

Pteah Baitong Solar Water Pump Survey Results *October 2022*



INTRODUCTION

For our **vision** Pteah Baitong believes in a clean energy society where all rural Cambodians thrive, living productive and healthy lives.

Our **mission** is to transform agriculture in Cambodia by introducing high quality, clean energy technologies and innovative agri-services specifically designed for smallholder farmers. Pteah Baitong exists to increase farmer profits, advance rural livelihoods, promote gender equality and safeguard the environment.

Survey Objectives

In 2021 Pteah Baitong began selling the 'Future Pump' solar water pump to small scale farmers in rural Cambodia. Pteah Baitong is looking to expand this product as a core part of its business operations following a recent transition from selling solar lamps and setting up mini grids.

This survey represents a complete analysis of the Solar Water Pump product and the profile and activities undertaken by the first households to make a purchase.

The overall survey objectives are to better understand...

- 1) The customer profile
- 2) Water pumping habits and changes
- 3) How the product is used
- 4) Overall satisfaction with the product, payment and maintenance systems
- 5) The impacts the product has on peoples lives
- 6) Views on additional services Pteah Baitong may be able to offer

The Future Pump Solar Water Pump



LOCATION OF SURVEY RESPONDENTS

28 customers were interviewed in July and August 2022 face to face (15) or over the telephone (13) using an online questionnaire encoded into Kobo Collect with both open ended and fixed response questions.
(total customers end of August = 61 (45 % of all customers were surveyed))

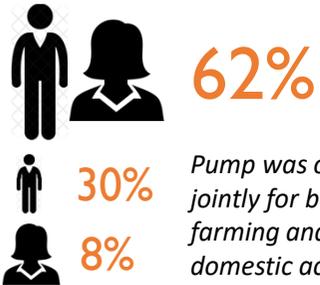
Surveys were undertaken across 7 regions of Cambodia where Pteah Baitong had sold its solar water pumps

Collecting data in Pray Veng

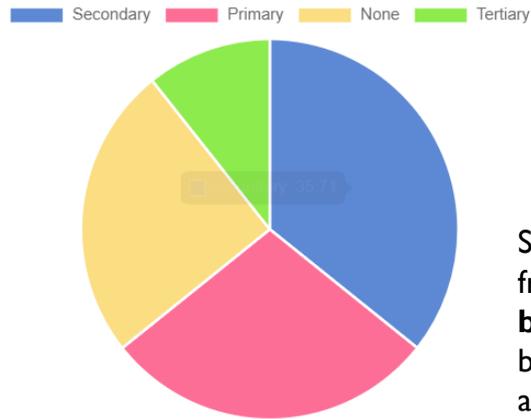


CUSTOMER PROFILE

Main user of the solar pump



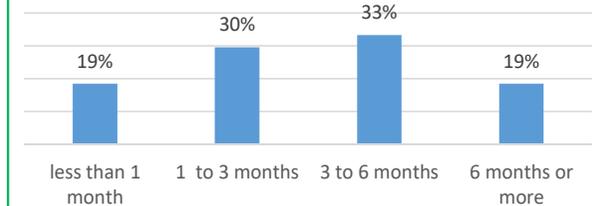
Education level of survey respondent user



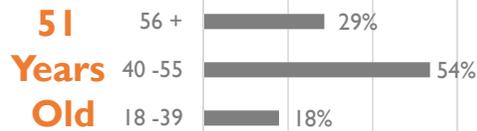
Solar water pump users come from a **mixed educational background** with an even split between no education, primary and secondary

Time since pump purchase

The majority of customers surveyed had the solar pump for between 1 and 6 months. Customers having the pump less than a month were not asked impact questions.



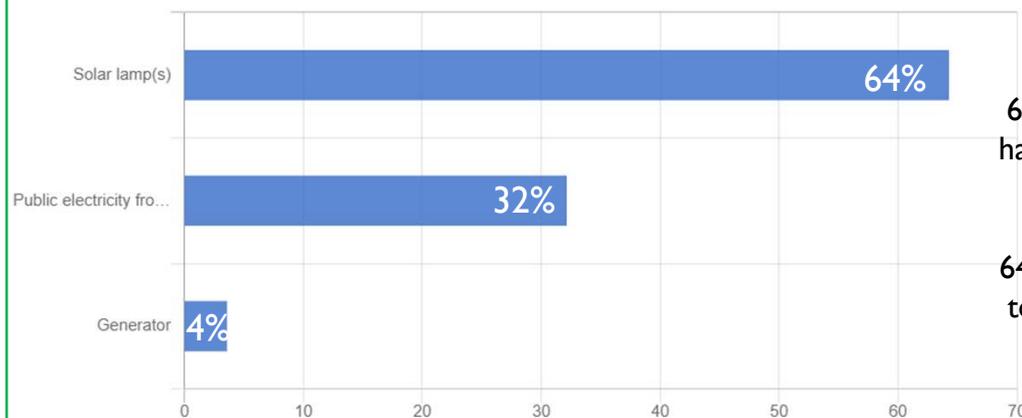
Average age of respondent



Household size



Main source of energy for lighting

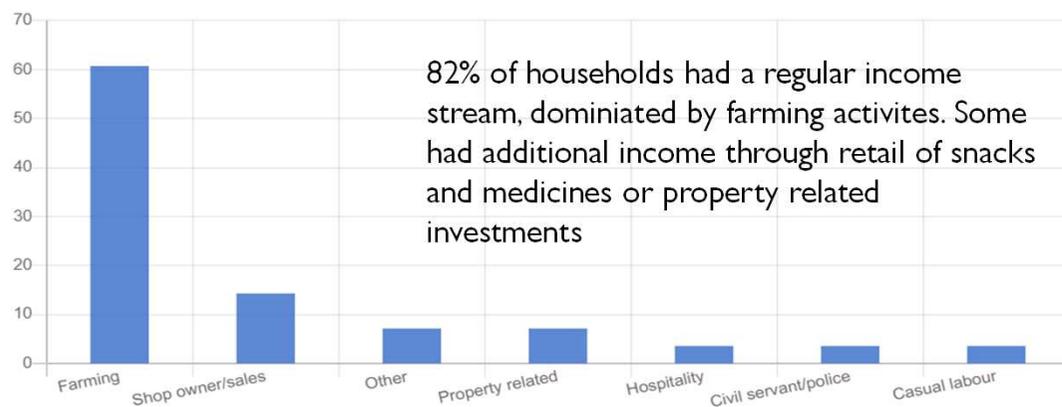


68% of households had no access to grid electricity

64% were using solar to light their homes

INCOME GENERATING ACTIVITIES

Main household income generating activities

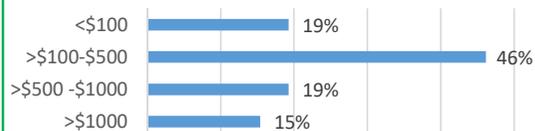


Land owned for farming activities (hectares)

Minimum	0.1
Median	1.3
Average	5.6
Maximum	50

Typically households had land between 1 and 6 hectares. One very large land owner had a diversified 50 hectare farm including rice fields. There were also a small number of very small farms below 1 hectare in size.

Monthly Household Income (\$)



Median household income was \$300. However a large range existed from \$80 a month up to a large land owner with \$7000 a month

Types of farming activities undertaken

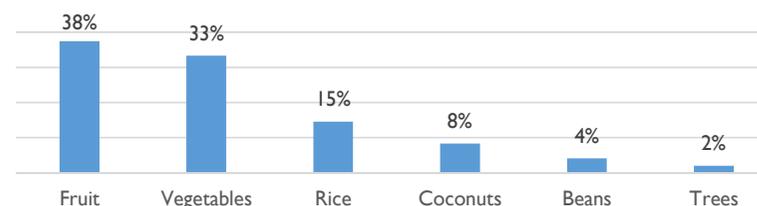
Farming activities were diversified. 71% of households farmed both **crops and animals**, around 10-15% of respondents farmed only crops or animals.

87% of farmers owned their own land, the rest owned and rented.

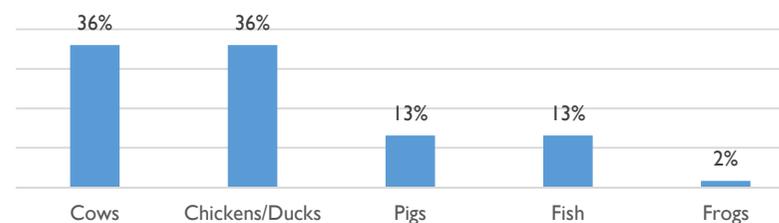
In 82% of households farming income made up >50% of all household income.

Half of households studied were entirely dependent on farming for their household income. Typical farming products included, carrots, onions, fruits, lemongrass, pak choi, rice coconuts, corn and beans.

Crops farmed

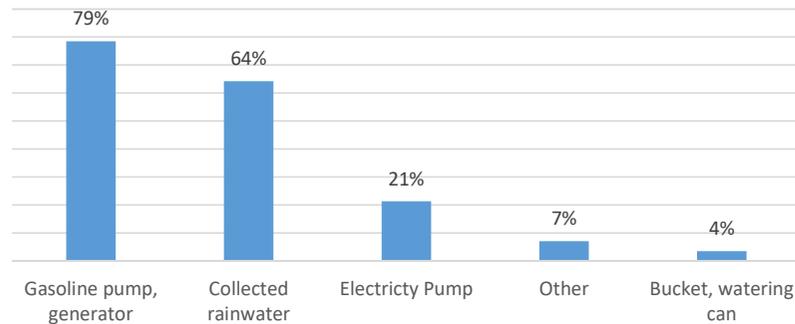


Animals reared



WATER PUMPING METHODS BEFORE THE SOLAR WATER PUMP

Water pumping methods (before the solar water pump)



The most popular method to pump water before accessing the solar water pump was **gasoline pump generators** (79% of households) and **collected rainwater** (64%). A smaller proportion of slightly better off households were using **electricity pumps** (21%).

All households interviewed used these sources of irrigation to support their animal and crop rearing activities.

For those that used the gasoline pump, 82% used it for **domestic activities** such as showering, cooking and cleaning.

All households with electricity pumps used this for both farming activities and domestic activities.

Gasoline water pump



Collected rainwater



Traditional water pump



Future Pump, solar water pump

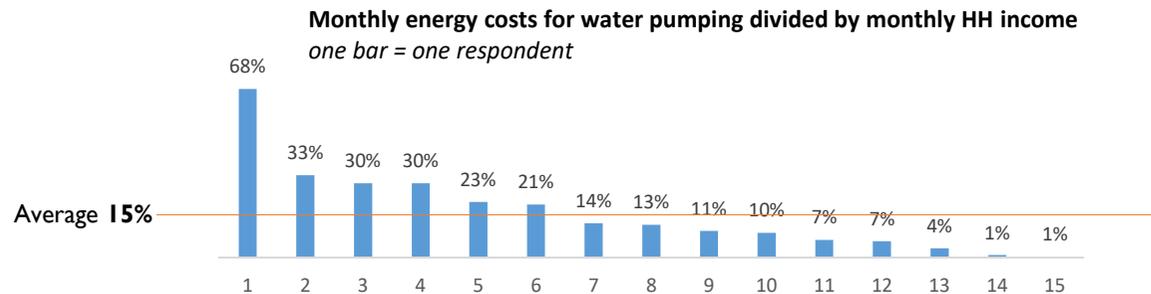
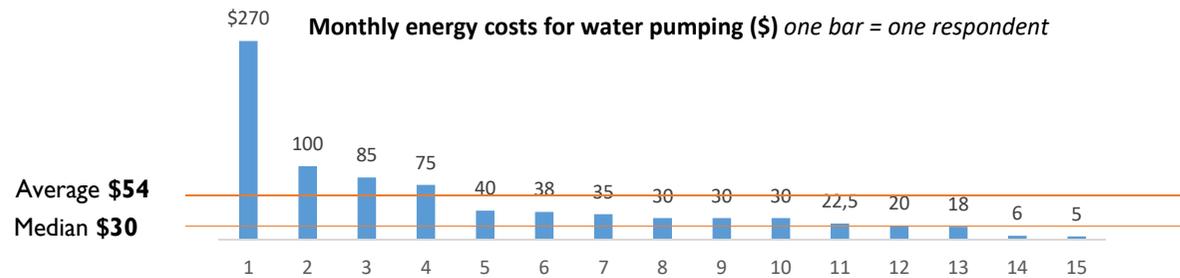


EXPENSES ON PUMPING WATER BEFORE THE SOLAR WATER PUMP

Expenses on gasoline/electricity for water pumping before solar pump

For those using gasoline and electricity pumps the costs of energy to power them was high in relation to the income of the household.

Before the solar pump, an average household was paying \$54 (median \$30) per month for energy costs operating water pumps. This is around 15% of overall household income. A breakdown of water pumping costs with gasoline and electricity and the ratio of these costs to household income is provided below.

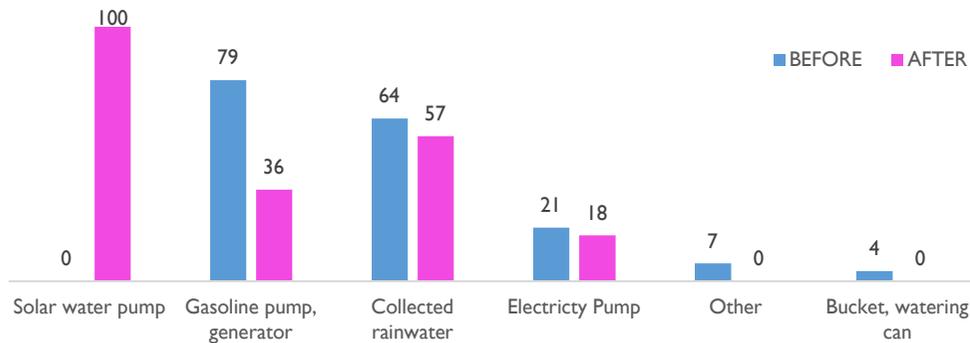


WATER PUMPING METHODS SINCE PURCHASE OF THE SOLAR WATER PUMP

Change in water pumping methods

Every respondent interviewed was now using the solar water pump. The percentage of those continuing to use their gasoline pumps fell from 79% to 36%. Those that continued to use it used it less frequently than before. Collected rainwater was still largely used as a free way of irrigating farming activities.

Water pumping methods used before and after purchase of the SWP (% of Households)



The following table summarises the reasons why households continued to use other irrigation methods alongside the solar water pump.

To save water	33%
It's too cloudy/dark to use solar pump	28%
Solar pump not suitable for rice farming	22%
Solar pump is too small to serve all my needs	28%
Same activities are too far from home	6%
I use rainwater as it's a clean water source for crops	6%

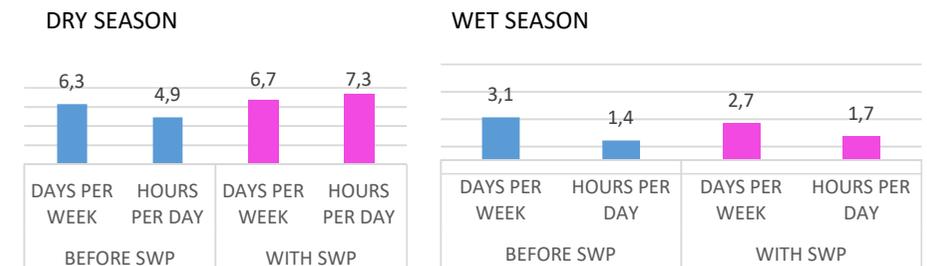
Irrigation methods

All households used hoses and 82% used drip lines as methods of irrigation. Sprinklers and spray tubes were used by around 20% of farmers. These practices did not change with the purchase of the solar water pump.

Time spent irrigating crops

Users of the solar water pump were able to water their crops for longer than before simply by leaving it on during the day and not having to worry about costs. On average users were able to irrigate their crops and provide water to animals for around 2- 3 hours more per day, and half a day more a week. Time spent irrigating crops and animals in the wet season remained roughly the same than before the purchase.

Time spent irrigating crops and animals before and after SWP



ACTIVITES UNDERTAKEN WITH THE SOLAR WATER PUMP

Activities undertaken with the solar water pump

The pump was used for a variety of activities including crop farming, animal rearing and domestic activities.

For animal rearing the solar pump was used as drinking water, to clean the animals, helping them keep disease free and for watering grass and other crops that are used to rear animals.

For crop farming the pump was often left on for long periods of time to water crops, particularly fruits and vegetables. The size and speed of water flow was generally inappropriate for rice farming due to the size of the area needing watering. Just over half (57%) of users used the solar water pump for domestic activities such as showering, cleaning and cooking.

Almost all farmers, bar one, kept farming the same animals and crops they had before they bought the solar water pump. However a few had plans to expand. One in three farmers continued to use old irrigation methods, such as gasoline for certain crops, due to the limits in the capacity of the pump (eg to cover rice farming or bigger farms) and the limits of using it in cloudy/rainy/night conditions.



This customer completely stopped using diesel to pump water since his purchase. He currently grows vegetables such as pack choi and lettuce on his small farm of less than one hectare.

Stopping using diesel saved him 40\$ a month. Due to this, and due to being able to water his crops for longer he was able to increase profits from his farming activities after 6 months by 50%.

He used the pump every day for around 4 hours a day. Up from 2 hours a day with the old gasoline pump.

CHANGES IN ENERGY EXPENDITURE SINCE BUYING THE SOLAR PUMP

Change in energy spent on water pumping

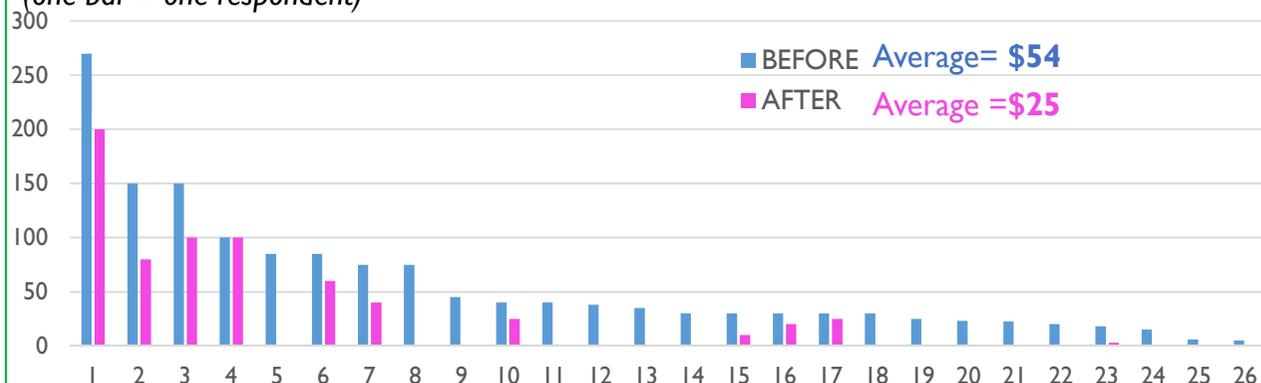
One of the largest, most immediate impacts of the solar water pump is taking people away from their overdependence on gasoline towards solar for their water pumping needs. The data tells us that since purchase, customers had, on average, cut their monthly expenditure on water pumping by half, from \$56 per month to \$25 per month. 58% of customers had completely cut out all expenditure on diesel and electricity for water pumping activities. With water pumping expenditure previously taking up on average 15% of overall household monthly income, these changes are significant.

The chart below shows energy expenditure for water pumping before (in blue) and after purchase of the solar water pump (in pink) per household. In particular poorer households spending \$50 or less a month on gasoline, were the most likely to be able to completely cut this expenditure out with the solar water pump.

With the total cost of the pump being \$800, and conservative gasoline savings alone of \$25 a month, the payback period would be 2 ½ years. Given the solar water pump has a ten year guarantee this already represents good value for money. The increase yields and associated profits from being able to water crops and better raise livestock further increases the value for money of the product beyond just gasoline savings.

Expenditure (\$ per month) on water pumping before and after purchase of the solar pump

(one bar = one respondent)

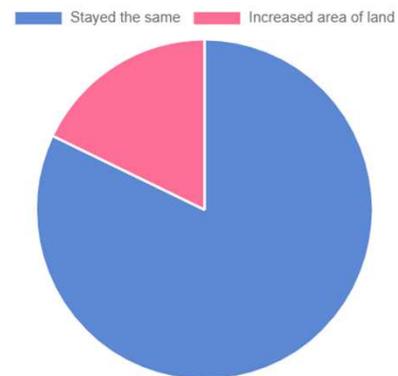


IMPACTS: CHANGES IN CROP YIELDS AND INCOME

Area of land cultivated

20% of farmers increased the area of land they cultivated since buying the solar water pump, another 14% had plans to expand their cultivation areas as a result of the solar water pump. The rest planned to maintain their cultivation areas for now.

Increases in land were between 500 m² - 3000 m² expanding on the current crops being farmed.



Farming profits

30% of farmers using the solar pump for more than two months had increased their farming profits through being able to produce a higher crop yields. This translated into better overall income for the family each month. Many other farmers expected yields to rise over time. These four examples of increased farming profits are listed below.



“before I got around 1T per month of vegetable and beans but now I have around 1.5T or 2T”

“before I harvested vegetables around 240kg per month and now around 300 kg my monthly income increased from \$250 to \$350

“Before my vegetable harvest was 15kg/month and now around 30kg per month, monthly income increased from \$125 to \$250”

“before I sold 15kg of chickens and now I sell around 18kg every 2 months, monthly income increased from \$2500 to \$3000

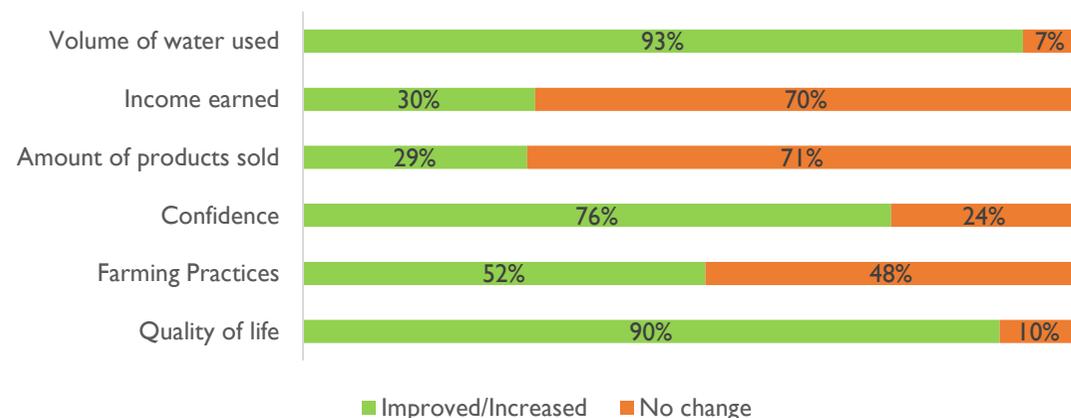
Given the increased length of time crops are being watered, we would expect these success stories to increase as people have the solar water pump for a longer period of time.

OTHER IMPACTS

As well as the obvious financial benefits of purchasing the solar water pump in terms of being able to increase crop yields through more time spent watering in the dry season and through reduced energy expenditure users mentioned several other positive impacts.

- Half said they actively **improved their farming practices** through more productivity and more water being used for crops and animals (93% of respondents said they used more water than before) .Three quarters said they had **more confidence** to be able to improve their farming activities since the pump purchase.
- 90% said their **quality of life had improved** due to:
 - 1) lower costs on gasoline and more money for other household expenses
 - 2) ease of use of the pump in terms of starting it up and moving it around (particularly for older, less mobile farmers)
 - 3) the freedom of time and labour saving to do other things around the house while the pump is left on irrigating without the need to worry about energy costs
 - 4) Feeling more healthy due to not having to breathe gasoline fuel and using less energy to turn gasoline pumps on and off/ moving them around.

Summary of changes reported since using the solar water pump



MARKETING AND BUYING DECISION

26 out of the 28 respondents had **never heard about solar water pump technology** before contact with Pteah Baitong. However since learning of the product half of the respondents say they could find an alternative to the solar water pump in the provinces around Battambang, Siem Riep and Phnom Penh.

Households found out about the product through a mix of sources including **door to door, internet adverts, word of mouth and the village head**. This reflects the success of the varied marketing channels used by Pteah Baitong. A summary of marketing channels used is provided in the chart opposite.

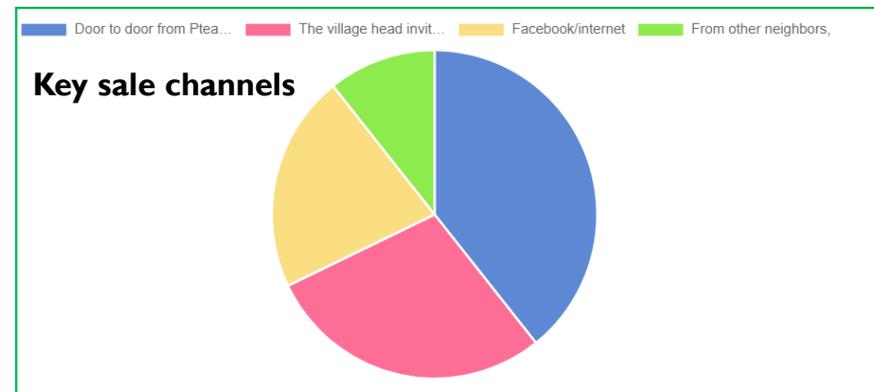
32% of buyers went to a **village meeting** where the product was demonstrated. Satisfaction with the meeting was very high across product demonstration, duration and knowledge of the Pteha Baitong staff. Most people chose to buy the product immediately after the village meeting, with a small percentage taking up to one month to make a decision to allow time for discussion with family members.

In 71% of sales a **joint buying decision was made between male and female household members** on purchase. In 21% of sales the male household member made the financial decision, in 7% just the female made the decision.

In all cases the major buying decision was based on three factors:

- Money savings through using solar
- Ability to save labour and time
- Easy to use and efficient product

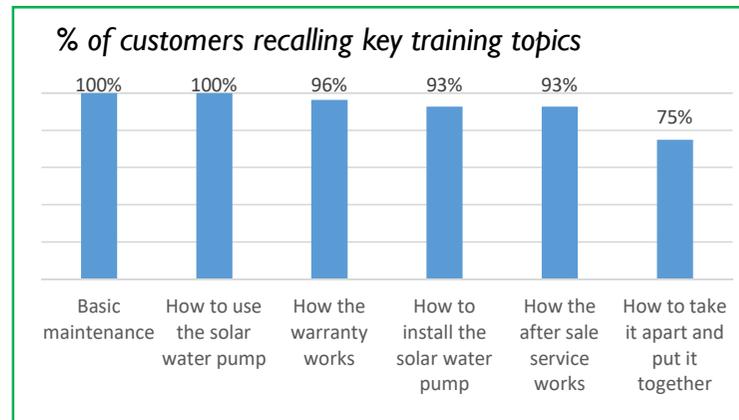
Anecdotal evidence suggests that participants in the villages who did not buy were put off by the new product and having the confidence to part with a lot of savings for something that for them is untested. Many were waiting to see the experience of the 'first adoptors' in their village before committing to finance a solar water pump.



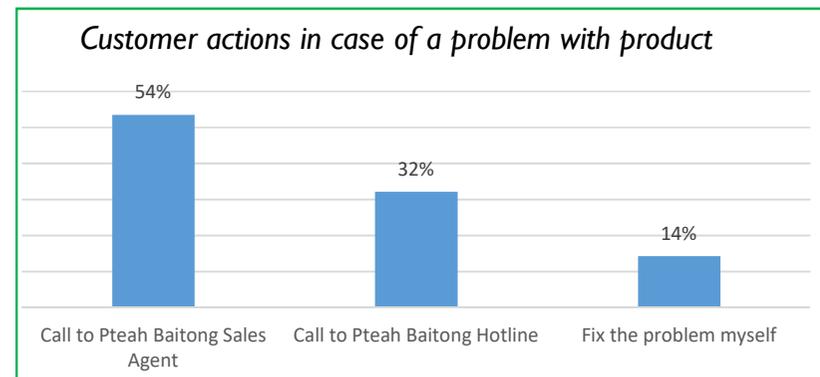
TRAINING ON HOW TO USE THE SOLAR WATER PUMP

All respondents received training on how to use the solar water pump.

Almost all training topics could be recalled by respondents. The least remembered topic was on how to take the product apart and together again in the case of basic at home maintenance.



- ✓ All customers were very happy with the **duration and quality** of the training and were able to ask questions if they did not understand anything.
- ✓ Four customers (15%) said the quality and **level of the trainers** were 'average, the rest 'good'. Two of these customers were based in Svay Rieng, one in Kampong Speu and one in Siem Riep. Overall however, all customers were 'satisfied' or 'very satisfied' with sales agents.
- ✓ 100% of the customers were able to recall details of the **product warranty**
- ✓ 27 out of 28 (96%) of customers were able to recall the **hotline** in case of a problem with the product
- ✓ In case of a problem with the product directly calling the sales agent was more popular than using the official hotline



OVERALL SATISFACTION WITH THE SOLAR WATER PUMP

Overall 100% of customers were either satisfied (64%) or very satisfied (36%) with the solar water pump

Satisfaction with key elements of the product show that **people are broadly happy**, particularly with how easy and simple the product was compared to old pumping methods.

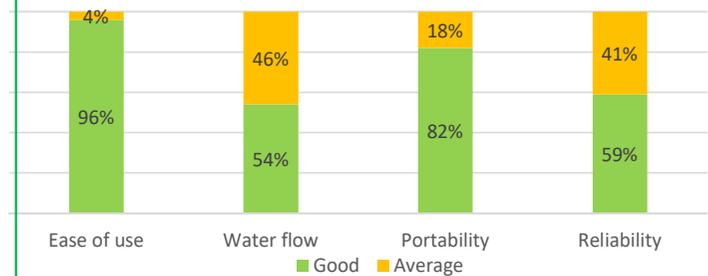
Some lower satisfaction scores were given to **water flow**, given that sometimes in cloudier conditions the product pumps water at a slow rate. Due to some issues with breakdowns and maintenance listed below the reliability score of 'good' sits at 59%.

Aspects that people like the most are certainly the ease of use of the product, the savings on gasoline, the 10 year guarantee and the ability to make simple repairs at home in the case of certain issues.

Aspects that could be improved were mentioned as increasing the horsepower/motor power, addition of more solar panels and a battery to be able to use the pump at night.

Customers were very happy overall with Pteah Baitong and gave a **Net Promotor Score of +82** (a score is between -100 and + 100 and shows the extent to which Pteah Baitong customers recommend the product to friends or families.)

Satisfaction with the solar water pump



Maintenance Issues

35% of users has some challenges with the pump stopping working/breaks down, and in one case the wrong solar cable being used. In these instances the customers tried to fix issues themselves before using the maintenance service. Many customers with the older version of the model with two solar panels instead of three sometimes had issues with **poor water flow**, particularly when cloudy or low light.

In all cases, 50% of all issues were fixed the same day, 30% within 3 days and 20% within a week by the Pteah Baitong maintenance service. All respondents interviewed that had used the maintenance service were happy with it. PB commitment is to fix problems in one week.

COST AND PAYMENT OF THE SOLAR WATER PUMP

Payment

Two payment options exist. An upfront one off payment of \$800 for the product, or an upfront payment of \$200 then \$35 per month transferred through mobile money or bank transfer for 2 years.

79% of customers (22) paid through the PAYGO scheme, and 21% (6) paid cash upfront direct. Upfront payers did not necessarily seem to be from a wealthier group, income wise. All buyers used income from their household savings to pay for the upfront cost, no one said they borrowed the money. Ongoing payments were often managed through the household budget through savings made from less energy expenditure. PAYGO better for trust in a new product?

46% of customers managed their PAYGO payments through a money transfer agent the other 54% through a direct bank transfer.

Everyone interviewed was satisfied with the means to which make PAYGO payments. Only one customer mentioned payment issues referring to issues with the Cambodian Shared Switch (CSS) system initiated by the National Bank of Cambodia (NBC). This issue was outside of Pteah Baitong's control.

Satisfaction with costs

When asked about the initial price, 25% were satisfied and 75% said it was average.

Asked to assess the overall value for money of the product 67% were satisfied and 33% said average. We can infer from this that at first for many the price seems expensive, but given time to use the product and experience its effectiveness, views on the price become more favourable.

Satisfaction with costs of the product



ADDITIONAL PRODUCTS AND SERVICES

Demand for technical agricultural support

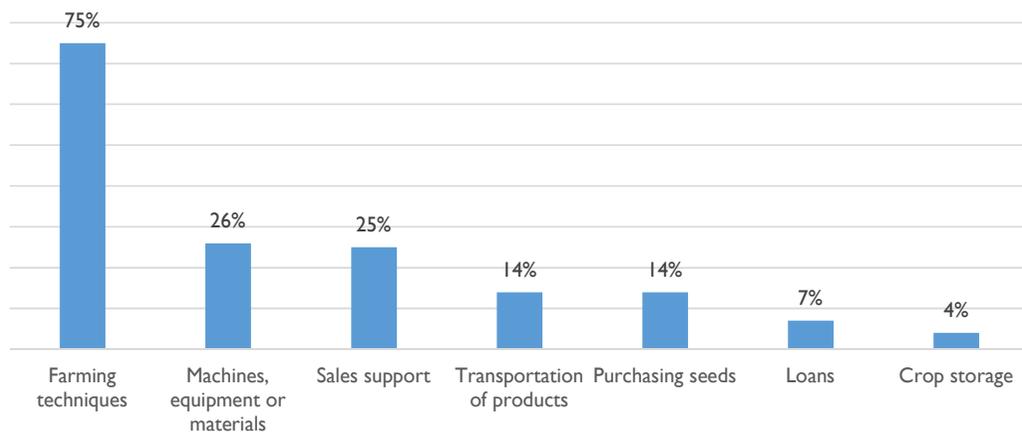
Part of Pteah Baitong's Theory of Change and overall social mission involves not only the sale of high quality, clean energy technologies, but also the provision of needs driven agri-services.

In order to test the demand for these services, participants in the survey were asked which areas they would like more support.

The most popular demand was for **technical agricultural support training** followed by support in **acquisition/leasing of agricultural equipment** and finally support in **selling products**.

Specifically technical support was required for **grass growing, vegetable and crop protection, and animal husbandry**.

Requested additional services Pteah Baitong could provide



MAIN CONCLUSIONS

- ✓ Most customers are slightly older farmers, living off grid with have low incomes from \$100 to \$500 a month, with a few exceptions of larger land owners with additional property related incomes. Males and females equally used the product, and were often both involved in the buying decision
- ✓ The solar pump is used for diverse activities from animal husbandry to crop irrigation (vegetables, fruits) and domestic cooking, cleaning and showering
- ✓ Gasoline pumps are still used for larger farms and rice farming where the capacity and water flow are not enough to meet certain farmers needs
- ✓ The pump cuts energy expenditure on gasoline roughly in half. With over half of users cutting their dependence entirely on gasoline for water pumping as a result of purchasing the solar pump
- ✓ The pump allows for at least 3- 4 hours more watering of crops per day in the dry season contributing to the increase in farming productivity and yields. The pump saves significant time and labor allowing households to focus on other activities while irrigation is being taken care of
- ✓ Village head is a powerful marketing tool alongside facebook, door to door and friends an family. All thse marketing avenues should be promoted.
- ✓ Generally the pump has not increased the diversity of crops and animals being farmed, but has led to some increase in volume, yields and cultivation areas of existing activities
- ✓ Satisfaction with the village meeting, product training and knowledge on the guarrantee, hotline and how to use the pump is very high.
- ✓ Overall satisfaction with the pump, payment structure and maintenance is high, but problems exist with the water flow, general breakdown and horsepower, particularly in cloudy conditions. Breakdowns can be quite common, but are always fixed in a week, with 50% the same day.
- ✓ The price is seen as more favourable once people experience the product and the impact both financially and non financially on their lives. Pteah Baitong needs to double down on its marketing and product demonstration to focus on the future benefits of the product.
- ✓ There is demand for additional technical farming training on how to manage crops and animals, and a smaller demand for agricultural equipment and sales support

KEY RECOMMENDATIONS

- ✓ Maintain focus on small holder farmers with 1-2 ha of land or less, primarily growing fruits, vegetables and crops. Rice farmers are not appropriate customers for the solar water pump.
- ✓ Households using gasoline pumps as their main way of pumping water for their farming activities and with incomes between \$100-\$500 per month are most likely to see the highest social impact from purchasing the solar water pump. This group should also be targetted.
- ✓ Stress further during the product training and customer interactions that the Pteah Baitong hotline is to be called in case of a problem as a first port of call, not the sales agent directly.
- ✓ Add extra sticker to the solar pump itself with the hotline number
- ✓ Make efforts to convince the village head of the value of the product, they can provide lots of sales leads to the village
- ✓ Double down on sales training, stressing the future benefits of the product in terms of income and overall life changes to potential customers, use customer testimonials and experiences to help people in making their purchase decsion.
- ✓ Go back to villages regularly for re sales. With a high net promotor score it is likely that exisiting customers will be talking positively about the product to their neighbors. Many customers want to wait to learn from the experience of other users in the village so purchase decisions from certain households may take some time
- ✓ Focus a little more time on the basic training on how to take the product apart and put it together for basic fixes.
- ✓ Consider offering agri-training such as grass growing techniques, fruit, vegetable and crop protection, and animal husbandry as a new service to help improve household livelihoods