ, so pumps and services with several different functions, ease of use, price and other features should be prepared based on the needs by the operator prior to the agricultural stakeholder meeting. The supplier should consider and prepare these in advance to facilitate discussions and decision-making within the farmer group.
- 2) Pre-use assessment of solar pumps, including the condition of water sources and the amount of water available during the dry season:** Solar pump vendors and provincial Ministry of Agriculture officials will visit each target farmer group at or around the time of the demonstration to check the condition of water sources, access to water sources from the members' cultivated land, the main crops and area under cultivation, and the number of farmers who intend to use them, together with the target farmer group members. **Based on these conditions, also exchange opinions on the appropriate pump type, operational methods and expected benefits. The information captured from the activity will help the farmer groups to make decisions on pump use, increasing the likelihood that more appropriate decisions will be made and helping to avoid post-decision problems.**

12.7 Cooperation and effectiveness of the District Ministry of Agriculture and agricultural extension officers, etc.

12.7.1 Discussions with irrigation technical officials in the target district

The first step to be taken by farmer groups that have access to solar pumps is to start using them through purchase or rental services. It can be envisaged that technical support will be required, including the above-mentioned water requirements and considerations of appropriate irrigation times for the area under cultivation. It was confirmed through discussions with extension officials and irrigation technology officers in each target district that the Government's role is to provide assistance in the above technical issues. On the other hand, solar pump suppliers of the private sector generally do not have staff with such knowledge and experience. Representatives of MAEVE and Vitalite, the subcontractors, share the same opinion that such collaboration between private organisations and government agencies is necessary. MAEVE has so far not made such a move in this study, but has provided guidance to irrigation officers on water requirements per crop to farmers who have purchased solar pumps, for example. In contrast with NGOs such as MAEVE, private solar pump sellers in general do not always have such a perspective or experience, and it would be desirable for the project implementation team to take the lead in facilitating this and establishing a mechanism.

12.7.2 Cooperation by agricultural extension officers and other government officers

Each agricultural extension officer is assigned an area of responsibility and has a good understanding of, or at least acquaintance with, the farmers and farmer groups in this area. Ideally, there are some activities where the target farmer groups may need some support before they are able to use the solar pumps, where the agricultural extension worker can provide appropriate assistance. For example, they could play an important role in ensuring that the participating farmers have a session to share with the rest of the group members after the farmers' meeting, or in providing an objective facilitation role when decision-making within the farmer group

is not going smoothly. Cooperation from those government officials could be beneficial, as commercial officers may have extensive knowledge and contacts regarding the local market and buyer situation. The survey also found that the farmers' groups are not always able to reach decisions in the same way as individual farmers. However, as there was uncertainty in this study about the extent to which agricultural extension officers, commercial officers, as well as irrigation officers would be able to help, we did not envisage in advance that they would support the above activities and did not request them to do so.

It was confirmed with the former Chief Advisor of the MA-SHEP when a daily allowance was paid to government officials to participate in or accompany the project activities for a day during the MA-SHEP period. In this study period, government officials were also paid a daily allowance when they were asked to accompany or cooperate with the study activities for half a day or more. From a sustainability perspective, it would be desirable to have these government officials cooperate in all activities without paying them a daily allowance. However, the reality is that it was difficult to expect government officials at the county level, who realistically have little or no budget for activities, to work on their own, especially without a daily allowance. If they are involved, it is often beneficial, including in terms of relationships with farmers, but from a budgetary perspective, asking them to get involved can be costly. In this regard, many projects have endeavoured to establish an activity fund for the purpose of project involvement in the regular budget of the Ministry of Agriculture or other government organisations, but this is time-consuming. However, given the need for this, it may be necessary to discuss with the Director of the Extension Department of the Ministry of Agriculture what the realistic possibilities are in this regard.

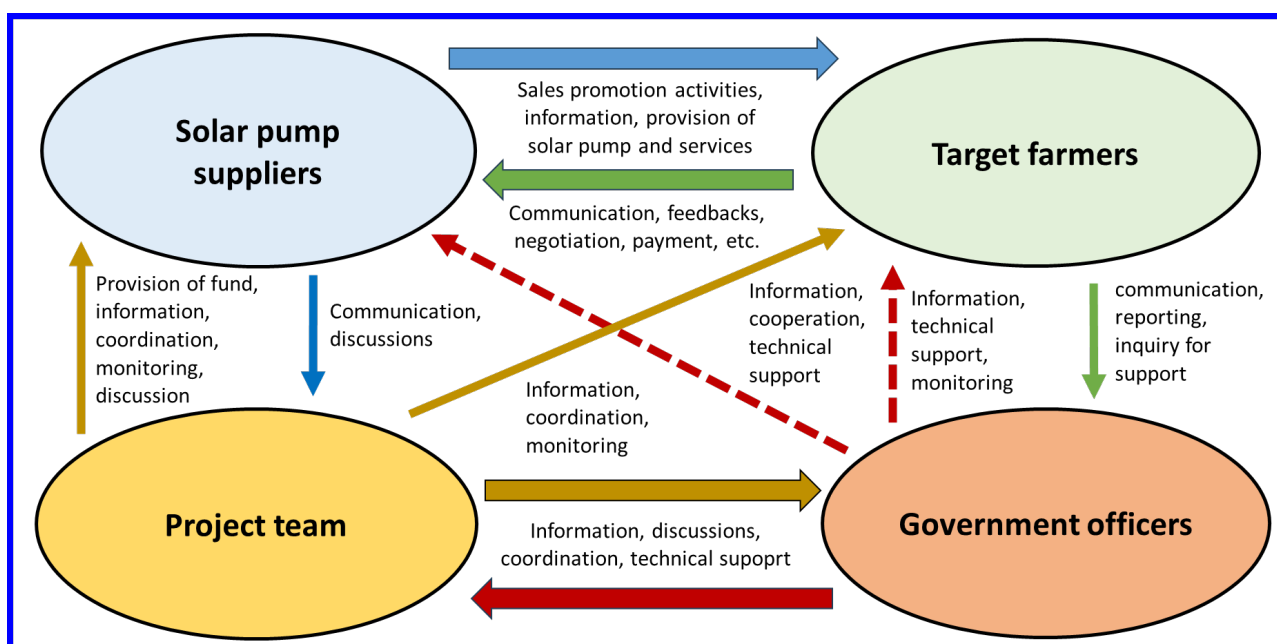


Figure 22: Desirable liaison and co-operation between the organisations concerned in promoting this approach

12.8 Use of Malawian staff in the project

Two Malawian staff were employed during the implementation of this study: one was a former staff member of the MA-SHEP project with nearly 30 years of experience working in the Extension Department of the Ministry of Agriculture, and the other was a young person who had interned at the Ministry of Agriculture. The former was particularly helpful in liaising and coordinating with the Ministry of Agriculture, as he was well-connected with officials in the Ministry's main office and in the target districts. They were very useful resources because they were familiar with Malawi's common practices in the field of crop cultivation, the Ministry of Agriculture's approach, and the system for implementing extension activities. Employing people like this who can act as a bridge to government officials, such as agricultural extension officers, is beneficial for implementing activities in a short period or limited number of days. The presence of two staff members also allowed the project team to work in two groups, and although it was not always known until the last minute whether they would be able to accompany the government officials on the days they visited the sites, even if they were unable to attend, the presence of staff ensured that the necessary activities could be carried out and communication with the farmers was sufficient with those Malawian staff. It is therefore very effective to employ a few staff with expertise in crop cultivation, agricultural extension (or PUE equipment such as solar

pumps), etc., and to use these people while conducting survey activities to promote solar pumps for farmers.

13. Future prospects and proposed approaches to the use of solar pumps in Malawi

Based on the findings and lessons learned from this study, the approach attempted in this study to promote solar pumps in rural Malawi is considered to have been effective in promoting the use of solar pumps by target farmers. However, there are still some implementation issues and implementation methods that could be considered and improved. Thus, activities based on the basic set-up in this study should be implemented in different areas to test more effective and efficient approaches. Three possible approaches are considered for this purpose, and their advantages, potentials, challenges and risks are presented in the following table.

Table 28: Proposed approaches, their advantages and challenges, etc.

	Approach 1	Approach 2	Approach 3
Overview of the proposed approach	Linking the subcontractors with the target farmer group, with the two parties in principle liaising to purchase or rent the solar pumps. JICA's interventions would be limited to coordination at the beginning of the activity, conducting farmers' meetings and checking the results at the end; JICA will be responsible for the implementation of the solar pumps and the use of the solar pumps in the farmers' groups. In principle, the above two parties will communicate with farmers on the use of solar pumps, and the JICA survey team will not provide any other assistance or collect information on the target farmers.	The main objective is to verify a more effective and efficient implementation of the approach based on the results obtained from this study. The JICA study team will collect and analyse information on the target farmers in the first half of the project and share the results with the subcontractors and the target farmer groups. Agricultural stakeholder meetings will then be held to support the subcontractors' activities to promote the use of solar pumps. This will include reviewing the activity design, collecting, organising and analysing preliminary information on the target farmers, conducting agricultural stakeholder meetings, liaising and coordinating with relevant stakeholders and monitoring activities with the target farmers, checking the final results of solar pump use and analysing more effective and efficient ways of implementing this approach.	In addition to the activities in Approach 2, the JICA study team will carry out some additional activities that may be effective in promoting awareness of the purchase of solar pumps among the target farmer groups, conduct follow-up activities with the target farmers and facilitate the process of the use of the pumps by the farmers. Provide more intensive support to target farmers and test its effectiveness.
Advantages/opportunities	• The cost of implementation can be kept low. • Decisions on the use of solar pumps are made in the interaction between the private sector and the target farmers, thus minimising the need for outsiders to intervene. • Provides business opportunities for the private sector.	• <u>Implementation costs are similar to those of the study conducted, but relatively low.</u> • The project team can act as a guide to private contractors with limited information. • <u>As the JICA study team conducts information on the target farmers before the meeting of agricultural stakeholders, it is easier to promote the use of pumps than Approach 1, as the JICA study team can organise the situation of farmers, their interest in solar pumps, their current situation regarding farming and issues related to pump use, implement necessary activities and bridge the gap between the parties concerned.</u>	• In addition to the benefits and potential of Approach 2, the process to pump utilisation is likely to be smoother, as farmers can be assisted based on the skills and knowledge that government officials and JICA study team have. • <u>The selection of target farmers can be based on clear criteria, and activities can be implemented in a more organised manner.</u> • Support activities for target farmers can be proactively implemented by the project team, enabling the necessary capacity-building to be carried out.

	Approach 1	Approach 2	Approach 3
		The project team can be the main actor in the implementation of SHEP approach activities, such as agricultural stakeholder meetings, thus ensuring the effectiveness of the activities.	
Challenges/risks	- The private sector may not have the skills or knowledge to provide assistance, and technical challenges may remain. - Some farmer groups are unable to make decisions on their own and may require more time before they can use the programme. <u>The intervention may have limited impact because it is difficult to conduct follow-up activities with target farmers.</u> - The assumption of a limited budget makes the involvement of government officials very limited and makes it difficult for government organisations to utilise the technology they have. <u>The selection of target farmers tends to be ambiguous, which may cause problems in the process of preparing pumps that meet their needs and using the pumps after the decision is made.</u> <u>Difficulty in understanding the situation of the target farmers as a whole.</u>	<u>The support for skills and knowledge that private sector providers do not have is difficult and technical challenges may remain.</u> - The approach is not designed for farmers' groups who are unable to make decisions on their own, so it may take a long time before they are able to utilise the technology. <u>The limited budgetary assumptions make the involvement of government officials limited and make it difficult to utilise the technology that government organisations have.</u> - Insufficient follow-up and technical support for target farmer groups, which may create challenges in the process from decision-making to pump utilisation.	- The cost is higher than approaches 1 and 2, and therefore needs to be considered in terms of the versatility of the approach. - The division of roles between private contractors, government agencies and project team needs to be clearly defined in advance.

The activities undertaken in this study and the level of intervention with the target farmer groups are almost identical to Approach 2 above, although the sequencing of some of the activities needs to be changed and added in order to improve the effectiveness of the approach. Due to the small number of activities undertaken by the JICA study team, it is not certain whether the same level of results can be expected as in the main study. Also, Approach 1 does not examine more effective and efficient ways of implementing the approach, so the approach focuses on promoting the use of solar pumps by target farmers based solely on the results obtained in the main study.

Approach proposal 3 builds on the results of this study, but also organises more interventions and then tries them out in a more carefully delivered form to target farmers to test their effectiveness. It is more costly and time-consuming, but it is expected to achieve more than what was achieved in the main survey, and the process of smoother decision-making and solar pump use can be facilitated by the project implementation team and other stakeholders. All of the proposed approaches are based on the assumption that the subcontractors will be paid a subcontracting fee, a contract will be signed, and the activities will be carried out according to the terms of the contract. Approaches 2 and 3 are more effective and efficient interventions because they first conduct a survey on the target farmers, so that the situation of the farmers can be understood in advance, and based on the organised and analysed information, agricultural stakeholder meetings can be prepared and information can be shared with the subcontractors before activities start. For example, in the case of proposals 2 and 3, based on the survey results, the target farmer groups could be classified according to the level of their monthly available cash balance, with priority given to the top group, which is considered to have the highest potential to access solar pumps, for necessary information and assistance. Another possible proposal is to consider and implement appropriate support activities based on the characteristics of each group, including their situation.

The differences between the three approaches presented in the table above are summarised in the table below, based on the experience and results of this study, and the useful activities that can be envisaged based on the objectives and the institutions that can implement them. The activities marked are those to be implemented under each approach. Numbers 1 to 3 correspond to Approaches 1 to 3.

Table 29: Availability of activities to be implemented in each approach (Proposed activity packages)

	1	2	3	Objectives	Effective activities	Implementable agencies
1	✓	✓	✓	The Ministry of Agriculture officials are asked to agree on the purpose of the survey activities and the content of the cooperation request.	Online or face-to-face meeting prior to the activities	JICA (or development partner) and project team
2		✓	✓	Select appropriate target farmer groups	Target farmer group selection using Criteria	Project team and district officials of agriculture department
3		✓	✓	Fully understand the target farmers' situations	Surveys and fieldwork activities through visits to potential target farmers	Project team and district officials of agriculture department
4	✓	✓	✓	Select appropriate subcontractors	Selection using criteria after conducting pre-briefing sessions and online interviews based on the content of the proposals	Project team
5		✓	✓	Ask them to consider preparing solar pumps and services that match the farmer's situation and needs.	Detailed information-sharing on farmers and meetings on activities	Subcontractors
6		✓	✓	Increase understanding and awareness of the use of solar pumps by explaining about agricultural stakeholder meetings and sharing survey results.	Sensitisation session for target farmer groups	Project team and district officials of agriculture department
7	✓	✓	✓	Ensure that target farmers are familiar with solar pumps, know who to contact for distributors, and can identify next actions.	Agricultural stakeholder meeting	Project team and district officials of agriculture department

	1	2	3	Objectives	Effective activities	Implementable agencies
8			✓	All farmer group members have a better understanding of solar pumps and can initiate discussions within their membership.	Sharing of information with the rest of the members by farmers who attended the meeting	Project team and district officials of agriculture department
9	✓	✓	✓	All farmer group members have a better understanding of solar pumps and can have more specific discussions within their membership.	Demonstration activities by subcontractors	Subcontractors
10			✓	Specific forecasts can be made based on the economic aspects of purchasing the solar pumps desired by the target farmer groups.	Household budget management training	Project team and district officials of agriculture department
11		✓	✓	Assess the status of each target farmer group's decision-making and issues related to the use of solar pumps.	Follow-ups by project stakeholders	Project team and district officials of agriculture department

While the table above provides an overview of the activities in each approach, their objectives and the institutions that can implement them, Appendix 9 provides notes on the implementation of the activities envisaged in each approach in response to the table above. In addition, it is necessary to select a more appropriate and feasible approach from the three proposed approaches in the table above, and to consider more specific implementation methods and scale of implementation, including the target population and target areas. As noted in the lessons learned section of Chapter 12, it can be inferred from the current situation that farmers with a certain level of income and savings, based on cultivation techniques and marketing knowledge, such as MA-SHEP, have the capacity and potential to make use of the pumps, compared to other farmers in the general population. The current situation suggests that the potential is high compared to other farmers in general.

There are a total of 135 MA-SHEP groups not only in the three target districts of this study but also throughout Malawi, with similar characteristics to the farmer groups in the three target provinces, although the crops grown and farming environments in each region differ in some areas. Therefore, it can be inferred that MA-SHEP farmers have a high need for solar pumps in all districts and have the capacity to realise their use. Although 15 groups were targeted in this study, there are at least 120 other groups in the country with a need and potential to purchase solar pump use. However, these points may well have regional differences depending on the groups, so the effectiveness of this approach and effective activity packages for different environments and situations should be tested. Promoting the dissemination of solar pumps while trialling the approach of this study in other parts of Malawi would be beneficial to small-scale farmers in Malawi and would also help to revitalise rural areas as a whole, including other African countries.

Although a certain level of effectiveness and potential for activities based on the concept of linking private contractors and farmers implemented in this study has been confirmed, there is still room for further validation. Although the implementation of solar pump promotion activities based on the three aforementioned proposed approaches and verification of more effective methodologies could be considered, there are areas where the methodology cannot be said to be fully established, and it is unlikely to be easy to get other development partners to implement the proposed approach based on the concepts and pilot activities tested in this study. In addition, the study did not find any development partners implementing programmes with a high degree of affinity to the activities based on the concepts in this study. Therefore, the approach based on the concept of this study is assumed to be implemented by JICA, and Tables 28 and 29 are selected as the approaches, and there are four possible methods and scale of deployment for implementing them, as shown in the table below.

Table 30: Proposed implementation methods of approaches considered effective in this study

	Target farmers		Target areas		Points to note
	MA-SHEP farmers	Non MA-SHEP farmers	Entire country of Malawi	Some parts of Malawi	
1	○	×	○	×	Focused on the Central region (number of targeted farmer groups is around 30 and implementation is envisaged to last around two and a half years).
2	○	×	×	○	MA-SHEP farmers will be targeted throughout Malawi. (However, as 120 farmer groups will be targeted, implementation is expected to take around five years).
3	○	○	×	○	MA-SHEP farmer groups are selected mainly in the Central region, while non-MA-SHEP farmers are limited to one or two provinces (overall number of targeted farmer groups is expected to be around 30, and implementation is expected to take around two and a half years). The link between solar pumps and the use of PUE equipment such as SHS will also be included in the study.
4	○	○	○	○	MA-SHEP farmers are targeted throughout Malawi. Non-MA-SHEP farmers will be limited to about 3 provinces. (However, implementation is expected to take up to five years as more than 120 farmer groups will be targeted).

In the case of the first and the second options, taking into account the solar pump procurement capacity of the subcontractors, the target area is mainly the Central region (central region), and the effectiveness of the approaches considered in this study will be verified and improvements will be made where possible. In the options 1 and 3, the main focus will be on the implementation methods, combinations and implementation of activities considered effective in this study. The third option also includes pilot activities on promoting the use of solar pumps to non-MA-SHEP farmers, to test the proposed package of effective activities. In addition, the third option will also test the linkages between the use of solar pumps and PUE equipment such as SHS and effective activities to promote the use of such PUE equipment. Even though the approaches proposed in the Table 28 and 29 did not mention this idea, it can be implemented by adding activities, if the third option in the Table 30 were selected.

Although this study was conducted over a one-year implementation period, it is assumed that more groups will become available for purchase during the dry season and the following rainy harvest season, as they will start considering and preparing for use after the farmers' meeting, so depending on the timing of the meeting, it may take one batch (one activity implementation period) of at least about 18 months would be needed to see the effects of the activities. Therefore, although the options 1 and 3 in the Table 30 are planned to be implemented in a limited area, assuming that the target farmer groups are divided into two batches, an overall activity implementation period of at least two and a half years is likely to be required.

For implementation the fourth option, in addition to MA-SHEP farmers, the project's approach will be to promote solar pumps to farmer groups that have some distribution outlets; for MA-SHEP farmers, target farmer groups will be selected around the central region, and for non-MA-SHEP farmers Proposals 2 and 4 will cover all of Malawi, but activities will be implemented at different times in different regions, taking into account the extent to which the subcontractor is able to cope with the project. In addition, for proposals the second and the fourth options, the main focus will not be on establishing an effective package of activities, but on implementing a technical cooperation project based on the activities considered effective in this study, with a focus on the dissemination of solar pumps throughout the country. However, in the fourth option, activities

will be combined with activities to test effective approaches to non-MA-SHEP farmers.

14. Relevance and potential for dissemination of PUE equipment through the survey activities in rural Malawi

Through this research activity, it was confirmed that there is a need for solar pumps in rural areas. In addition, farmers who have certain cultivation techniques and a market to sell to, such as MA-SHEP farmers, can purchase solar pumps if their income and cash balance are adequate based on the aforementioned economic analysis. The survey also confirmed that the basic set-up of the study - the subcontracting method to private contractors and sharing of information about solar pumps and distributors to the target farmer groups through farmers' meetings - were very effective activities in increasing the understanding of solar pumps and farmers' willingness to purchase them.

While the context of this study was to improve energy access through the promotion of the use of PUE devices in rural Malawi, solar pumps were chosen as the target of the study based on their characteristics. Apart from solar pumps, other PUE devices such as access to electricity at home through solar home systems (SHS), charging mobile phones or using radios powered by solar panels were considered as PUE devices in rural areas. Of these, the solar pump is a very beneficial PUE device for farmers whose main livelihood is farming in rural areas, as it can increase income, enable more efficient farming practices and reduce labour in farm work compared to other PUE devices. Therefore, although prices are higher than for other PUE equipment use, incentives for effort for its use are of a more workable nature.

On the other hand, the above-mentioned SHS and mobile phone charging and radio use have the advantage of making life more convenient, and have the effect of reducing costs related to electricity use, but they do not act as strong incentives, such as increased income, especially for farmers who have other high priority expenditure items to use those PUE devices. However, they are not considered to be a strong incentive to use PUE equipment, especially for farmers who have other high priority expenditure items. From the above characteristics, it can be said that solar pumps and other PUE equipment have inherently different properties. The differences in the characteristics of these different PUE equipment are shown in the table below.

Table 31 : Comparison of features of solar pumps and other PUE equipment

	Solar pump	Other PUE equipment
Price	Very high	Relatively lower
Benefits to livelihoods	Dry-season cultivation is feasible or easier to carry out, allowing dry-season cultivation over larger areas	It will be convenient to have lights on in your home at night. Savings can be made as the cost of charging radios and mobile phones is eliminated.
Effects on income growth	Direct effects	Less direct effect
Procurement methods and level of difficulty	Limited number of suppliers and difficult to obtain in rural areas.	PUE equipment is also available in local towns, and is relatively easy to obtain
Method of purchase or use	Mostly purchased and used by groups	Basically used on an individual or household basis

It was observed that some farmers had already installed solar systems in their homes or were using solar panels for some other purpose, as the MA-SHEP project has been running for more than five years and all the farmer groups targeted in this study have been supported since the first batch (at the beginning of the project). Even though the direct intervention period was limited, the introduction of the SHEP approach allows farmers to continue once a mechanism is in place that leads to improved incomes. Therefore, all of the target farmers interviewed strongly felt that their living conditions had improved in some way through their experience with MA-SHEP, and they were not only able to meet their daily expenses such as children's education, family medical expenses and food, but also to build their homes, buy livestock, purchase transport and means of transport, buy TV sets and other through the survey also confirmed that they have increased their assets and improved their livelihoods. Furthermore, some of these farmers were able to obtain electricity by personally installing their own solar panels. It is quite possible that such farmers may consider installing SHS at their homes or solar panel-based lighting as a step towards improving their livelihoods in the future, and such conscious farmers may place a higher priority on purchasing PUE equipment such as SHS before purchasing solar pumps, which are more expensive.

As the purpose of the survey was to verify changes in the awareness of target farmers of solar pumps as PUE equipment, including the effect of the content of the activities, it was not possible to confirm the relevance of the survey as this did not include interviews on whether interest in other PUE equipment such as SHSs increased in tandem with that of using solar pumps. Therefore, it is possible that the agricultural stakeholder meetings and community demonstration activities that were found to be effective in this study may have some effects (increase in understanding and willingness to purchase by farmers) when applied to other PUE equipment, but as PUE equipment is not directly linked to increased income, it is difficult to estimate how farmers will decide to purchase PUE equipment after the agricultural stakeholder meetings have been held. It is difficult to guess what kind of decision the target farmers will make to purchase PUE equipment after the meeting. For PUE equipment other than solar pumps, it may take longer than for solar pumps to be purchased, so it is considered necessary to raise awareness among farmers and create behavioural change for purchase, e.g. by raising awareness about livelihoods.

PUE equipment such as SHS is inexpensive when compared to solar pumps, and more readily available from many suppliers. (However, SHS can be expensive depending on its size and mechanism.) Basically, farmers purchase and use solar pumps as a group, while other PUE equipment is generally purchased and used by individuals or households as a rule. Therefore, it is likely that PUE equipment other than solar pumps is easier to purchase or rent out for use, and the approach of the supplier is likely to change. With these considerations in mind, one possible approach is to start PUE equipment promotion activities with farmers who live in areas closer to cities and have some understanding of urban values and lifestyles, and then move on to farmers in more rural areas. In any case, the dissemination of PUE equipment in rural areas should start with farmers with a certain income, such as MA-SHEP farmers, and awareness-raising activities on improving farmers' livelihoods through the introduction of PUE equipment are considered essential for improving the use of PUE equipment.

List of Appendices

- Appendix 1 : Questionnaire for the farmer already using irrigation other than solar pump or the farmer never used irrigation equipment
- Appendix 2 : Main contents of the discussions and matters reported to JICA's Infrastructure Management Department
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- Appendix 8 : Interests and preparation status of each group regarding use of a solar pump
- Appendix 9 : Proposed packages of activities in response to 3 draft approaches and notes on each activity

Data Collection Survey on Productive Use of Energy in Rural Area in Malawi

Questionnaire for the farmer already using irrigation other than solar pump or the farmer never used irrigation equipment

We greatly appreciate your understanding of the value of this study and your kindest cooperation in this regard. The information collected will be used only for analysis for the study.

Date of interview: _____

District: _____

Group name: _____

Current number of the group member: _____

Interviewee's name: _____

Interviewee's position in the group: _____

Gender of interviewee: _____

Tel No.: _____

【demographic information and land ownership】

Q1 Are you a head of household?

☐ Yes ☐ No

Q2 Please select your marital status.

☐ Married ☐ Single ☐ Widow/Widower ☐ Divorced

Q3 How many members are there in your family? _____

Q4 Can you read and write?

☐ Yes ☐ No

Q5 Is farming the primary source of your household income and/or food?

☐ Yes ☐ No

If “No”, please inform us what is a major source of income of your household and about how much you are earning in a year.

Q6 Is your farm work managed by your family members?

☐ Yes ☐ No

If No, please explain how you manage it. _____

Q7 Do you own your farm land?

☐ Yes ☐ No

If No, please explain who owns your farm land and how profit is shared with you. _____

Q8 How long is your farming experience?

☐ 1 – 10 years ☐ 10 – 20 years ☐ 20 – 30 years ☐ Over 30 years

【Information of farming and business】

Q9 What type of crops including vegetables do you cultivate? Please inform us of some details including traditional crops.

	Name of crop	Months to cultivate	Volume of production (Please put a unit)	Size of land	Cost (in average)	Volume of sales	Sales Price (Rainy season) (Please put a unit)	Sales price (Dry season) (Please put a unit)	Buyer	Profit
1										
2										
3										
4										
5										
6										

*If some items are not sold, cost, sales, and profits do not need to be filled.

**Clarify if some products are produced in the dry season or not based on the cultivated month.

***Profit can be entered later by the interviewer.

Q10 Are these vegetables commonly produced by other group members?

☐ Yes ☐ No

If not, please explain a reason. _____

Q11 What is a major challenge in crop production including vegetable production?

Q12 How do you cope with these challenges for vegetable production?

Q13 How do you sell your products?

Q14 Do you sell your products with other group members?

☐ Yes ☐ No

Please explain about a reason of the response above. _____

Q15 What products are sold with other group members?

Q16 How do you find a buyer or a place to sell your crops and/or vegetables?

Q17 How much can you save per month in average?

Q18 What is the past and expected change of your savings compared with the current savings?

When	Less savings	No change	More savings
5 years ago	☐	☐	☐
5 years later	☐	☐	☐

Q19 The reason behind your estimation.

Q20 How income has been used to improve quality of your life and livelihood since the beginning of the support by the MA-SHEP?

Q21 What are your first 3 prioritized items to spend money?

- (1)

- (2)

- (3)

Q22 **【Awareness and perception of solar pump】** Are you interested in solar pump?

☐ Yes ☐ No

Q23 How much are you interested in utilizing solar pump?

- (1) Very much (2) Moderately (3) To some extent (4) Not so much

Q24 What is a reason of having interest or no interest in solar pump?

Q25 Have you ever had other irrigation systems?

☐ Yes ☐ No

Q26 If yes, what kind of irrigation systems such as engine pump and treadle pump do you have?

Q27 Please explain about what you think about other irrigation equipment such as engine pump and treadle pump.

Q28 If there is an existing irrigation system, how it is used by the group?

Q29 Is there any challenge to the existing irrigation system?

☐ Yes ☐ No

If Yes, please explain the details. _____

Q30 If No for the above question, why are you interested in solar pump?

Q31 At which companies' product are you most interested and why?

Product					
Sunny Money		Vitalite		Maeve	
Lorenz	SolarPlex	Climate Smart	RainMaker2C Kubwa	Future Pump	Lorenz
☐	☐	☐	☐	☐	☐
Reason					
Affordable price of the equipment				☐	
Farm work will be lighter than now.				☐	
High pumping capacity to irrigate my farm from an available water source (capacity to pump water for long distance)				☐	
High pumping capacity to extend a land size for dry season production				☐	
No cost of fuel				☐	
Easy to operate & carry				☐	
Attractive support, spare parts & services by suppliers				☐	
Other				☐	

Q32 What would be a preferable payment conditions?

(1) Pay As You Go, (2) EaaS, (3) Loan program by financial institution

Q33 What is a reason of the response for the above question?

Q34 Have you applied any loan to any financial institutions?

Yes

☐ No

Q35 Please explain about details of loan application and a reason and current status.

Q36 Have you decided to buy or utilize a solar pump?

☐ Yes

☐ No

Q37 The reason for the above response

Q38 How would you buy a solar pump?

(1) Individually

(2) As the MA-SHEP group

(3) With some members of the group

Q39 If you would buy a solar pump with other group members, how would you use and maintain it?

Q40 If you have not decided to buy or utilize a solar pump, what is a main reason of hindering your decision making?

Q41 In what situation, would you decide to buy or utilize a solar pump?

Q42 What is a timeline to buy a solar pump?

【Geographical Information】

Q43 What is a water source for the farming? (If respondent practices dry season production, please confirm a water source in the dry season as well.

Q44 What is a distance of the water source from your farm?

Q45 How do you bring water to your farm?

Q46 Are these water sources reliable?

☐ Yes ☐ No

If No, please explain about the situation and a reason.

Q47 Where is the water source? (Confirm the location of the water source.)

Q48 Please describe the location of the water source, the approximate distance to the respondent's farm, and neighbors

Longitude: _____

Latitude: _____

Q49 What do you consider a difficulty of buying and utilizing a solar pump?

Q50 Does your group make and update an action plan periodically?

☐ Yes ☐ No

If No, please explain a reason. _____

Q51 What is the security situation in the community? _____

Thank you very much for your cooperation.

Main contents of the discussions and matters reported to JICA's Infrastructure Management

Department

Month of meeting	Main issues discussed and reported
December 2023	The background of the work, the concept and framework of the study, the main policies and points to note for the implementation of the work, as well as the schedule, were confirmed and discussed. They also agreed to prepare a work plan (in Japanese) in addition to the inception report, and submitted the Japanese version of the work plan to JICA in December 2023. The deadline for submission of the inception report was also set at 28 December 2023 and the report was submitted accordingly.
January 2024	The purpose and framework of the study, the main work implementation policy and concerns were confirmed and discussed in line with the comments made in the draft inception report. During the meeting, the parties specifically discussed and confirmed the replicability of the project's intervention methods, including the positioning of the agriculture stakeholder meetings, the survey targets, the reasons for the Japanese consultants to collect information, and points to be noted when doing so.
February 2024	Specific discussions were held on the TORs and selection criteria for the local recommissioning contractors. It was agreed that the selection method would be weighted by criteria so that more points would be allocated to the most important criteria. The draft selection criteria were submitted by the JIN study team to JICA's Social Infrastructure Department by email. The JIN team then briefed the Malawi Ministry of Agriculture on the activities of the study prior to the field trip, and as it was necessary to hold discussions and coordination before the first field activities, the team prepared a concept note, including requests to the Ministry of Agriculture, which was submitted to the JICA Social Infrastructure Department. JICA's Infrastructure Management Department informed the JICA Malawi Office of the survey requirements and made necessary explanations and requests to the Ministry of Agriculture at a meeting held on 8 February.
Early March 2024	As coordination between JICA HQ and the JICA Malawi Office took longer than expected, the JIN survey team contacted the JICA Malawi Office directly as there were several matters that needed to be coordinated by the end of March through discussions with relevant parties, including the need to explain and obtain approval from the Ministry of Agriculture regarding this survey activity, explanations, sharing and requesting necessary documents, etc. The JIN study team distributed the guidelines related to the preparation of proposals, including the terms of reference (TOR), to the potential local subcontractors, and held an online briefing session on 5 March. It was explained to the potential subcontractors who participated in the briefing that proposals for this recommissioning would be evaluated using the QCBS method and that a lump-sum contract would be signed with the selected subcontractor. The deadline for submission of proposals from subcontractors was set for 14 March.
End of March 2024	After proposals were submitted by subcontractors, the content was reviewed and online interviews were held with each of them, where questions and opinions were exchanged, mainly on methods of sales promotion activities. The proposals were scored according to the selection criteria set in advance, and the three companies to be commissioned were selected.

Appendix 2

Month of meeting	Main issues discussed and reported
	On 26 March, a pre-departure debriefing was held for JICA's Social Infrastructure Department. At the debriefing, the names of the three selected subcontractors (Vitalite, SunnyMoney and Maeve), the selection process and the characteristics of each selected subcontractor were reported together with the scores of the selection results. At the time of this debriefing, the local subcontractors had been selected but contract negotiations with each contractor had not yet been conducted, so the report on the selection results for the subcontracting was prepared after the contracts with each contractor were officially signed and submitted to JICA's Infrastructure Management Department.

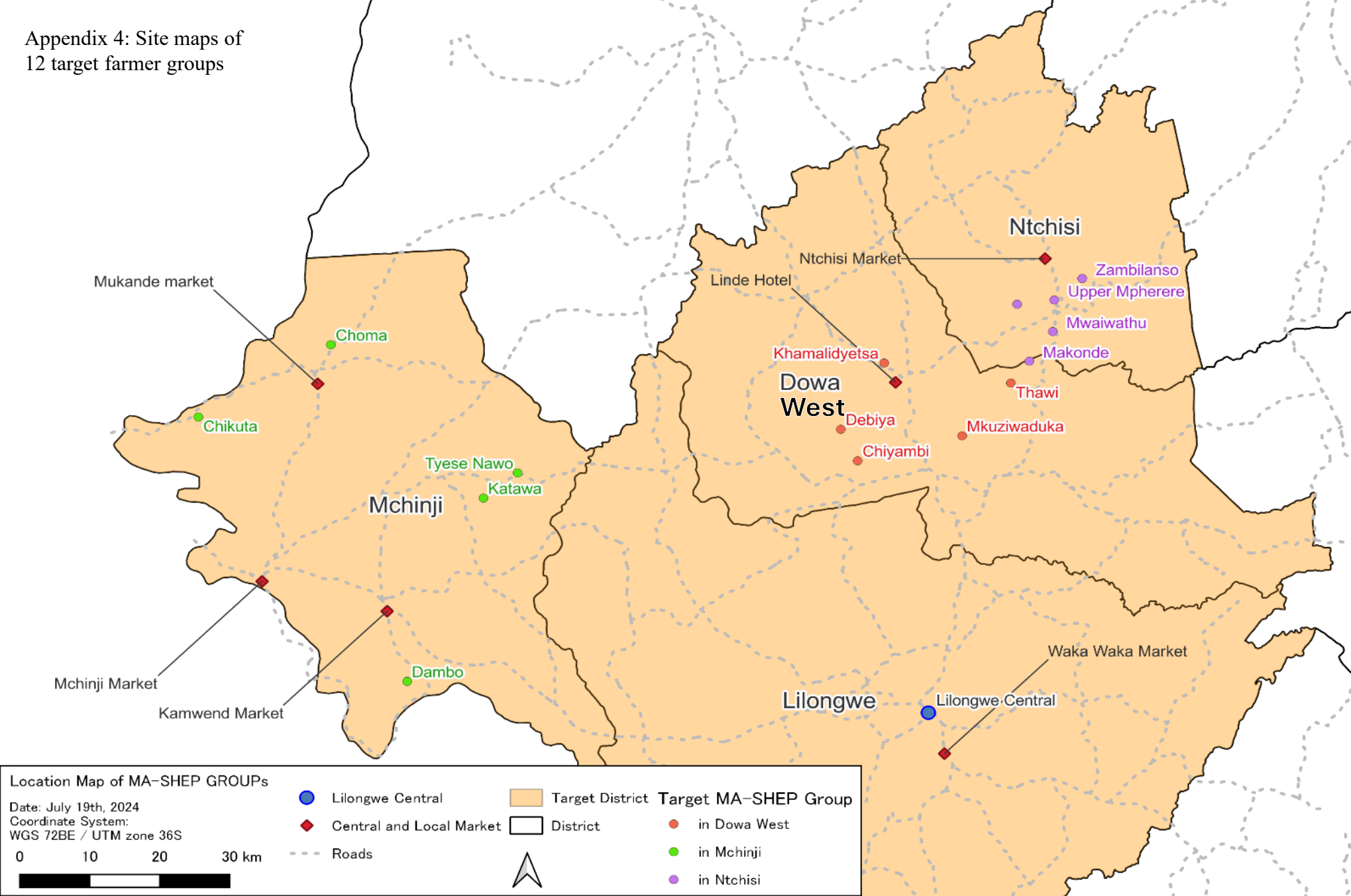
Key discussions during online meetings with Malawi Ministry of Agriculture

Year and month of Implementation	Content of discussions and reports
End of February to the end of March, 2023	• An online meeting was held with Andrew Chamanza from the Extension Department of the Ministry of Agriculture and several other officials from the same department. The meeting covered the concept, objectives, main activities and proposed timetable for implementation of the study, using a simplified workplan based on the inception report. Officials from the Ministry of Agriculture commented that the implementation of this survey is also in line with the needs of MA-SHEP farmers and expressed the Ministry's willingness to cooperate with this survey. • An online meeting was held with the Extension Department of the Ministry of Agriculture to confirm approval and willingness to cooperate on the project's activities; the contact person in each province was contacted in early March and two online interviews were conducted with each of them. In the first session, the concept, objectives, main activities and proposed schedule of activities were explained using a workplan and the necessary information was shared. The second session was used to review the information collected, the reactions of the target farmer groups and the situation the farmers are in. The coordination activities with the Ministry of Agriculture, which had been delayed at the end of February, were implemented in March in a prioritised and efficient manner; by the time the pre-trip debriefing meeting with the Ministry of Social Infrastructure was held at the end of March, the progress in implementing activities was close to the originally planned schedule and there were no delays in activities that should have been prepared in Japan. The delay in the activities to be prepared in Japan has been resolved.
1 st week in April	The objectives and activities of the project, future plans and the cooperation that the project would like to seek from the county officials were explained and opinions were exchanged. We were able to confirm the willingness and attitude of all the prefectures to be co-operative and to help us with the necessary information, contacting farmer groups and collecting information from the stakeholders. The planned dates and venues for the agricultural stakeholders' meetings, the stakeholders to be invited and the division of roles regarding communication, and the programme of the agricultural stakeholder meetings were confirmed.
Middle of April	A courtesy call was made to Mr Pearson Soko, Director of the Extension Department of the Ministry of Agriculture, to explain the purpose and activities of the study and the progress of the activities. Due to scheduling constraints, the timing of the courtesy call on Director General Soko was after the meeting of agricultural stakeholders, but

Appendix 3

Year and month of Implementation	Content of discussions and reports
	we were able to provide a concrete explanation of the implementation status of the stakeholders' meeting instead. After the report from the survey team, Director General Soko commented that the Ministry of Agriculture would continue to provide whatever support it could, and asked the delegation to contact him whenever necessary, thereby confirming their continued cooperation.

Appendix 4: Site maps of
12 target farmer groups





Main water source

Water Pump Point

1447

1477

Site Map of Upper Mpherere

--- Routes Record of site visit

◆ Irrigation Point

● Elevation Point (Meter)

Water Source

— Main River

... Main River (estimated)

— Diverted River

... Diverted River (estimated)

Farm Zone

▨ Farming Zone in a dry season (steep)

▨ Farming Zone in a rain season (very steep)

There is a slope difference of approximately 30 meters from the water supply point to the highest elevation farmland. By creating a waterway on the steep slope, a limited dry-season crop area is formed. Areas with higher slopes or farther from waterways or main rivers are farmland in the rainy

Date: August 9th, 2024

Coordinate System:

WGS 72BE / UTM zone 36S

0 30 60 90 m



Site Map of Makonde

--- Routes Record of site visit

◆ Irrigation Point

● Elevation Point (Meter)

Water Source

— Main River

--- Main River (estimated)

— Diverted River

Farm Zone

▨ Farming Zone in a dry season

▨ Farming Zone in a dry season (steep)

▨ Farming Zone in a rain season

Major rivers flow from east to west. The gradient increases gently towards the south. Diversion by excavation exists at higher elevations in the south, but frequent water logging limits the use of agricultural land. Farmers are considering expanding their farmland by watering directly from the main river using solar pumps.

Date: August 9th, 2024

Coordinate System:

WGS 72BE / UTM zone 36S

0 20 40 60 m



Diversion and Water Pump Point

Site Map of Chiliwa

--- Routes Record of site visit

◆ Irrigation-Point

● Elevation Point (Meter)

Water Source

— Main River

... Main River (estimated)

— Diverted River

... Diverted River (estimated)

Farm Zone

▨ Farming Zone in a dry season

▨ Farming Zone in a rain season

Major rivers flow from southwest to northeast. The elevation gradually decreases from the upper reaches, and there are several diversion rivers. The higher elevation areas along the diversion rivers are used as cultivation areas during the rainy season, and are being considered for use as cultivation areas during the dry season by using solar pumps to supply water.

Date: August 9th, 2024

Coordinate System:

WGS 72BE / UTM zone 36S

0 30 60 90 m



Main water source

Site Map of Chikuta – large scale

--- Routes Record of site visit

◆ Irrigation-Point

Water-Line-All-Group

— Main River

--- Main River (estimated)

— Diverted River

--- Diverted River (estimated)

Farm-Zone-All-Group

▨ Farming Zone in a dry season

▨ Farming Zone in a rain season

There is an existing canal from which the group members irrigate. However, the distance from the water source is a bit far, so the group is considering purchasing a solar pump, including a water storage tank, etc.

Date: August 9th, 2024

Coordinate System:

WGS 72BE / UTM zone 36S

0 20 40 60 m



Main water source

Water Tank Point

Water Pump Point

Chikuta Irrigation Scheme

Site Map of Chikuta – Small Scale

--- Routes Record of site visit

◆ Irrigation-Point

Water-Line-All-Group

■ Main River (estimated)

■ Diverted River

■ Diverted River (estimated)

Farm-Zone-All-Group

■ Farming Zone in a dry season

■ Farming Zone in a rain season

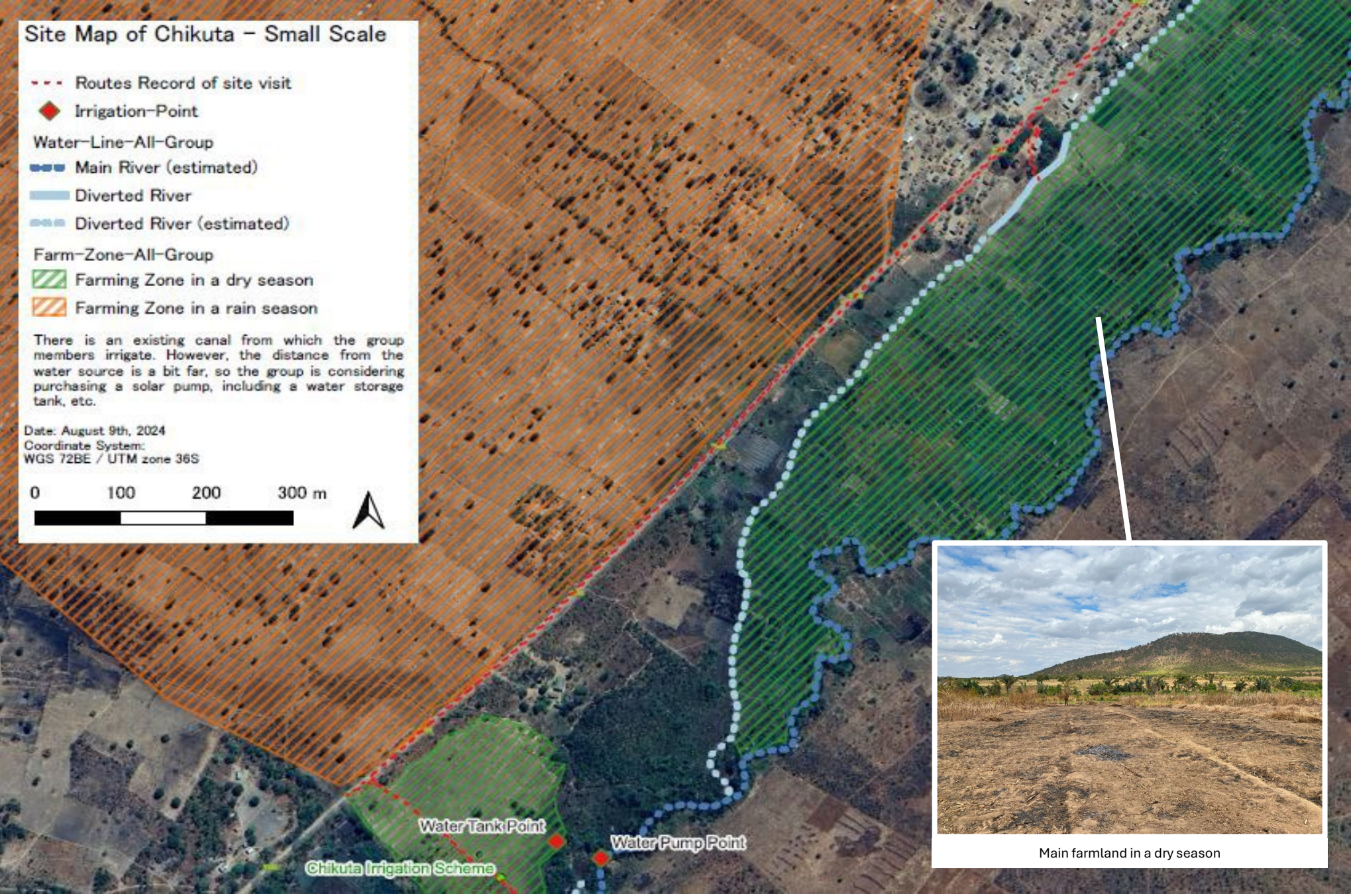
There is an existing canal from which the group members irrigate. However, the distance from the water source is a bit far, so the group is considering purchasing a solar pump, including a water storage tank, etc.

Date: August 9th, 2024

Coordinate System:

WGS 72BE / UTM zone 36S

0 100 200 300 m



Main farmland in a dry season

Site Map of Tyese Nawo

--- Routes Records of site visit

◆ Irrigation Point

● Elevation Point (Meter)

Farm Zone

▨ Farming Zone in a dry season

— Waterways (Rivers, Streams, and Ditches)

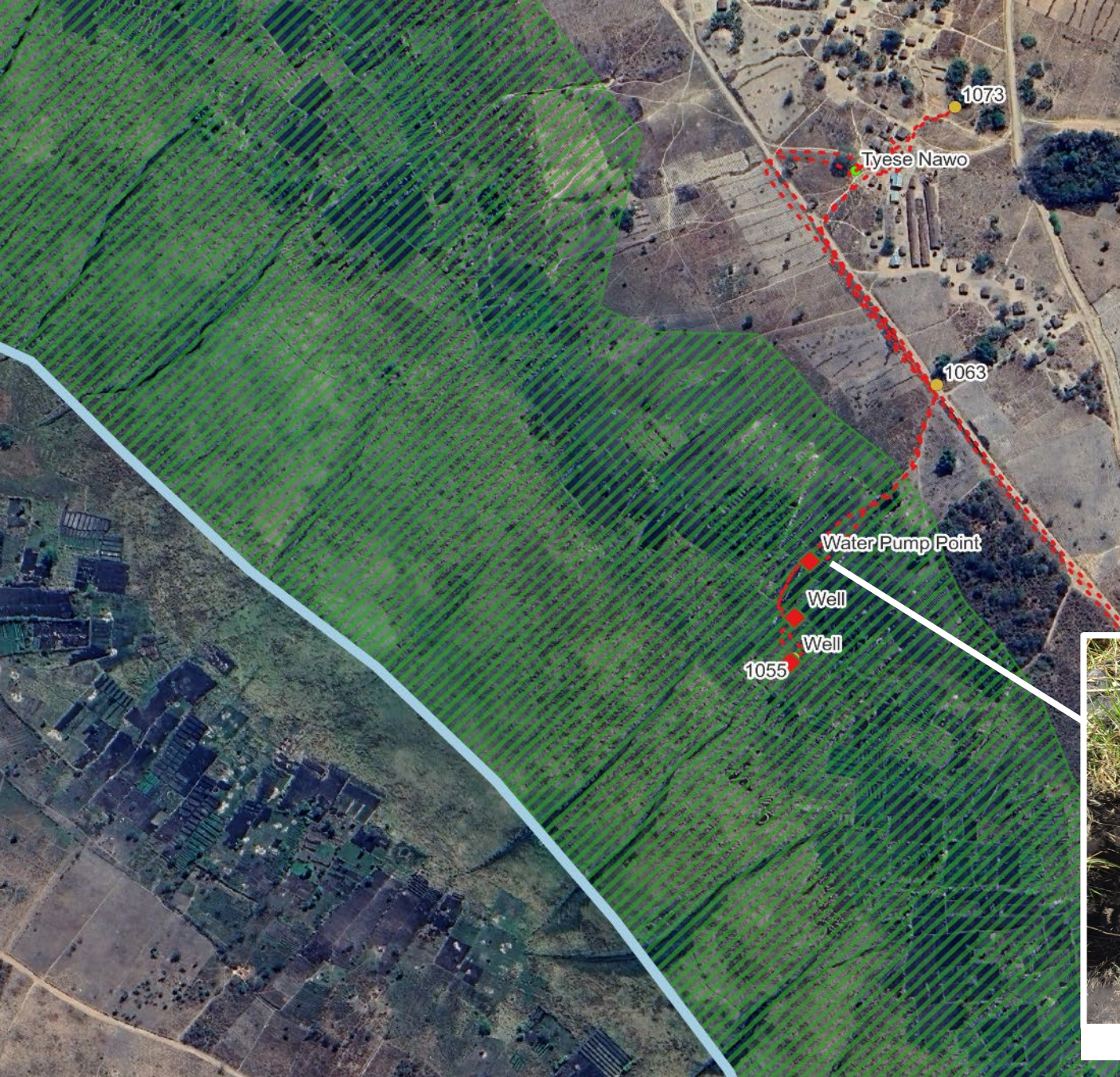
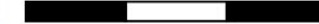
Major rivers run from south-west to north-east. Water bodies are extended by tributaries to the west of the main rivers. Further to the west are scattered wells drilled by farmers, which farmers are considering as water supply points using solar pumps. The zone further west from the dry-season farmland is presumed to be wet-season farmland.

Date: August 9th, 2024

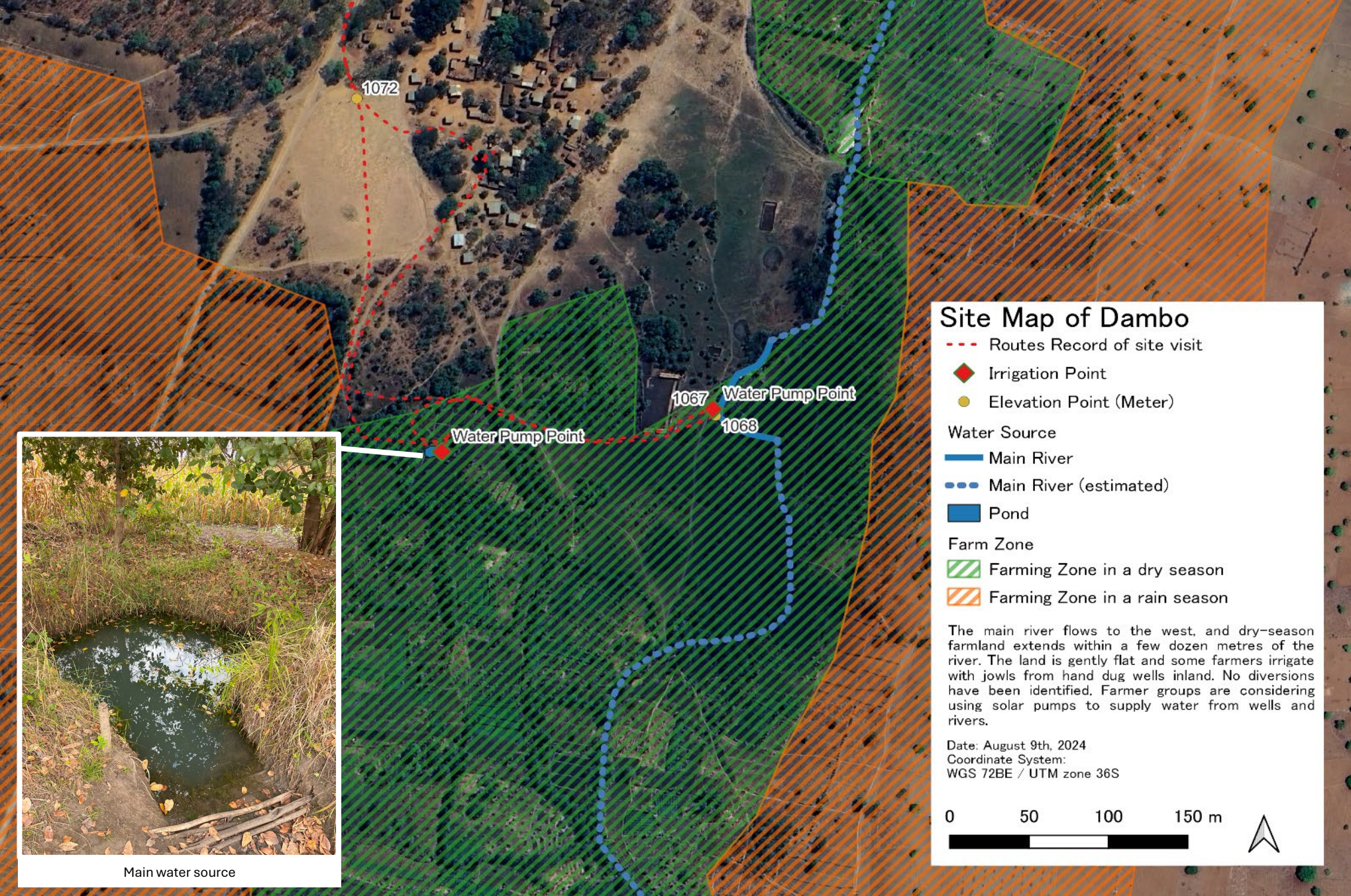
Coordinate System:

WGS 72BE / UTM zone 36S

0 50 100 150 m



Main Water Source



1072

1067

Water Pump Point

1068

Water Pump Point

Site Map of Dambo

- Routes Record of site visit
- ◆ Irrigation Point
- Elevation Point (Meter)

Water Source

- Main River
- ... Main River (estimated)
- Pond

Farm Zone

- ▨ Farming Zone in a dry season
- ▨ Farming Zone in a rain season

The main river flows to the west, and dry-season farmland extends within a few dozen metres of the river. The land is gently flat and some farmers irrigate with jowls from hand dug wells inland. No diversions have been identified. Farmer groups are considering using solar pumps to supply water from wells and rivers.

Date: August 9th, 2024
Coordinate System:
WGS 72BE / UTM zone 36S

0 50 100 150 m



Main water source

Site Map of Katawa

- Routes Record of site visit
- ◆ Irrigation Point
- Elevation Point (Meter)

Water Source

- River
- River (estimated)

Farm Zone

- ▨ Farming Zone in a dry season
- ▨ Farming Zone in a rain season

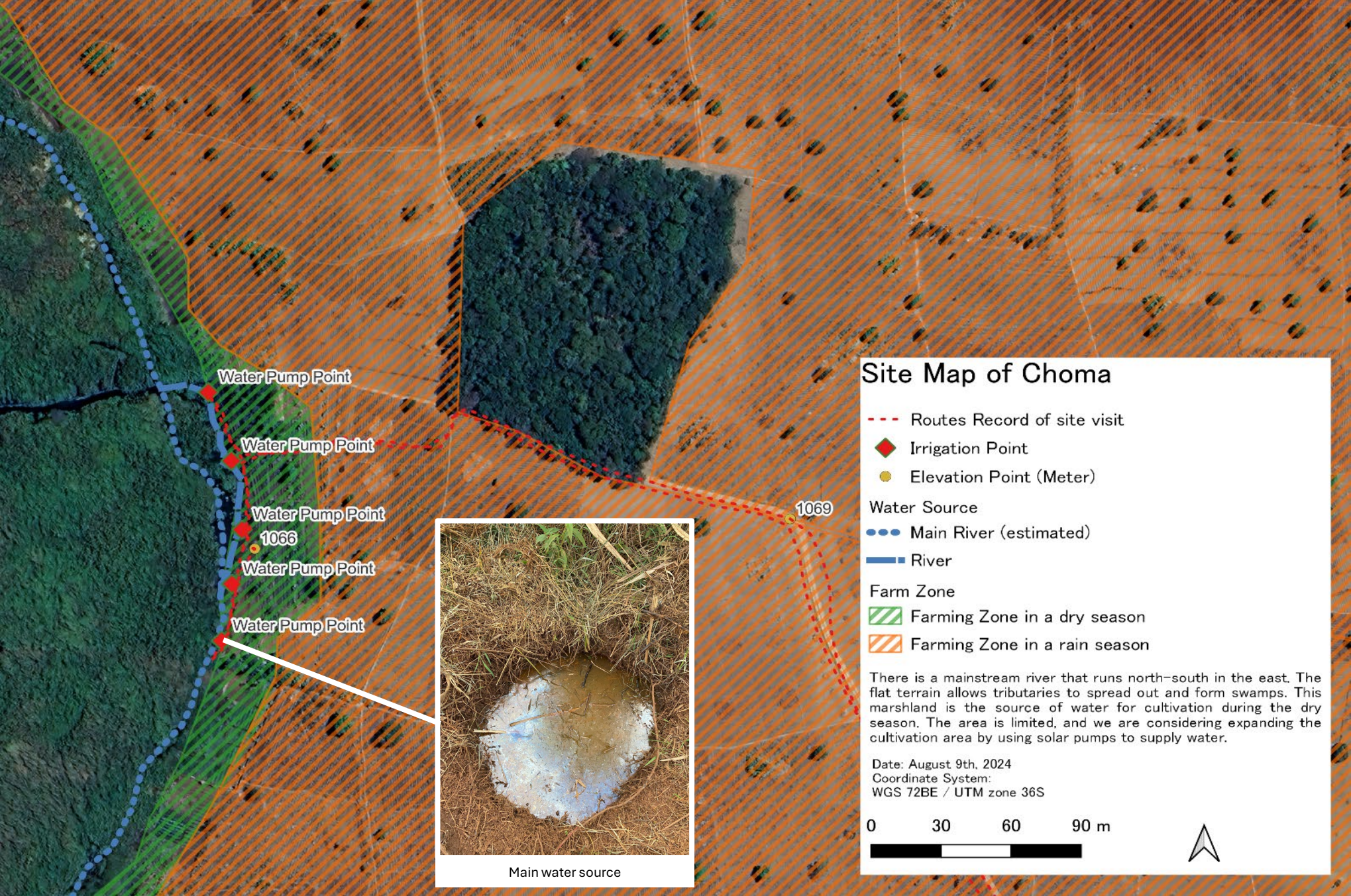
Major rivers flow in the north and a lake of about 2 ha exists in the north-east. A tributary flows south from the main river, and farmers drill wells to water dry-season cultivation areas. When the wells dry up, they are drilled in new locations, so there are a scattering of wells of different sizes. Farmers are considering these wells as water supply points for solar pumps.

Date: August 9th, 2024
Coordinate System:
WGS 72BE / UTM zone 36S

0 15 30 45 m



Main water source



Site Map of Choma

- - - Routes Record of site visit

◆ Irrigation Point

● Elevation Point (Meter)

Water Source

●● Main River (estimated)

— River

Farm Zone

▨ Farming Zone in a dry season

▨ Farming Zone in a rain season

There is a mainstream river that runs north-south in the east. The flat terrain allows tributaries to spread out and form swamps. This marshland is the source of water for cultivation during the dry season. The area is limited, and we are considering expanding the cultivation area by using solar pumps to supply water.

Date: August 9th, 2024

Coordinate System:

WGS 72BE / UTM zone 36S

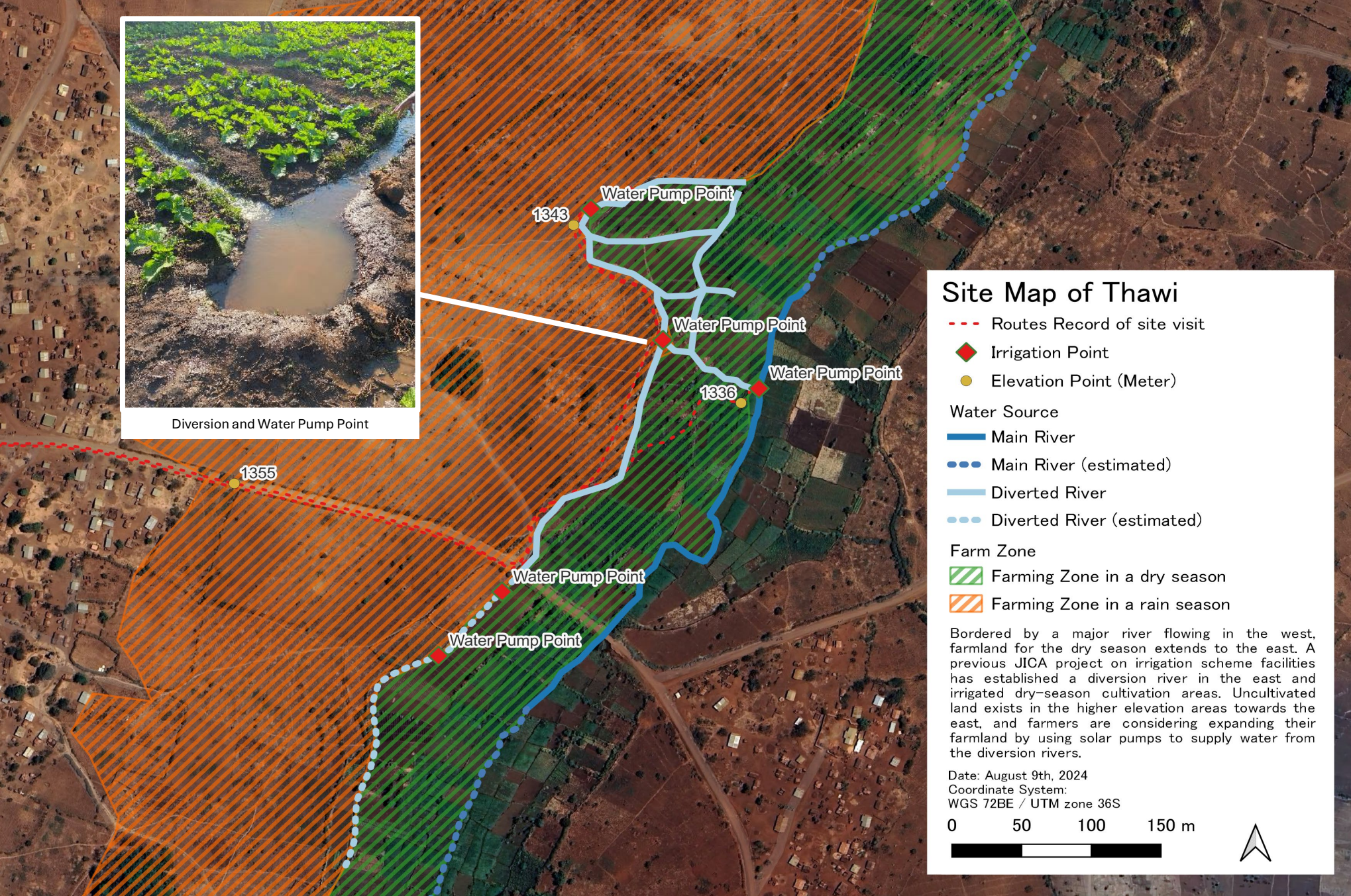
0 30 60 90 m



Main water source



Diversion and Water Pump Point



Site Map of Thawi

--- Routes Record of site visit

◆ Irrigation Point

● Elevation Point (Meter)

Water Source

— Main River

... Main River (estimated)

— Diverted River

... Diverted River (estimated)

Farm Zone

▨ Farming Zone in a dry season

▨ Farming Zone in a rain season

Bordered by a major river flowing in the west, farmland for the dry season extends to the east. A previous JICA project on irrigation scheme facilities has established a diversion river in the east and irrigated dry-season cultivation areas. Uncultivated land exists in the higher elevation areas towards the east, and farmers are considering expanding their farmland by using solar pumps to supply water from the diversion rivers.

Date: August 9th, 2024

Coordinate System:
WGS 72BE / UTM zone 36S

0 50 100 150 m



Site Map of Mkuziwaduka

-  Irrigation Point
-  Elevation Point (Meter)

Water Source

-  River
-  River (estimated)
-  Diverted River
-  Diverted River (estimated)
-  Pond

Farm Zone

-  Farming Zone in a dry season (steep)

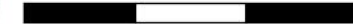
Tributaries flow from north to south. Diversion points exist every few metres from these tributaries, irrigating agricultural land to the West. This farmland is farmed during the dry season. A reservoir is being built at the end of the diverted river. The group farmers envisage this reservoir as a water supply point with solar pumps.

Date: August 9th, 2024

Coordinate System:

WGS 72BE / UTM zone 36S

0 30 60 90 m



Main water source



Main water source

Site Map of Chiyambi

-  Irrigation Point
-  Elevation Point (Meter)
-  Pond
-  Waterways (Rivers, Streams, and Ditches)
- Farm-Zone-All-Group
 -  Farming Zone in a dry season
 -  Farming Zone in a rain season

There is a main stream running from north to south on the east side, and dry-season cultivation areas are spread along this main stream river. There are several ponds scattered at a distance of about 100 meters from the river, which are planned to be supplied with water by solar pumps.

Date: August 9th, 2024
Coordinate System:
WGS 72BE / UTM zone 36S

0 100 200 300 m





Site Map of Debiya

- ◆ Irrigation Point
- Elevation Point (Meter)

Water Source

- Main River
- Main River (estimated)
- Pond

Farm Zone

- ▨ Farming Zone in a dry season
- ▨ Farming Zone in a rain season

There is a major river running north-south to the east. Swamps are formed around the rivers and naturally formed ponds can be seen. There is a hand-drilled well a few metres from this swamp, which the farmers are considering as a water supply point using a solar pump. Further inland, there is farmland used only during the rainy season.

Date: August 9th, 2024
Coordinate System:
WGS 72BE / UTM zone 36S

0 50 100 150 m



Main water source

Water Pump Point

Well

1214

Water Pump Point

1208

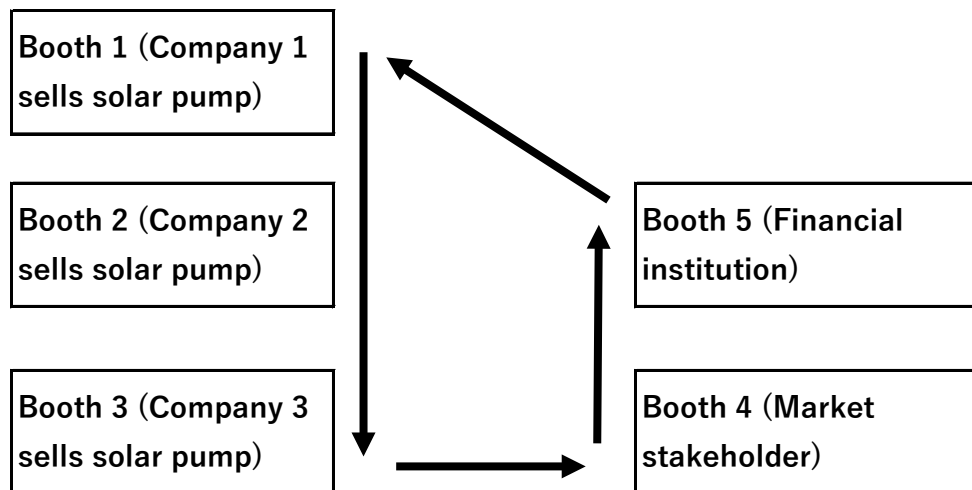
Appendix 5

Detailed program of the Agricultural Stakeholder Meeting

Start	End	Contents	Person in charge	Remarks
9:00	9:05	Introduction of participants	Moderator	
9:05	9:10	Opening remark		
9:10	9:15	Brief explanations on a project purpose and the stakeholder meeting	Consultant	Short explanation
9:15	10:15	Presentations made by companies selling solar pump		20 minute presentation by each company about solar pump
10:15	10:20	Explanations on a rule of the session for the business talk and distribute initial linkage form	Moderator/ Consultant	
10:20	12:00	Business talk session	Moderator/ Consultant	20 minutes at each booth and 5 stakeholders are expected
12:00	12:40	Talk by farmers who uses solar pump and Q&A	Consultant/ Moderator	
12:40	13:20	Distribute questionnaire regarding the solar pump and ask participants to fill out	Consultant/ Moderator	
13:20	14:00	Lunch		
14:00	14:20	Way forward	Consultant/ Moderator	
14:20	14:25	Closing remark		
14:25	14:45	Distribution of transportation cost	Consultants	

Appendix 6

Layout of the Agricultural Stakeholder Meeting



*Number of booth will be five to secure enough time to talk at each booth.

Data Collection Survey on Productive Use of Energy (PUE) in Rural Area in
Malawi

Agriculture Stakeholder Meeting

Initial Linkage Form

Date: _____

District name: _____

Name of the MA-SHEP group: _____

1. Name of the stakeholder: _____

2. Contact person's name: _____

3. Phone number of the contact person above: _____

4. Key information received from the stakeholder:

5. Any negotiation or agreement made with the stakeholder:

6. Any appointment to meet or planned action to take:

Appendix 8

Interest and preparation status of each group regarding use of a solar pump

Group name	Demonstration*			Products of most interest	Decision regarding use of pumps	Situation regarding purchasing and/or using rental service, status of preparation
	V	M	S			
Ntchisi district						
Upper Mpherere Cooperative	●			Vitalite / Kubwa	Decided	• Harvesting of potatoes and other crops is expected to start in July, and the amount required for advance payment could be reached around October.
Mwaiwathu	●	●		MAEVE / Futurepump	Decided	• Collections are expected to start in November, as a collective income from the dry season crop harvest is expected to come in around November.
Makonde	●	●	●	Vitalite / Kubwa	Decided	• Collections at 5,000 MWK/month per person started in June; of the 30 members, 20 had completed payments up to a total of 500,000 MWK as of August. The remaining members will make payments once they have finished harvesting their crops.
Zambilanso	●	●		Vitalite / Kubwa	Not decided yet (under consideration)	• About half of the group members cultivate close to the water source, while the other half cultivate on slightly higher ground within 200 metres of the water source. Therefore, currently, there is no agreement on the purchase of solar pumps between group members in those different cultivation locations. However, Vitalite, who visited the group, explained to the group that it is possible to pump water from a slightly higher location up to 200 metres if a hose is connected, and based on this information, the group is now considering purchasing a Vitalite pump. The group is also considering how to distribute the time of use among the 67 members if it is purchased.
Chiliwa Irrigation Group	●	●		Vitalite / Kubwa	Decided	• At 5,000 MWK per person, a total of 200,000 MWK has already been collected; collection should be completed by December, after which the purchase will be made. However, the JICA consultant helped to make a cash flow calendar with core group members and found that the average member's income is in a level

Appendix 8

Group name	Demonstration*			Products of most interest	Decision regarding use of pumps	Situation regarding purchasing and/or using rental service, status of preparation
	V	M	S			
						where it is basically possible to pay the monthly payment, and will discuss with other group members again to purchase on a Pay-As-You-Go basis earlier than December.
Mchinji district						
Chikuta Irrigation Scheme	•	•		Vitalite / Climate Smart	Not decided yet (under consideration)	There is an existing canal from which group members irrigate. However, due to the distance from the water source, they are considering purchasing a solar pump, including a water storage tank.
Tyese Nawo	•	•	•	MAEVE / Futurepump SunnyMoney / Lorenz	Already purchased	- The group had already decided in May to purchase a submersible pump (Lorenz) from SunnyMoney based on information obtained at the agricultural stakeholder meeting, but finalised which pump they wanted to purchase after seeing demonstrations of the pump through visits by three different suppliers. The group paid an advance payment of 125,000 MWK in early July and discussions with SunnyMoney proceeded, but the advance payment was refunded to the group when it became clear that SunnyMoney was unable to procure Lorenz through Pay-As-You-Go immediately. - SunnyMoney instead offer the group a solar pump rental service. They checked the status of the group's water source in order to offer Lorenz on a lease basis, but found that it was not immediately available due to low water levels. In view of the above situation, the group decided to purchase a Futurepump, a surface water pump from MAEVE. The pump has already been purchased under a Pay-As-You-Go system and is now in use.
Dambo	•	•		Vitalite / Kubwa	Decided	Due to interest in purchasing solar pumps, collections at 5,000 MWK/month per

Appendix 8

Group name	Demonstration*			Products of most interest	Decision regarding use of pumps	Situation regarding purchasing and/or using rental service, status of preparation
	V	M	S			
Horticulture Group						person started in May; as of July, about half of all members had not paid their collections; since July, harvesting of potatoes and other crops has started, so collection activities within the group are progressing. However, as of the end of September, collection by members had still not been completed. Due to differences in income levels within the group, some farmers are able to pay at an early stage while others are not, and it is expected to take some more time for the entire membership to complete the necessary collections.
Katawa Irrigation Club	•	•	•	Vitalite / Kubwa	Decided	- Interviews with group representatives revealed that due to low rainfall this year, only 15 of the 65 members had access to a water source from their respective fields, leaving the rest unable to effectively carry out dry-season cultivation. This was the reason why the group was unable to agree on the purchase of a pump. - The JICA consultant suggested several options and the group discussed them, as it was found from the cash flow calendar prepared that it was financially feasible to purchase a pump with only 15 members with access to a water source. - After checking again in early September, it was agreed that all members would purchase a solar pump with the expectation that all group members would have access to the water source from next year onwards, and the group members started collecting the money.
Choma Irrigation Group	•	•	•	SunnyMoney / Lorenz	Considering using the rental service	The group decided to use the loan and started collecting money from the group on a monthly basis in June. As some members have not been able to collect the money, preparations are underway for rental use.

Appendix 8

Group name	Demonstration*			Products of most interest	Decision regarding use of pumps	Situation regarding purchasing and/or using rental service, status of preparation
	V	M	S			
Dowa West						
Khamalidyetsa	●	●	●	Vitalite / Kubwa	Already purchased a pump	• A submersible pump has already been purchased. The pump was being utilised by the group, but due to the death of one of the members in September and the ensuing payments made as funeral offerings, many members were unable to keep up with their monthly payments for the pump. As a result, payments have been delayed, and the pump is not currently being used.
Thawi Irrigation Scheme	●	●	●	SunnyMoney / Lorenz	Decided and requested to use the rental service	• The group is considering increasing its income by increasing its agricultural inputs and purchasing a solar pump from December onwards. It was planning to use the loan-out service of three Lorenz machines, which would be available for short-term use with a low financial burden. SunnyMoney has since procured one pump for the group for loan, but SunnyMoney is carefully considering the provision of the service as soil erosion near the water source is ongoing and the use of the pump may cause further soil erosion.
Mkuziwaduka Irrigation Group	●	●	●	SunnyMoney / Lorenz	Decided and requested to use the rental service	• Interest in purchasing solar pumps is high and serious consideration is under way; SunnyMoney has procured one pump for loan to the group and has surveyed the water source, but is unable to lend it out as there is not enough water to pump. The group is also interested in purchasing a pump and will start collecting money for an advance payment and preparing a loan application to NEEF, but has not been able to apply.
Chiyambi Irrigation Scheme	●	●	●	SunnyMoney / Lorenz and MAEVE /	The group started using the rental	• <u>It took some time to verify the facts, as there were reports that the company had decided to purchase a pump from SunnyMoney and that it had expressed a desire to borrow a loan from NEEF to purchase a Futurepump from MAEVE. As a</u>

Appendix 8

Group name	Demonstration*			Products of most interest	Decision regarding use of pumps	Situation regarding purchasing and/or using rental service, status of preparation
	V	M	S			
				Futurepump	service.	<u>result, they were not able to apply for a loan from NEEF and finally decided to use SunnyMoney's pump rental service; SunnyMoney has already provided a solar pump for rental and the group has started using it.</u> • <u>One farmer out the Chiyambi group member purchased a surface water pump from MAEVE under a Pay-As-You-Go system individually. An advance payment of 10% of the pump has already been paid and the member has already started using the surface water pump.</u>
Debiya Irrigation Scheme	•	•	•	Vitalite / Climate Smart	Decided	• Collection of 6,000 MWK per person started in June and up to 280,000 MWK has now been collected, with a target of 350,000 MWK to be paid in advance. It is expected to take a little longer to collect as some members plan to pay the amount collected from income from the dry season crop harvest.

*V: Vitalite, M: MAEVE, S: SunnyMoney

Appendix 9

Proposed packages of activities in response to 3 draft approaches and notes on each activity

	1	2	3	Expected activities	Points to note
1	✓	✓	✓	Meetings before activities	Consultations with the Ministry of Agriculture headquarters followed by consultations with district officials.
2		✓	✓	Target farmer group selection using criteria	Criteria should be developed and selected accordingly, e.g. groups with farmers who do not have access to water sources during the dry season should be excluded.
3		✓	✓	Surveys and fieldwork activities through visits to potential target farmers	Conduct a survey of potential target farmer groups to ascertain their farming situation, income levels, savings, cultivated land and water sources, and interest in using solar pumps. The survey will also include a cash flow calendar making based on information from farmer members with average income levels. To the extent possible, irrigation officers or agricultural extension officers will be invited to participate in the survey. Based on the survey results, consider appropriate pumps and possible support.
4	✓	✓	✓	Selection of subcontractors using criteria	Selection should also take into account the challenges of implementing the activity, such as prioritising suppliers with the financial capacity to procure solar pumps with as few problems as possible.
5	✓	✓	✓	Discussions and preparation with relevant stakeholders on the nature of the work	Share necessary information with subcontractors, confirm the role of government officials, and hold meetings on the details of agricultural stakeholder meetings. • Determine who will participate in stakeholder meetings, taking into account their objectives. • Discuss with provincial irrigation officers and extension officers the appropriate solar pumps and number of people with whom to share based on survey results. • The subcontractors will be asked to prepare solar pumps and services as appropriate to the farmers' situation as possible.
6		✓	✓	Sensitisation sessions	Explain to each target farmer group the purpose of the project, the features of the solar pumps, the objectives of the farmers' meetings and the role of the representatives attending. Explain the financial prospects for the purchase of solar pumps for each group based on the results of a preliminary survey of the farmer groups and advise on the type of solar pump considered appropriate based on the water source conditions.
7	✓	✓	✓	Holding an agricultural stakeholder meeting	Devise a programme that allows subcontractors to share information for as long as possible. Allow sufficient time for the initial linkage form to be written and to be used in discussions with the rest of the group members.
8			✓	Support for the delivery of sharing sessions to the remaining members of the target farmer groups	Ask farmers to conduct sessions to share the information collected at the agricultural stakeholder meetings with other members in each target farmer group, but provide support for the implementation of these sessions with the agricultural extension officer in charge of each group to ensure that the information is properly shared.
9	✓	✓	✓	Demonstration activities	Consideration should be given to having each subcontractor visit as many target farmer groups as possible.
10			✓	Household budget management training, etc.	A simple training session for each target farmer group on how to improve the cash flow generated by the survey and how to manage household finances. If some farmers want to change the crops they grow to improve their profit margins, they are encouraged to conduct market survey and follow up on this.
11		✓	✓	Follow-up by project stakeholders	Check the status of decision-making and preparation by target farmer groups on the use of solar pumps and any concerns or challenges they may have, and advise where possible.