Behavior Change for Low Carbon Energy Access Technologies

A TOOLKIT

WORLD BANK GROUP

Ci-Dev
CARBON INITIATIVE FOR DEVELOPMENT

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Acknowledgments

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Presentation

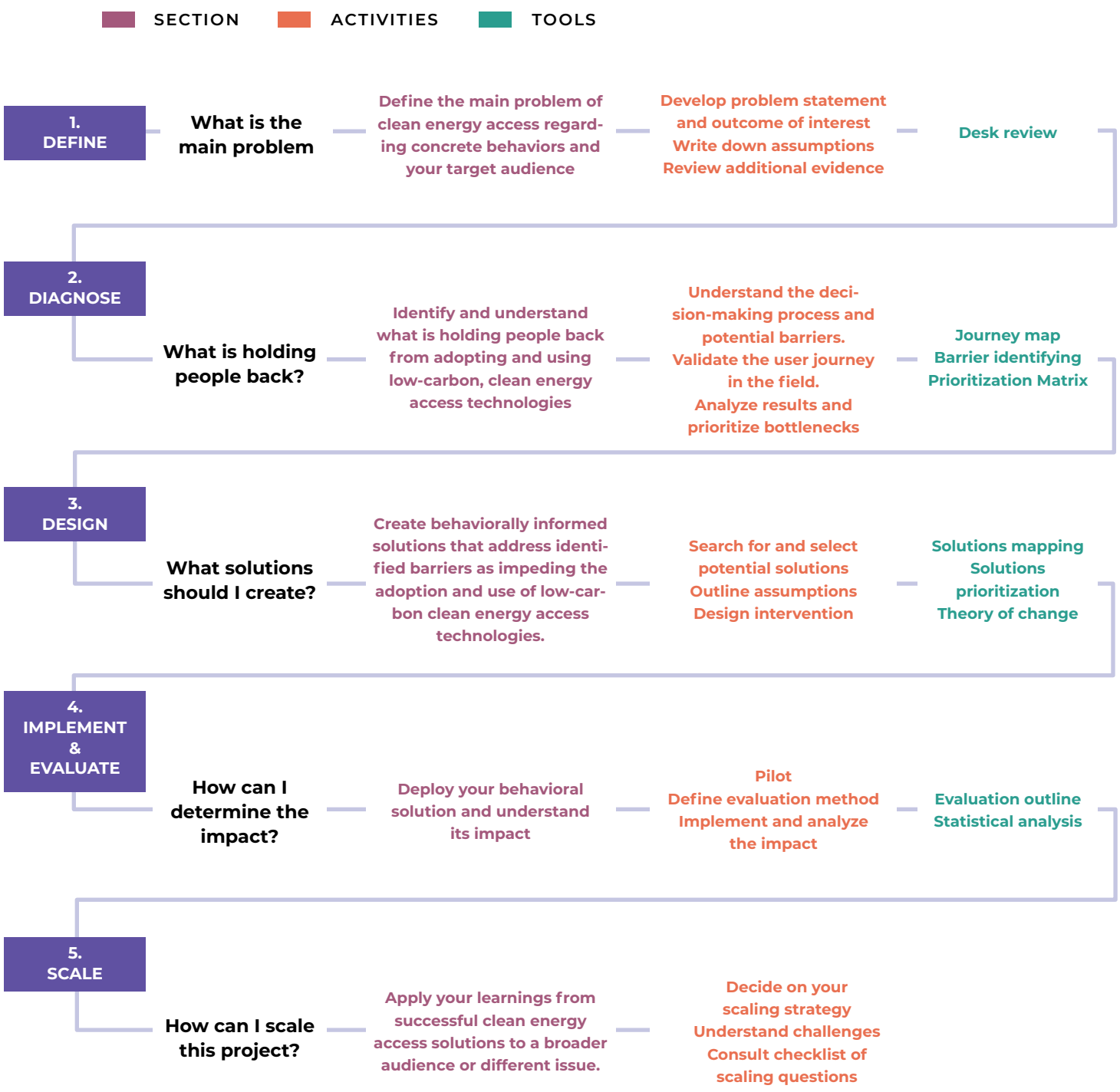
1. Objective and intended audience

This toolkit aims to help WB task team leads and other practitioners apply behavioral science principles to identify factors influencing clean energy technology adoption and design effective solutions to overcome individual, social, and environmental barriers to adopting and sustaining clean energy solutions among low-income households and communities in developing countries. Rather than providing a ready-made list of solutions, the toolkit offers the tools needed to construct behavioral solutions from the ground-up and given them the greatest odds of success.

While there are a variety of low-carbon technologies, this toolkit will center on challenges associated with adopting solar home systems (SHS), improved cookstoves (ICS), and clean cooking solutions (CCS). However, the toolkit can apply to other clean energy technologies as well.

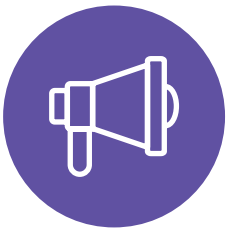
2. What to look for from this toolkit

The toolkit addresses the following questions.



3. Navigating the toolkit

The toolkit is organized such that specific icons denote specific types of content:

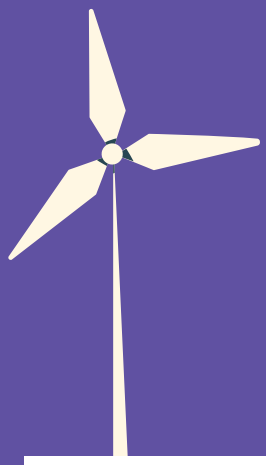


General information, instructions, and examples

Project-specific examples

Reminders to better integrate a gender focus

Tool description and templates



Introduction: Behavioral Science and the Challenge of Clean Low-Carbon Energy Access

Lack of access to electricity and dependence on traditional fuels for cooking and heating homes pose challenges to human capital and climate change. Low-carbon energy access technologies have emerged as an essential solution to provide affordable, reliable, and sustainable energy.

- **Over two billion people—roughly one-third of the global population—lack access to clean fuels for cooking.[1]**

- **Only 16 percent of people in the least-developed countries can access clean cooking fuels and technologies.[2]**

- **The indoor air pollution burden from traditional fuels (solid biomass, kerosene, and coal) is linked to 2.5 million deaths annually.[3]**

- **660 million people worldwide will still lack access to electricity by 2030.**

- **The least-developed nations are significantly behind the rest of the world, with an average access of electricity of 55 percent.[4]**

- **Slow progress threatens the global attainment of securing affordable, reliable, sustainable, and modern energy by 2030 in line with Sustainable Development Goal 7.**

LOW-CARBON ENERGY ACCESS TECHNOLOGIES:

- Increase access to energy for people experiencing energy poverty and
- Generate fewer greenhouse gas emissions than traditional technologies.

THEY INCLUDE:

- Energy-efficient technology: energy-efficient cookstoves, high-efficiency (LED) lighting, mini-grids, solar-powered irrigation systems, wind-powered water pumps, solar lanterns, hydroelectric generators, heat pumps, micro-hydro, biogas.
- Renewable sources of energy: solar, wind, geothermal.

1. What is the role of behavioral science in the context of a project outline?

Despite significant effort and international momentum, the adoption of clean energy technologies is not keeping pace with the change needed.[5,6,7] Further initiatives are required to promote the uptake of clean energy access technologies, such as SHS and ICS.

The transition to low-carbon energy is both a technical and social challenge.[8] In turn, an overreliance on technology and price-focused solutions overshadows other barriers to adoption, such as undervaluing benefits and prioritizing more pressing basic needs,[9] doubts about the benefits of clean energy access technologies,[10] and gender dynamics in decision making.[11] Drawing on knowledge of human behavior and decision making, behavioral science can apply a unique lens to the design of clean energy policies, products, and programs.

The following principles underlie how people make decisions:

THINKING SOCIALLY:

We cooperate, as long as others do the same, and rely on social networks and expectations about how others behave.

THINKING AUTOMATICALLY:

We tend to think fast and rely on mental shortcuts, or rules of thumb. Many of our actions are driven by habits rather than explicit deliberation on all options to find the optimal choice.

THINKING WITH MENTAL MODELS:

Rather than inventing new concepts, we use mental models drawn from society and a shared history. Our past experiences guide our present actions.

Collectively, our decisions are a function of psychological (e.g., values), social (e.g., what others do), and contextual (e.g., convenience) factors.

By considering the nuances of human behavior, behavioral science can help increase the effectiveness and sustainability of clean energy access programs, often at a comparatively low cost. Rather than supplanting the need for key energy infrastructure or programs, behavioral science can be a part of initiatives aimed at maximizing the impact of low-carbon energy access technology solutions.

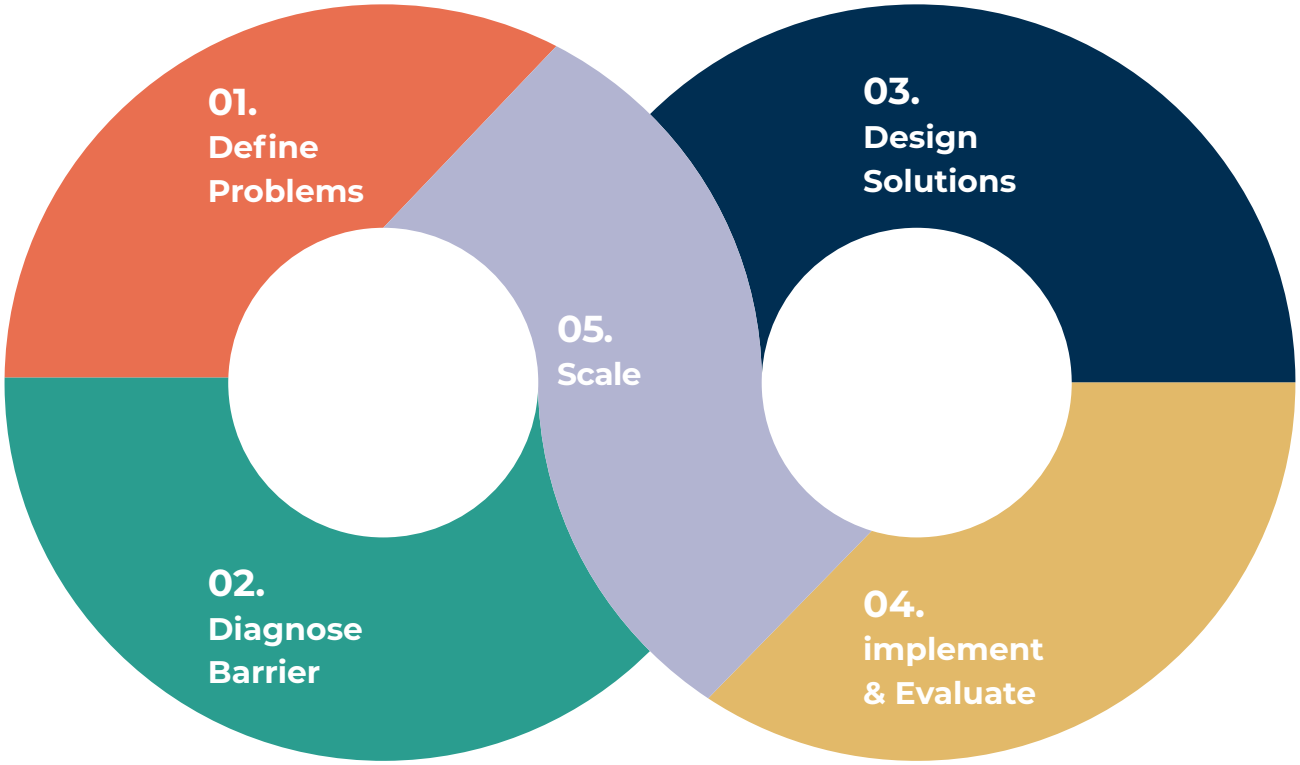
Let's look at when you can apply behavioral insights:

PHASE	BEHAVIOR CHANGE OPPORTUNITIES
Project identification/ policy discussions	During project identification discussions, there may be opportunities to raise policymakers' and suppliers' awareness of the key benefits of behavior change.
Public consultations throughout the project	Project development generally includes relatively wide consultations with different experts and stakeholders to further understand the current situation and what changes might be achievable. Consulting behavior change experts will help identify key opportunities.
Data collection and survey efforts during project appraisal	As projects are being designed, surveys or other data collection activities may be used to assess baseline conditions. The data collected should be sex-disaggregated whenever possible. Collecting information about current energy behaviors, with an eye toward potential improvements, can help set targets and enhance project design.
Project communications and stakeholder engagement plans	Energy efficiency projects often include communications campaigns to raise public awareness of the benefits of clean energy access technologies. Initial communication planning discussions offer an opportunity to consider applying behavior change approaches.
Market assessments and program design	In any market assessment, it is important to document the baseline provision and access of energy access technologies. Program design will need to address the identified behavior change opportunities.

Source: Adapted from Energy Sector Management Assistance Program (ESMAP). (2020). "A Practitioner's Guide to Integrating Behavior Change in Energy Efficiency Projects in Developing Countries." ESMAP Knowledge Series 029/20. Washington, DC: World Bank.

2.The life cycle of a project informed by behavioral Science

Several toolkits and resources are available for practitioners,[12] but some lack hands-on guidance. This toolkit fills that gap. It centers around five stages that are designed to be integrated within your existing project activities and goals. Behavioral insights are often best applied at the outset of a project rather than retrospectively. For this reason, this framework is designed to support all aspects of your projects and programs, from conception to design, implementation, and evaluation.



Source: Authors' elaboration

DEFINE:

Define the main problem of clean energy access in terms of concrete behaviors and your target audience.

- *Are clean energy technologies available, but people aren't interested?*
- *Do households have ICS but aren't using them?*
- *Are households stove-stacking?*
- *Do supply and distribution of solar products remain low despite demand?*

DIAGNOSE:

Identify and understand what keeps people from adopting and using low-carbon, clean energy access technologies.

- *Is the technology incompatible with cultural ways of cooking or ingrained ways of getting electricity?*
- *Do people think solar products or ICS are impractical for everyday use?*
- *Have people had a negative experience with different products?*
- *Is the cost of ICS or solar products too high for households?*

DESIGN:

Create behaviorally informed solutions that address the barriers you identified as impeding the adoption and use of low-carbon clean energy access technologies.

- *Can you use a savings calendar help people save money for solar products or ICS?*
- *Can you use social networks to change prevailing attitudes around cooking with traditional fuels?*
- *Can you simplify information to make the benefits of solar product or ICS more salient and attractive?*

IMPLEMENT AND EVALUATE:

Deploy your behavioral solution and understand its impact.

- *Which methods can you use to gauge the impact of your solution?*
- *Did the solution have the desired impact?*
- *What are key learnings you can use to improve future initiatives?*

SCALE:

For successful clean energy access solutions, apply your learnings to a broader application.

- *Can you scale up the solution to more households in an area?*
- *Can you adapt the solution to fit a different audience or different technology?*

3. The need for a gendered and distributional lens

When thinking about clean energy access, it's important to keep gender and poverty top of mind. Insufficient finances, information, training, and education disproportionately affect women and those living in poverty.

BENEFITS OF USING A GENDERED LENS

As the primary users of energy, women reap outsized rewards, in terms of poverty alleviation, from clean energy technologies. The decreased time spent collecting fuel and the ability to do housework outside daylight hours frees up time for social and economic-generating activities. Further, transitioning away from polluting fuels improves women's health and well-being, which can be a precondition for their empowerment. Yet women may face unique barriers to purchasing and using clean energy technologies, such as lacking the financial autonomy to make purchasing decisions. For these reasons, tailoring programs to respond to women's needs is essential. Table 3.1 lists questions to consider across all project stages.

Integrating women into project activities and considering their needs is important across all project stages, including shepherding clean energy access technology uptake. Women can be powerful agents of change. In Kenya, women engaged as entrepreneurs in the ICS value chain. They also received empowerment training due to their lower perceived capability and more significant fears of failure than men. Women sold three times more ICS cookstoves than male entrepre-

neurs. Female consumers were also more likely to correctly use ICS purchased from female entrepreneurs, thanks to their greater emphasis on articulating proper instructions on cooking typical meals.[13]

Recommended Reading

Readers interested in learning more about the dynamics of poverty and gender (and how to address them in their projects) are encouraged to review the following resources:

- ***Gender and Energy Online Toolkit for Practitioners***
- ***Integrating Gender Considerations into Energy Operations***
- ***Energy Access and Gender: Getting the Right Balance***
- ***Mainstreaming Gender in Energy Projects: A Practical Handbook***
- ***Energy and Poverty***

ACCOMMODATING POVERTY IN PROJECTS

Interventions to change behavior must be sensitive to the diversity of constraints felt by impoverished individuals. The psychological costs of poverty can affect how much time and energy individuals can dedicate to exploring and purchasing clean energy access technologies. Therefore, traditional interventions to increase the adoption of these technologies may (unintentionally) exclude those of the lowest socioeconomic status.[14] Indeed, past research highlights a correlation between ICS adoption and socioeconomic status. In turn, impoverished people can be trapped in a cycle of relying on dirty fuels and suffer disproportionate health consequences. Those living in poverty may oppose clean en ergy access technologies that offer long-term benefits but involve risks of loss (such as a low-quality, counterfeit product breaking down). Fear of failure can consequently impede the adoption of new technology and make it increasingly difficult for individuals to escape poverty.

Individuals living in poverty often have limited attention to dedicate to securing and using clean energy access technologies. Therefore, practitioners may consider alleviating burdens on targeted groups.[15] This might include streamlining project activities (e.g., reducing paperwork) to remove logistical hurdles or offering commitment devices, like dedicated savings funds, to help overcome the difficulty of eschewing present needs to set aside money for specific purposes (like solar products or ICS) that will generate future benefits. This strategy has shown promise across a range of pro-environmental behaviors.[16]

4. About the case study: Solar home systems for refugee communities in Uganda

We will use the case of an intervention implemented by WB in Uganda to illustrate the application of the tools and recommendations provided in this toolkit.

The research team conducted a behavioral diagnostic in two Ugandan refugee camps—Kyangwali in the Southwest and Rhino Camp in the West Nile region—aimed at identifying why people failed to become interested in, purchase, or sustainably use SHS and identify opportunities for behavior change to increase uptake. Then, a the team partnered with local savings associations to experiment with how to increase adoption through behavior change.

The results of the diagnostic showed that structural (e.g., counterfeit products) and behavioral (e.g., limited time and energy) barriers limit clean energy uptake. Refugees tend to use fuels like firewood to satisfy heating and lighting needs; fewer than 10% have adopted solar energy.[17] Refugees who own solar products tend to use solar lanterns[18]. Their meager and often sporadic incomes limit access to more substantial solar products, as flexible payment schemes are rare in refugee settlements. Language barriers and a lack of tailored communications campaigns further exacerbate access issues and limit uptake.[19]

1. Define: Define a clean energy access challenge in terms of the concrete behaviors of a target audience

The definition phase focuses on understanding the behaviors that contribute to your policy challenge and the key stakeholders that play a role in stopping or sustaining those behaviors. To solve a problem, you must first ask the right questions and understand the opportunities. This section will help you answer:

- *What is my policy challenge?*
- *What is the target behavior I hope to address?*
- *Whose behavior do I want to change?*
- *Why should I define target behaviors early on?*
- *What tools can I use to understand the desired behavior?*

By the end of Stage 1 and before you move on to Stage 2, you should comprehensively understand the context in which behaviors are situated.

1.1 Develop a problem statement and the outcome of interest

General Information

WHO SHOULD BE INVOLVED?

- An energy subject matter expert to provide expertise to understand the energy-specific context and goals.
- A behavioral scientist to define the behavioral problem and understand the context as it relates to behavior.
- Government decision-makers and country counterparts provide information on the physical, political, and social context.

Exploring the context (physical, political, social) can help you systemically understand how individuals make decisions regarding the purchase and use of clean energy access technologies, as well as their attitudes and perceptions toward adoption or sustained use. Meetings with decision-makers and country counterparts involved in energy access can lend valuable insights to your project.

Examples of questions that can guide exploratory sessions include:

- *What does clean energy access look like in this region?*
- *How do individuals currently satisfy their energy needs?*
- *Is there institutional buy-in from governments, NGOs, or other actors to promote clean energy uptake?*

Once you've had initial conversations, work to identify your problem and desired outcome upfront. This basic understanding will help you immensely down the road. Don't forget to be very specific!

- **Identify what you are trying to change.** The desired behavior is what you want to start, stop, or continue to reach your policy goal—your output under your theory of change. For example, the problem might be that solar products are available from almost all retailers and are heavily subsidized, but people are not buying them. The desired behavior may be to decrease weekly use of kerosene by increasing interest in and purchases of solar products.

- **Identify your target population.** In this case, it might be refugees who rely on kerosene, dry cell battery torches, and firewood to meet their lighting and other energy needs.

- **Identify the desired policy goal.** The goal is the "big picture" outcome of your project that your desired behavior contributes to, such as increasing women's empowerment.

DEFINING A TARGET BEHAVIOR

A good target behavior is **specific, assignable, and observable.**

An example of a poorly defined behavior is, "I want people to be eco-friendly." It's not specific, is not assigned to a target population, and the behavior is vague, which would make it difficult to observe whether you've accomplished it.

By contrast, a well-defined behavior would be, "I want to increase the purchase of solar products among people aged 18+ primarily responsible for household duties." This target behavior is specific, as it references what (purchase of solar products) you want to happen. It's assignable, as you note a target population. And it's observable, as you can quantify the purchase of solar products to identify whether you attain your outcome of interest.

Try framing your objective in this format:
I would like _____ *[target population]* **to** _____ [desired behavior]**.**

THE POLICY CHALLENGE IN UGANDA

OUR PROBLEM STATEMENT:

Households in refugee settlements in Uganda continue to rely on kerosene, dry cell battery torches, and firewood to meet their lighting and other energy needs despite the availability of solar options in the market.

OUR POLICY GOAL:

Poverty alleviation via increased uptake and sustained use of low-carbon energy access technologies.

1.2 Write assumptions of why this issue occurs

General Information

WHO SHOULD BE INVOLVED?

- **And energy subject matter expert to define energy-specific structural assumptions.**
- **A behavioral scientist to define behavioral assumptions.**

Based on what you know so far, why do you think people are not buying/using solar products? Questions to ask include:

- *Are solar products available?*
- *Do households have access to trustworthy information about solar products?*
- *Do households see people around them using solar products?*
- *Are households interested in using solar products?*
- *Do households have access to reputable solar-product suppliers?*
- *Do households have the time and energy needed to research solar product options?*
- *Can households afford to purchase solar products?*
- *If costs are prohibitive, do households have access to credit or other means of saving?*

1.3 Review evidence and initiatives

General Information

WHO SHOULD BE INVOLVED?

- A research analyst to conduct a desk review to find behavior change interventions, stakeholders, and policies, and extract relevant information.
- A behavioral scientist to support the desk review with a focus on the key behavioral elements of past initiatives and the current clean-energy landscape.

The next step is to narrow your understanding of the behavior and relevant approaches to changing the behavior through a desk review. During your desk review, you will also want to identify the main stakeholders and their relative roles. Questions to guide your desk review include:

- *What kinds of policies are currently in place related to clean energy access technologies?*
- *Has anyone rolled out solutions to increase clean energy access technology uptake before? If so, what did they look like?*

Project-Specific Examples

STAKEHOLDERS IN UGANDA

Credit organizations	Users	Government	Suppliers	Local leaders	Development partners
Village savings and loan associations	Households with solar Households without solar	Department of Energy Secretary of Environment Prime Minister's Office	Concessionaires Importers Retailers Distributors	Village chiefs	Development banks Financial institutions United Nations High Commissioner for Refugees

TOOL: DESK REVIEW

Gather information on relevant research with the Desk Review template. The information gained from the review can help you tailor your activities in Stage 2.

Focus your desk review on clean energy initiatives, aiming to understand:

- Which behaviors were targeted in similar projects;
- What the causes of those behaviors were (e.g., habits or cultural norms);
- Common descriptions of behavior (e.g., how people normally light their homes);
- Literature on initiatives that change behaviors (e.g., providing simplified information, use of trusted community members as messengers);
- Relevant policies; and
- Influential stakeholders.

When looking at the literature, ask yourself:

- How effective were past solutions that attempted to change users' behavior to increase the uptake of solar products? Are these findings specific to certain contexts (e.g., have certain solutions been effective with some sociodemographic groups but not others)?
- Is the data anecdotal, or have the authors referenced data collected systematically and analyzed to understand the main contributors to a behavior?
- Who are the most important stakeholders in the supply chain?
- What are the most relevant solar policies currently in place?

STEPS:

1. **Search for relevant literature**. Technical personnel in central or local government may be able to provide published or unpublished reports, or information about relevant policies, stakeholders, or projects in the region of interest. Government agencies' resource centers and libraries also contain a wealth of information. If you conduct an internet search, it should include peer-reviewed journal articles and grey literature (graduate-level theses and reports produced by international organizations, government agencies, and NGOs). Search for institutions and individual stakeholders that influence the behavior of interest. Search government documents or reports from NGOs and international organizations to understand the policy and solution landscape. Useful sources include:

    - **Multidisciplinary digital libraries, academic databases, and search engines:** *Google Scholar*, *JSTOR,* *SSRN*, *EBSCO*, *DOAJ*, *OAIster*, and *Sustainable Development Goals Online*.
    - **Specialized repositories and search engines for behavioral science literature:** *PubPsych*, *PubMed*, *RePEc*, *B-HUB*, *BIT*, *OPSI*, *Behavior Institute*, *IPA*, and *J-PAL*.

2. **Extract data:**
   Synthesize the relevant information from each document and record it in the relevant column of the template provided.

2. Diagnose: Identify and understand what keeps people from adopting and using low-carbon clean energy access technologies.

If you don't understand the problem and your desired outcome you won't be able to create an effective to solution to your challenge. This section will help you answer:

- *What is the difference between structural and behavioral barriers?*
- *How do I find out what is holding potential users back from adopting and using low-carbon energy access technologies?*
- *How do I prioritize identified barriers?*

By the end of Stage 2 and before you move onto Stage 3, you should have:

- *A comprehensive list of barriers validated with fieldwork*
- *A list of prioritized barriers to target with solutions*

2.1 Understand the decision-making process and potential barriers

General Information

WHO SHOULD BE INVOLVED?

- **The project team to leverage multiple points of view to ensure the completeness of decision-making processes**

The results from your desk review will inform your understanding of the barriers holding people back from becoming interested in, purchasing, and using clean energy technologies. When your team reviewed relevant literature and conducted exploratory sessions, did certain issues keep coming up? It's important to recognize both the structural and behavioral barriers that may be at play for your audience.

Structural barriers relate to laws, regulations, supply, and procedures. To assess structural barriers, you might ask:

- *Is there an adequate supply of SHS and replacement parts?*
- *Do residents have the financial means to purchase SHS?*

Behavioral barriers extend beyond the availability and accessibility of the product to include psychological (e.g., values, biases, difficulty saving up enough money) and social (e.g., prevailing culture) factors. To assess behavioral barriers, you might ask:

- *Do households want to buy SHS, but their erratic income makes it difficult to save?*
- *Do people underestimate the benefits of SHS, like the opportunity for their children to study after dark?*

Imagine that a household wants to learn more about SHS but doesn't know where to look (barrier: information asymmetry). SHS are quite pricey (barrier: cost), and they don't think their village savings association would be willing to provide a loan to buy one (barrier: misconceptions). They would also need to find a retailer and travel a great distance to town to purchase SHS (barrier: hassles).

When you make your hypotheses, pay close attention to whether barriers are structural or behavioral; discussions with behavioral scientists can help. Note that some barriers that appear to be structural could have underlying behavioral components. For instance, the purchase price of SHS, listed above as a structural barrier, is associated with several behavioral barriers related to saving, such as not wanting to take out a loan, assuming that savings groups cannot be used for SHS, and lacking product-specific savings goals to motivate long-term savings.

You can practice by creating several hypothesis statements, one for each relevant barrier that you uncovered in your literature review.

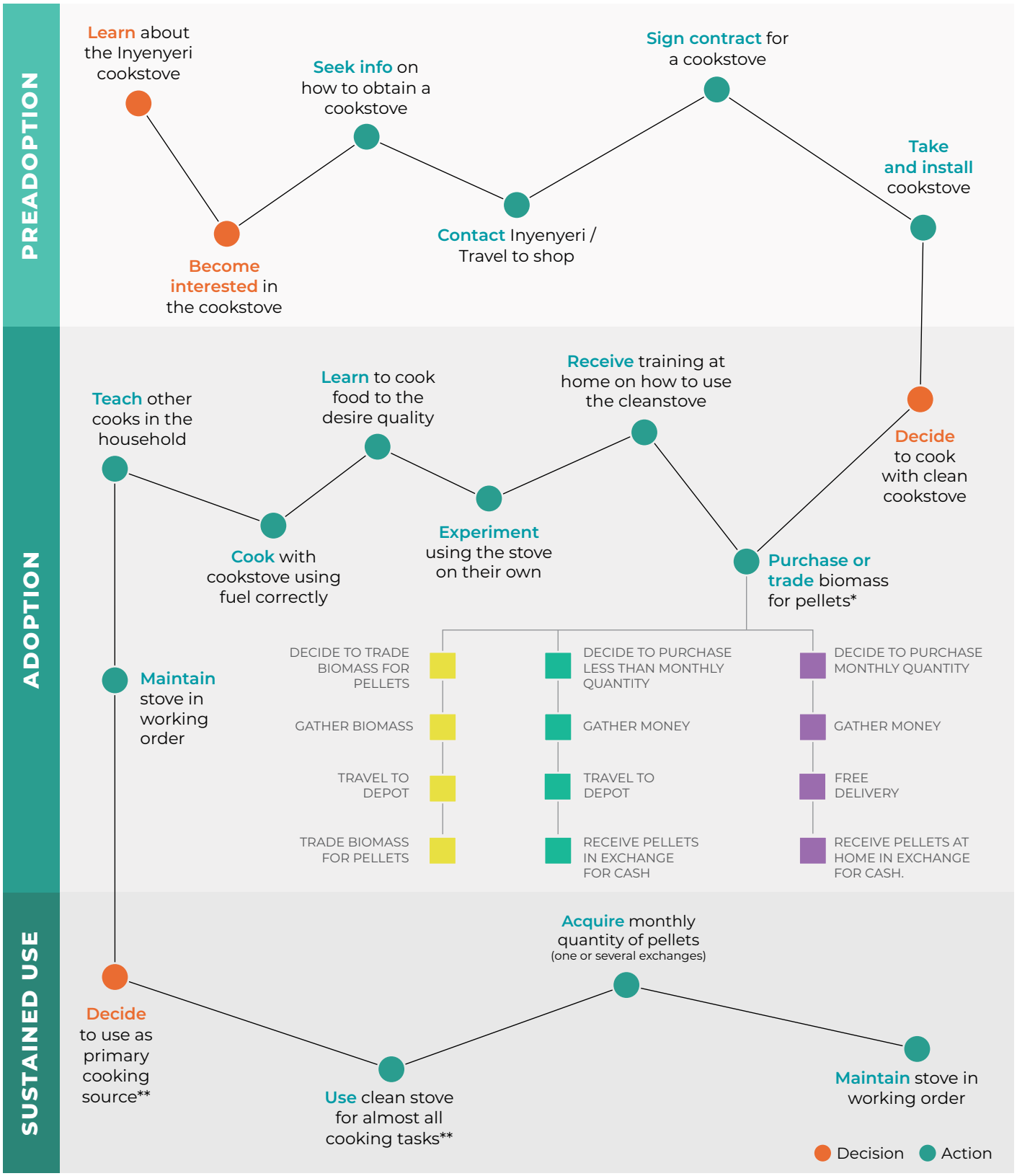
General Information

HYPOTHESIS STATEMENT:

I believe that _____ [insert barrier] is impeding individuals from _____ [insert whether the barrier is affecting people's interest in the product, their purchase of it, or their sustained use] based on _____ [insert relevant evidence].

Next, put yourself in the decision maker's shoes by creating a journey map—a method of denoting each decision and action an individual must make and take to learn about, purchase, and use SHS, in between structural or behavioral barriers.

Based on an initial desk review, the eMBeD team constructed a journey map to understand how a user transitions from learning about to using an SHS and relevant barriers along the way.



* Different non-exclusive options available, i.e., customers may rely on one or more of these options

** Requires knowing an alternative to slow cooking beanswith a charcoal stove, either:

- Soaking beans overnight
- Using a finishing container *(Neither of this approaches are currently known to customers)*

TOOL: JOURNEY MAPS

Create your own journey map using this *template*.

THE GOAL:

To identify the barriers holding people back from engaging in the desired behavior (i.e., learning about, purchasing, or using a solar product). Ideally, you want to identify the barriers between when a person's decision (i.e., "I want to buy a solar product") and their behavior (i.e., successfully purchasing a solar product). You will create two journey maps: one hypothetical map before the fieldwork and a second after you've conducted it.

STEPS:

1. **Revisit your literature review.** What do you know about how people learn about solar products? How do people purchase them? What do they have to do to maintain their product?
2. **Use the information you've found to think through the consumer's journey.** Starting from when individuals first learn about the product, map out each and every decision they must make to purchase a solar product and use it. You can use the solar journey map above to guide you. Include all decisions, actions, requirements, and interactions to meet the desired behavior. It's okay if there are gaps; you'll be able to fine tune this product later.
3. **Complete fieldwork.** After finishing your first journey map, it's time to complete your fieldwork (see the "Identifying Barriers" tool below).

4. **Revisit your first journey map.** Next, it's time to create a second journey map using the barriers you've learned about. Jot down the factors that are hindering individuals from becoming interested in, purchasing, or using solar products.

    - Based on your newfound knowledge, you may add or remove certain stages from your initial journey map

5. **Be realistic!** Make sure to map each stage of the journey based on the input you've received, not how an individual should work through the journey.

    - Consider your own life. When you need to make a significant purchase for your home, do you always behave rationally, or do you procrastinate? Does the paperwork deter you from moving forward? Would you rather buy something you want right now rather than saving up for something you know you'll need in a few months?

2.2 Validate decision-making processes in the field

General Information

WHO SHOULD BE INVOLVED?

- Data collection firm or anthropologist: Support execution of field validation activities with target population (recruiting, meeting with participants, recording feedback).
- Behavioral scientist: Define types of field validation; draft field validation templates and questions to guide fieldwork.
- Energy subject matter expert: Identify relevant stakeholders for interviews; oversee development of data collection instruments.
- Community leaders, NGOs, private firms, government actors, users: Stakeholders to be interviewed or to suggest relevant actors for interviews.

Once you have an idea of the steps someone must take to learn about, purchase, and use clean energy access technologies, it's time to validate your assumptions and hypothesized barriers with field-work. Use the stakeholder map you created to identify whom to talk to at this stage. You will want to speak with those who are interested in and engaged with clean energy access technologies (to understand motivating factors) as well as people who aren't (to understand barriers). Don't forget to include individuals across a range of socio-economic statuses, as those living in poverty will likely face unique barriers. Other stakeholders—including community leaders, influential figures, NGO and government workers, and private sector actors familiar with your target population and the dynamics of energy access—may also be helpful.

The type of field research you choose should depend on your goals. Let's look at some common types.

TYPE OF FIELD VALIDATION	WHAT IT IS	WHY, HOW, AND WHEN TO USE IT
Focus groups	Small gatherings of specific groups of stakeholders (e.g., a group of households or a group of community leaders). Questions are open-ended, allowing a conversation to flow.	Focus groups allow you to gain in-depth insights into specific behaviors – like how people prepare food and why they prefer traditional cooking techniques – without providing predefined answers. It is also useful to understand group dynamics in relation to an issue. You may consider gender-disaggregated focus groups.
Semi-structured interviews	One-on-one interactions with an individual stakeholder (i.e., a domestic worker) that follows a general narrative.	These can provide rich insights into the nuances of energy behaviors. This type of fieldwork allows you to present prepare questions but also to improvise if the conversation takes an interesting turn. Individuals may be more open to sharing their thoughts or experiences during one-on-one conversations than when they're in a group.
Surveys	This is the only quantitative type of method listed. Surveys use standardized, closed-ended questions that allow interviewees to choose from a range of options that fit their attitudes or practices.	They provide an opportunity to obtain broad insights related to energy practices (cooking, electricity needs and practices). If administered to the full target population or a representative sample, they can also provide reliable evidence on the generalizability of your findings.
Field observations	Passively observing activities in public areas (make sure you're not being intrusive).	Observations are unfiltered and don't require pre-defined questions. Seeing the behaviors in action can provide context to the information you've gained from other fieldwork and from your literature reviews.

FIELD RESEARCH IN UGANDA

The WB team spoke with ~130 individuals in the two refugee camps, including:

SEMI-STRUCTURED INTERVIEWS WITH:

- 13 households (7 with solar products and 6 without)
- 6 shop owners with on-grid electricity
- 3 health clinics and 3 schools

FOCUS GROUP DISCUSSIONS WITH:

- 6 Community member groups (6-22 participants)
- 2 Village savings and loan associations (containing 10-12 participants)

OBSERVATIONS

- 6 marketplace observations
- 6 public institution observations (3 in health clinics and 3 in schools)
- 2 energy kiosk observations

Household interviews focused on community norms around solar products, preferences, beliefs, experience with solar products, energy use for lighting, savings, loans, decision-making, and village savings and loan associations.

Don’t forget about the context.

When designing your solution, keep in mind the local context and available resources. For instance, what kinds of communication channels are available and commonly used? This may differ for urban versus rural populations. In Uganda, the WB team focused on two refugee settlements, which were quite different in refugee’s income and the availability of public services. In turn, refugees across settlements had distinct needs. This diversity informed where the team conducted fieldwork so that the barriers uncovered would be representative of the population.

Reminder: Gender

Don’t forget about gender, as men’s and women’s experiences with solar are likely to be different. As such, try to consider a gendered lens in your fieldwork, for instance by conducting sex-disaggregated focus groups. Women may perceive the reliability, affordability, convenience, and efficiency of solar products differently than men. You can use Block 5 of this toolkit to guide your fieldwork.

TOOL: IDENTIFYING BARRIERS

Conduct your own fieldwork and uncover relevant barriers using the guiding questions provided.

THE GOAL:

Once you've reached this stage, ask yourself, "What do I want to know more about?" The information you want to obtain will guide the questions you ask and the type of fieldwork you conduct. Think about:

- Questions that came up during your literature review;
- Barriers frequently mentioned in articles during your literature review; and
- Specific aspects of users' engagement with low-carbon energy access technologies. Do they use certain technologies out of habit or because of their observations of others?

STEPS:

1. **Review existing data.** Existing resources can provide valuable information on energy access and residents' prevailing norms and attitudes regarding energy use. Relevant resources include Multi-Tier Framework survey, Energy Data.Info, and RISE.
2. **Create and review questions to ask for each type of fieldwork.** Asking tailored questions can help you understand what barriers are present and how common they are.
    a. Create different types of questions for different fieldwork. For instance, questions for focus group discussions will tend to be

open-ended, while survey questions will be more structured.

   b. Start with open questions to capture respondents' own words. As you progress in your interviews, your questions can get more specific.

   c. You may have to prompt participants ("Tell me more," "Show me what you mean") to gain additional information about why they feel the way they do.

3. **Create a consent form.** Don't forget to obtain consent! Questionnaires must prompt participants to provide authorization from interviewees prior to obtaining information from them.

4. **Conduct interviews, focus group, discussions, and observations.** You can work with a dedicated company that can conduct focus groups, interviews, surveys, or observations for you. Make sure the interviewers can speak native dialects.

5. **Enumerate how many people mention specific barriers or perceptions around solar products.** For instance, are people aware of their benefits? Are they interested in solar products but have difficulty saving money? Do they lack access to quality information?

6. **Map barriers onto the provided template under its relevant category.** For example, if people talk about their hesitancy to purchase a solar product because they're afraid of the risks or have difficulty saving money, this would fall under "capability."

7. **Look for relationships between barriers or group of people.** For instance, is there an urban/rural divide?

8. **Extract main insights.** Based on what you've learned, are the barriers mainly oriented around capabilities, opportunity, or motivation?

9. **Proceed to the Prioritization matrix.**

2.3 Process data and analyze results

General Information

WHO SHOULD BE INVOLVED?

- A research analyst to clean, code, collate, and organize fieldwork results.
- A behavioral scientist to interpret and group results as they relate to key behavioral barriers and psychological biases.
- Local subject matter experts to validate fieldwork results and data interpretations.

Once you've conducted your fieldwork, it's time to collate your data. Your primary objective is to understand behavioral barriers (e.g., low valuation of product benefits) and psychological biases (e.g., present bias, or prioritizing present needs at the expense of future ones).
As you piece together your findings, try to group information based on themes. For example, you may analyze data based on issues people had related to (1) knowledge of and interest in a product, (2) product purchase, and (3) sustained use.

When you're sifting through data, examine whether certain challenges are very common among your target population and if the barriers you uncovered in your fieldwork align with what you found in your literature review. It may help to validate what you've found with experts, such as university professors. Look at the table of barriers the eMBeD team uncovered below for examples.

Project-Specific Examples

BARRIERS IDENTIFIED IN UGANDA

STRUCTURAL	BEHAVIORAL		EXAMPLE
Product cost	Related to knowledge of and interest in product	Information asymmetry and low trust in product quality	There's often only one person available to tell residents about the solar product benefits and warranties, and their answers may be incorrect. The abundance of counterfeit products means residents can't identify quality products.
		Limited opportunities for social learning from peers due to limited ownership of (quality) solar products	Limited ownership of solar in some camps hinders residents from learning about solar products from their peers.
Limited financing and credit options	Related to purchase of product	Bandwidth constraints	Irregular and fluctuating income and precarious living arrangements can limit the time and energy refugees can dedicate to saving for solar products.
		Mental effort involved in tracking multiple, fluctuating energy expenses	Residents must compare solar product payments against multiple separate payments (e.g., battery, candle, mobile phone charging purchases).
		Norms around what village savings and loan associations loans can be used for	Village savings and loan associations (VSLAs) are oriented towards business activities and often do not provide loans for non-income-generating activities.
	Related to sustained use	Overweighing of product limitations and lack of understanding of benefits	Solar products can provide basic electricity access (e.g., phone charging) but not more intensive needs (e.g., power a fridge).
		Low salience of benefits and perception of SHS are non-productive assets	Residents do not see solar products as income-generating assets, such as extending business hours or services.

Once you've uncovered barriers through fieldwork, you must then prioritize which ones to target in your project. You also must assess which stage of the user journey you want to focus on:

- *Do you want to increase consumer interest in and knowledge of solar products?*
- *Do you want to boost clean energy technology purchases?*
- *Do you want to increase the extent to which people use solar products after they've bought them?*

Some barriers may be applicable at more than one stage of the journey. For instance, bandwidth constraints can affect the extent to which individuals are interested in and seek information about solar products, but they can also affect the purchase and use of the technology, especially if training is required.

PRIORITIZED BARRIERS IN UGANDA

- Low salience of benefits and the prevalent perception that solar products are non-productive assets.
- Information asymmetry and low trust in product quality.
- Norms around what VSLA loans can be used for.
- Limited opportunities for social learning from peers due to limited ownership of (quality) solar products.
- Limited financing and credit options.

TOOL: PRIORITIZATION MATRIX

Narrow down which barriers you'd like to focus on using this *template*.

THE GOAL:

Now that you've uncovered barriers, it's time to create a short list of those you want to address in your current project.

STEPS:

1. **Gather your "Uncovering Barriers" and journey map templates.**
2. **Open your prioritization template.**
3. **Assign each barrier you have uncovered to either the structural or behavioral barrier column.**
4. **Using the template provided, plot the above barriers relative to both (1) how feasible they are for you to address and (2) the prevalence of the issue.**
    a. Feasibility: Is this something you can reasonably address, given your resources and time?
    b. Prevalence: Is the barrier something that came up time and again in interviews? Is it a sticking point to the interest/adoption/or use of solar products?
    c. Example: Solar product costs might be a common barrier (high prevalence) but not one that your team may have the means to tackle through a behavioral lens.
5. **Ideally, you'll want to address barriers that most people are dealing with and that are within your reach.**

3. Design: Create solutions that address barriers to the adoption and use of low-carbon clean energy access technologies

This section will help you answer

- *Why should I design tailored evaluations?*
- *How can I best address the barriers I uncovered?*

Before you move onto Stage 4, you should have:

- *A list of prioritized and designed solutions*
- *A completed theory of change*

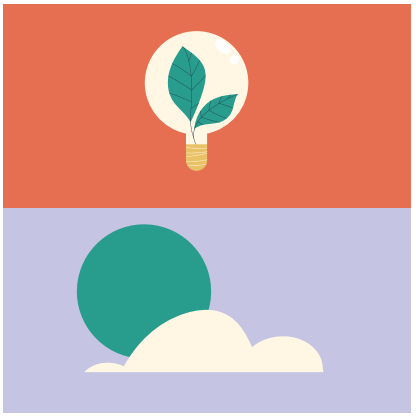
3.1 Select potential solutions

General Information

WHO SHOULD BE INVOLVED?

- A behavioral scientist to provide a behavioral lens to the development of solutions and prioritize solutions that address identified barriers.
- A research analyst to conduct literature review of potential solutions and extract and compile relevant findings.
- A project team to brainstorm solutions.

Your goal is to choose solutions that respond to the barriers you identified and prioritized in Stage 2. Your Stage 1 literature review of past behavioral solutions and past solutions implemented in your project's region will help you identify how others have tackled similar barriers, both in the area where your project is being implemented and beyond. As when you diagnosed barriers, solutions will be behavioral and structural. Brainstorming sessions between you and your team can also generate new solutions that aren't found in the literature.



BRAINSTORMED SOLUTIONS IN UGANDA

We leveraged evidence from the literature but also accounted for local contexts that were tailored to specific barriers, were creative, and drew on the team's behavioral expertise.

POTENTIAL SOLUTION	EVIDENCE
Commitment device (dedicated savings fund or box)	The cost of clean energy technologies and their associated fuels is a primary barrier to purchase. [20] Commitment devices – like savings boxes specifically for solar products – can significantly increase saving by helping people save very small amounts dedicated to that purchase. [21] Small savings collectively will build up to a down payment of a solar product.
Awareness campaign to simplify information and emphasize most valued benefits	Many residents did not value the benefits of solar products that were commonly advertised. Evidence suggests that communications should focus on the benefits most valued by customers as opposed to those valued by vendors.[22] In one study, highlighting the comfort and quality of life benefits of solar was much more successful at increasing adoption than highlighting the environmental benefits.[23]

We then checked that solutions addressed the different barriers that we identified.

	BARRIER		POTENTIAL SOLUTION(S)
Behavioral	Related to knowledge of and interest in product	Information asymmetry and low trust in product quality	• Combining information on benefits with monetary incentives • Use trusted community members as ambassadors • Provide simplified information
		Limited opportunities for social learning from peers due to limited ownership of (quality) solar products	• Transmission of messages around solar panels by respected community leaders
	Related to purchase of product	Norms around what VSLA loans can be used for	• Showcase brief videos of high- standing VSLA members talking about benefits and income-generating uses of solar products • Offer incentives or use trusted messengers to encourage VSLAs to provide loans specific to solar products
	Related to sustained use	Low salience of benefits and perception of solar products are non-productive assets	• Awareness campaign to simplify information and emphasize most valued benefits • Showcase brief videos of solar products adopters talking about benefits and productive uses of solar products like SHS
Structural	Limited financing and credit options		• Commitment devices • Role models • Goal monitoring and reminders • Offer loans and repayments over longer periods to align with financial constraints • Create pay-as-you-go systems using mobile money as alternatives to VSLAs

TOOL: SOLUTION MAPPING

Use the template for *Mapping Potential Solutions* to link potential solutions to the barriers you chose in Stage 2.

THE GOAL:

You've prioritized the most relevant barriers and the biggest burden to your desired outcome. Now, it's time to brainstorm potential solutions to help overcome those barriers, using both a literature review and by pitching in your own ideas. A few ground rules:

- Don't let perfect be the enemy of the good– to start, just focus on generating as many ideas as you can.
- Make sure everyone's voice is heard.
- Build on each other's ideas rather than tearing them apart.
- Shoot for the stars! Don't be afraid to get creative.

Reminder: Gender

Be sure to account for women's views gathered in your fieldwork during your brainstorming session. Remember, you want your solution to meet everyone's needs.

STEPS:

1. **Search for relevant solutions online.** Websites like *3ie*, *B-HUB*, *BIT*, *OPSI*, *Behavior Institute*, *IPA*, *UN Behavioral Science Group*, and *J-PAL* can give you an idea of the types of solutions that have already been implemented to tackle similar problems.
2. **Using the provided template, list potential solutions based on barriers and entry points.** This includes both solutions you've found in the literature as well as ones you've brainstormed. Which of these solutions are structural (e.g., subsidies to decrease cost) and which are behavioral (e.g., a savings box)?
3. **For each potential solution, write down the available evidence.** Where has the solution been implemented before? What was the target population? Has it been effective across contexts?
4. **Think about how your solutions can make the greatest impact.** The Behavioural Insights Team's EAST framework can help you design solutions that are easy, attractive, social, and timely. It can also help you piece apart how the solution attempts to change behavior. Does it simplify information to make solar product benefits clearer (easy) or use influential community members to increase interest in solar products (social)? What kinds of communication channels will you use?
5. **Once you've come up with several potential solutions, take a step back.** Are any solutions similar? If so, can you group them in a broad category (e.g., "reduce hassles" or "simplify information")? Once you've come up with 5-9 solutions that you're happy with, move to "Solution Prioritization."

DESIGN WITH THE END IN MIND

We'll be dedicating a whole stage of this toolkit to scaling up solutions. However, it helps to keep the end goal in mind when crafting your solution. If your intent is to eventually apply the solution to a broad population, you may want to consider this, as well as the solution's feasibility. For instance, consider:

- How cost-effective it will be to apply this solution to a lot of people;
- Whether the solution requires extensive engagement with solar product suppliers to implement;
- How burdensome (time/energy demands) the solution is on the beneficiary; and
- Whether you easily adapt the solution to a new context.

In Uganda, the team's brainstorming sessions led to the following solutions to test based on their degree of feasibility and scalability:

- An awareness campaign to simplify information and emphasize most valued benefits, and
- Commitment devices, role models, goal monitoring, and reminders.

Once you've found a range of solutions, it's time to prioritize them. Odds are, you'll probably only be able to test a few solutions, so choose wisely. Think about which solutions will have the most impact and are most realistic to implement.

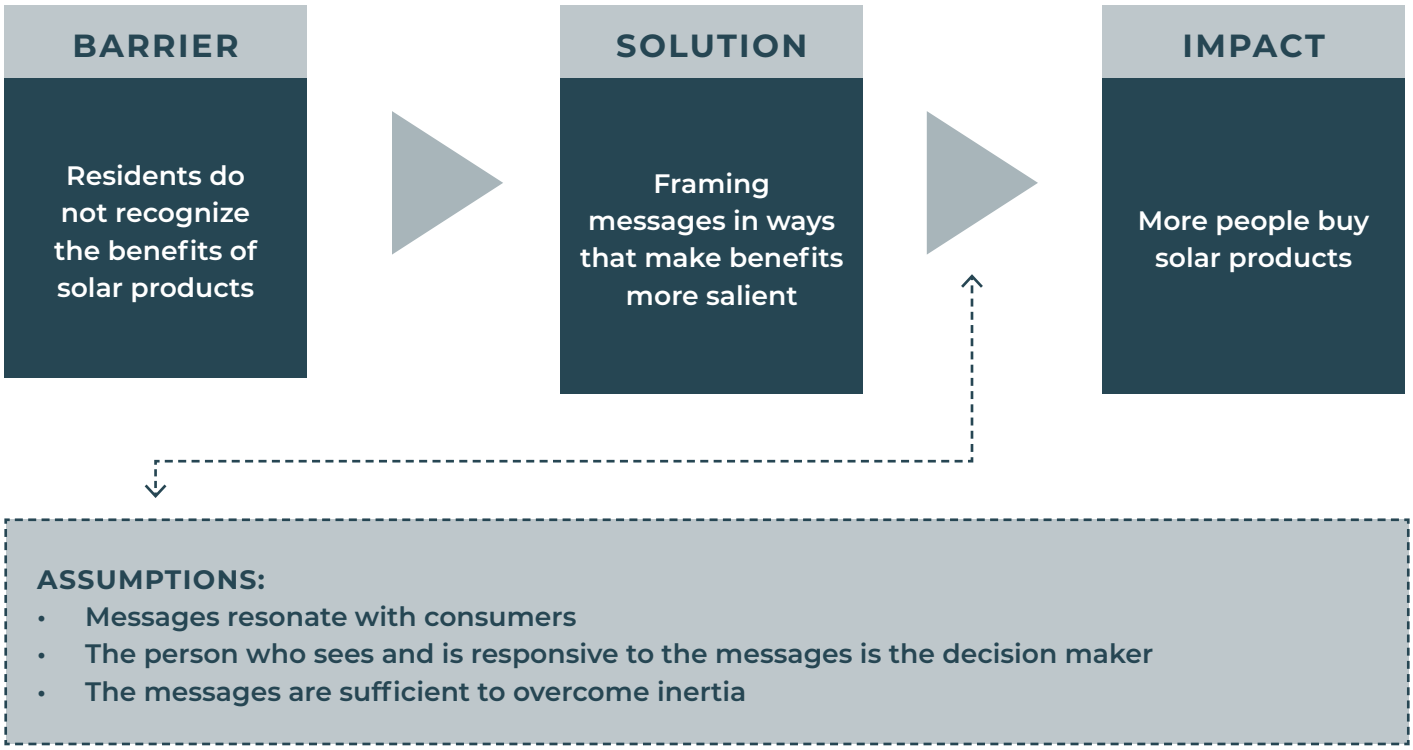
3.2 Outline assumptions

General Information

WHO SHOULD BE INVOLVED?

- Behavioral scientist: Define key behavioral assumptions that may limit solution uptake

It can be tempting to want to implement your solutions right away, but first, it's time to flesh out your theory of change. This is where you bring together your problem, your desired outcome, and your solution, and think about your assumptions. An example scenario is pictured below. You will outline our own assumptions in the Tools section.



TOOL: SOLUTION PRIORITIZATION

Narrow down which solutions you'd like to focus on using this *prioritization template*.

THE GOAL:

Once you've mapped potential solutions, it's time to develop your short list. Think critically about which solutions you can implement in the time you have and with the resources at your disposal.

STEPS:

1. **Refer to your completed "Potential Solutions Mapping" template.**
2. **Pick one solution.** Plot it on the "Potential Solutions Prioritization" template based on (1) the difficulty of implementing it and (2) its expected ability to scale.
    - Difficulty: How easy is this solution to implement (does it require a lot of logistics)? What kinds of resources would it require (material/time/money/manpower)?
    - Impact: How positively would this affect your target behavior? Is this solution likely to lead to short-term or sustained change?
3. **Repeat for each additional potential solution.**
4. **Prioritize.**
    - Which potential solutions would be very difficult and unlikely to scale? Eliminate them.
    - Which are likely to be low-cost and require limited resources, but may not be practical to scale? These are your quick wins.
    - Which are likely to be low-cost, require limited resources, and generate a high impact via scaling? These are the solutions to put at the top of your list.

- Which are likely to scale well but would take a lot of time, energy, and resources? These could be worthwhile but may not be practical for your project.

TOOL: THEORY OF CHANGE

Assess how assumptions could affect your project outcomes using the *Theory of Change template*.

THE GOAL:

Just like the standard theory of change that most development practitioners use, this theory of change will allow you to outline the activities associated with your shortlisted potential solutions and how they will help you reach your outcome of interest. In addition, thinking about your project's assumptions now will end up saving you time later.

STEPS:

1. **Write down the activities you plan to conduct and expected outputs.** Outputs are the concrete quantitative values you will achieve, such as the amount of time residents spend using traditional fuels.
2. **Write down the intermediary outcomes and impacts—the short-to-medium term effects of your solution.** For instance, if people use fewer traditional fuels for cooking, the air quality in their house will improve. Impacts are the big-picture changes you want to inspire, such as improved health from using fewer traditional fuels.
3. **Now, consider what assumptions you are making as you transition through each part of the theory of change.** For instance, bean-soaking containers must be user friendly to be effective. In addition, people must remember to use it the night before they intend to eat beans. Once you've mapped out your assumptions, you can try to design your solution in a way that addresses – or mitigates – them.

3.3 Design solution

General Information

WHO SHOULD BE INVOLVED?

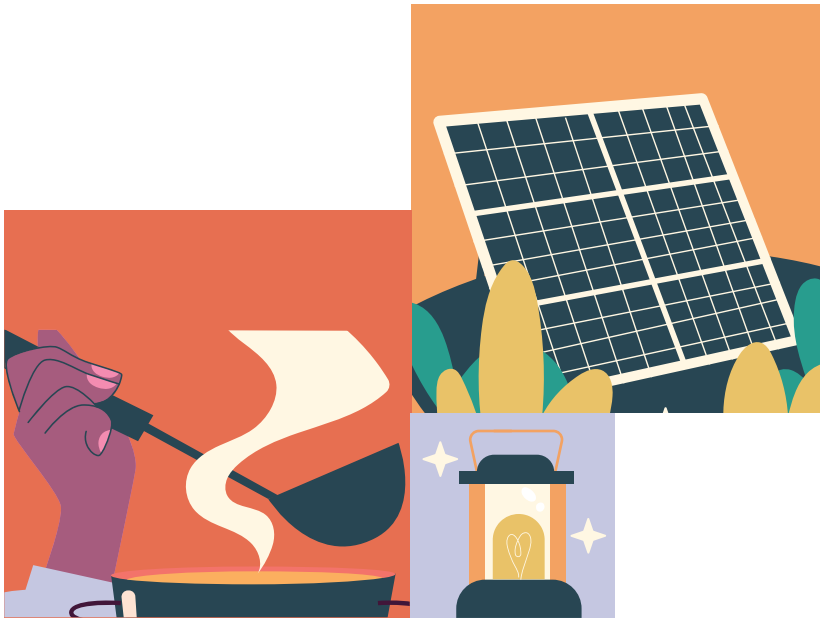
- A behavioral scientist who defines solution elements that draw on behavioral principles and are responsive to identified barriers.
- An energy subject matter expert who ensures responsiveness of solutions to clean energy needs.
- Local collaborators (e.g., village savings associations, solar product suppliers) who co-design solutions that can be feasibly implemented through partners, if applicable.

Now it's time to craft the content around the solution(s) you've selected, including how will you roll out your solution and to whom. Relevant stakeholders should be involved in and have ownership in this process. When designing solutions, we recommend using the EAST framework. That is, make your solution: **Easy, Attractive, Social, and Timely.**

Reminder: Gender

When designing your solution, ensure that it's gender inclusive. For instance, if you are designing a communications campaign, certain communications channels (e.g., television, social media, radio) may be more effective for women versus men.

In Uganda, the eMBeD team implemented solutions through VSLAs. While VSLAs can be powerful alternative financing options to increase savings, it's important to ensure that these entities promote financial inclusion for women or that you work with women's savings groups to ensure equal intervention access. Entities like SEWA Behrat in India and the Kenya Women Microfinance Bank offer solar product loans and cater exclusively to women.



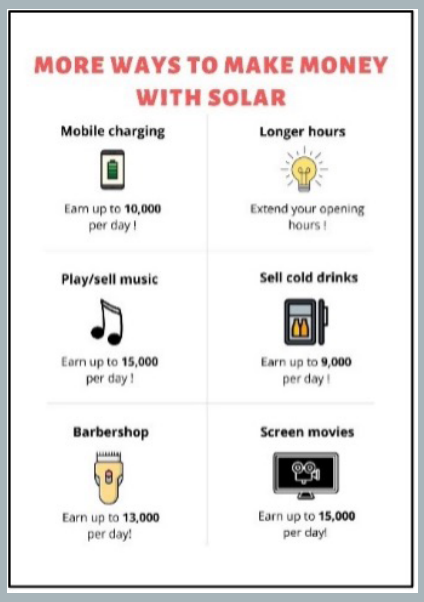
DESIGNING SOLUTIONS

When designing your solution, don't forget to keep in mind the local context and available resources. For instance, what kinds of communication channels are available and commonly used? This may differ for urban versus rural populations. In Uganda, the eM-BeD team focused on two refugee settlements, which had very different income levels and availability of public services. In turn, refugees across settlements had distinct needs that needed to be accounted for in the solution's design. Remember, poverty can create additional layers of complexity in improving access and uptake of solar products.

The WB team designed an **awareness campaign to simplify information and emphasize most valued benefits**, to be implemented through VSLAs, using the EAST framework:

SOLUTION: AWARENESS CAMPAIGN TO SIMPLIFY INFORMATION AND EMPHASIZE MOST VALUED BENEFITS

- Different flyers were designed to outline how people could (1) make money with solar—for example, by allowing their businesses to stay open later; (2) save money with solar, highlighting how they could save 10,000 shillings/month and recoup costs in six months; and (3) buy certified solar products.
- Checklists with simplified information made it **easy** for beneficiaries to understand the value of solar
- Graphics showing monetary savings and potential earnings made solar more **attractive**.



SOLUTION: GOAL MONITORING AND REMINDERS

- Worksheets were created to allow beneficiaries to set a solar-related goal, identify obstacles impeding their goal, and devise a plan to overcome stated obstacles. Goal setting made the process of saving for solar products **easy**
- An exercise was created to help beneficiaries form savings habits. The exercise was designed to map out what habits

were, how they were formed, and how beneficiaries could develop solar savings habits. Helping beneficiaries establish habits makes it **easy** to save for solar products.

- Personalized energy expenditure tracking sheets were created for beneficiaries to enumerate their energy uses and personal savings plan. These data could then inform personalized solar suggestions (i.e., types of solar products that would meet their needs). The sheets were also designed to provide feedback to beneficiaries on long-term cost savings for each recommended product. Feedback and reminders from energy tracking sheets made solar savings more **timely.**

Wish: What is your wish, a wish related to solar, that is challenging, but feasible?

Note your Wish in 3-6 words: _____

Outcome: What would be the best outcome of fulfilling your solar wish?

Note your best Outcome in 3-6 words: _____

Imagine...

Obstacle: What is your main inner obstacle that holds you back from fulfilling your solar wish?

Note your main inner Obstacle in 3-6 words: _____

Imagine...

Plan: What can you do to overcome your obstacle?

Note your action or thought in 3-6 words: _____

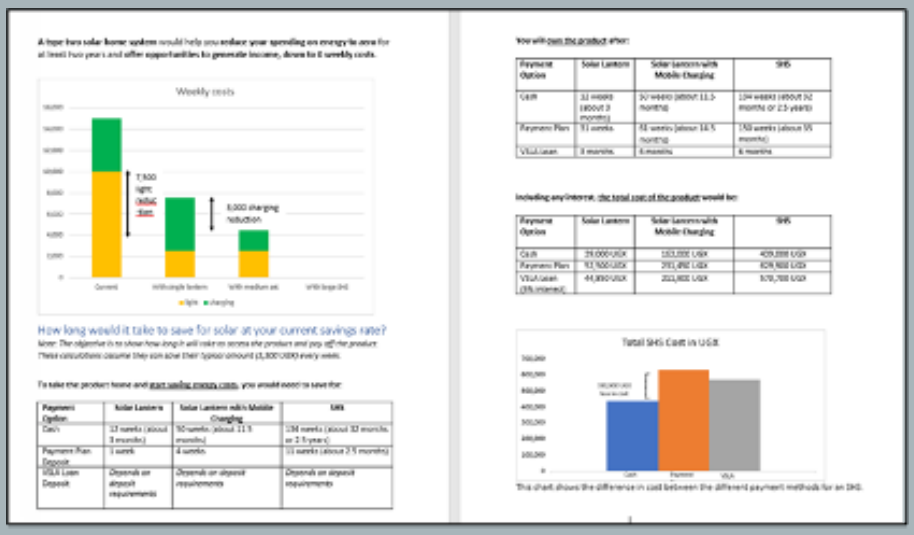
Fill in the blanks below:

If _____ then I will _____

(your obstacle) (your action or thought to overcome obstacle)

Imagine once more: If... (obstacle), then I will... (action).

You can use the WOOP card to remind you of the four steps of the WOOP exercise.



Weekly costs

How long would it take to save for solar at your current savings rate?

Total SHS Cost in UGX

SOLUTION: COMMITMENT DEVICES AND ROLE MODELS

- Videos were shown with a peer testimonial on the productive use and long-term savings for the solar product to motivate individuals to start saving for solar. Videos featuring peer role models made savings more **social.**
- Worksheets prompted beneficiaries to make a public commitment to other VSLA members of their intent to save for and purchase a solar product. Public commitments to VSLA members made purchasing solar products more **social.**

A NOTE ON ENTRY POINTS

Rather than trying to build something from the ground up, try to capitalize on what's already working. What well-performing aspects of the environment and social structure could your solution piggyback on as entry points?

The team in Uganda found that women were active in local community-based organizations and women's groups. Similarly, VSLAs offered small loans using a pooled pot of money. Their system provides an alternative to traditional financial services and, as they are already established in Uganda, could provide a more accessible alternative to help refugees save for solar products. These existing entities provided entry points for solutions. The team then brainstormed solutions that could be managed or implemented by these entities, such as disseminating information about, generating interest in, and helping people save for solar products.

4. Implement and Evaluate: Deploy your behavioral intervention and understand its impact.

This stage builds on all the subsequent phases of this toolkit. Implementing and evaluating potential solutions involve time, effort, and money, so you want to set yourself up for success. This section will help you answer

- *What tasks and challenges I will deal with during implementation?*
- *What was the impact of my intervention?*
- *What are common assessment methods?*
- *How will you know if your solution worked or was ineffective, and why?*

Before moving on to the next stage, you should have:

- *A final evaluation plan and solution design as well as a summary of your results from the implemented solution.*

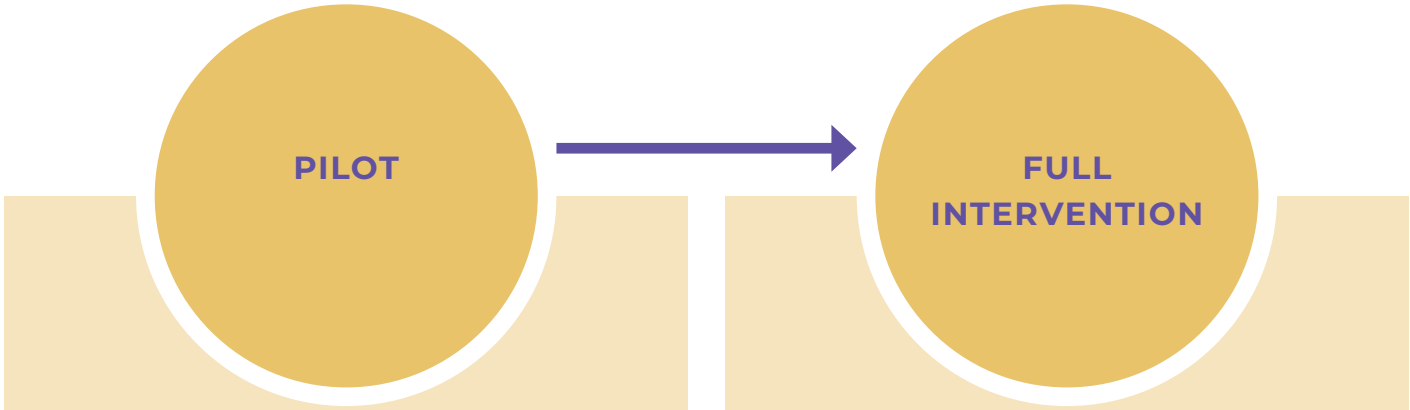
4.1 Pilot

General Information

WHO SHOULD BE INVOLVED?

- Local collaborators who support implementation of pre-pilot activities and engage participants.
- A behavioral scientist who designs pre-pilot materials and activities.
- An energy subject matter expert who defines the activity to be implemented in full.
- A fieldwork coordinator who oversees pre-pilot activities, recruitment of participants, and associated fieldwork.
- An evaluation expert who defines target participants and sampling methodology, administers surveys, and analyzes the results of the pre-pilot.

Before you run your solution on your target population, it's a good idea to do a pilot. Piloting helps test your potential solutions on a smaller but representative group over a short time. Think of it like a trial run of your interventions – you can test the solutions you've devised in a lower-risk environment. If something doesn't work or needs to be changed, pilots allow you to discover this information before a full rollout, saving you time and money. They can also help you narrow down which solutions to implement, if you are considering a large evaluation.



- Short term; small group of people
- Understand the factors to consider before a full intervention
- Gain a deeper understanding of context and barriers
- Assess viability of different interventions to overcome the identified barriers
- Test your assumptions about respondents
- Gain feedback on different versions of intervention material to understand what works best

- Longer term; large group of people
- Assess the impact of the solution(s) that worked best in the pilot

PRE-PILOTING SOLUTIONS

Using the shortlisted solutions, the eMBeD team ran several pre-pilots in Uganda. Pre-pilots are quick qualitative tests that help refine and select the content of pilots with a smaller and non-representative population. Pre-pilots include interviews and focus groups to help you understand why certain solutions were effective or not (so that you can modify these elements before piloting them).

HOW MANY PARTICIPANTS?

100 per trial

PARTICIPANT CHARACTERISTICS:

Individuals living in one of two refugee settlements

WHAT DID THE PRE-PILOT LOOK LIKE?

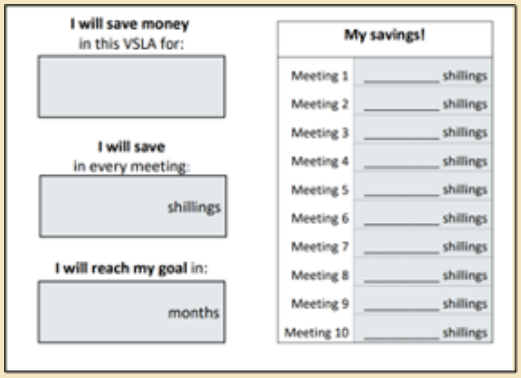
The pre-pilots tested the solutions designed at the end of Stage 3. In the first trial, informational flyers were tested to understand which was most engaging. The second trial tested the impact of videos, public commitments, habit formation exercises, and goal-setting activities to equip participants with the skillsets needed to save for solar products. The final trial provided personalized saving support in response to participants' energy-saving and spending habits.

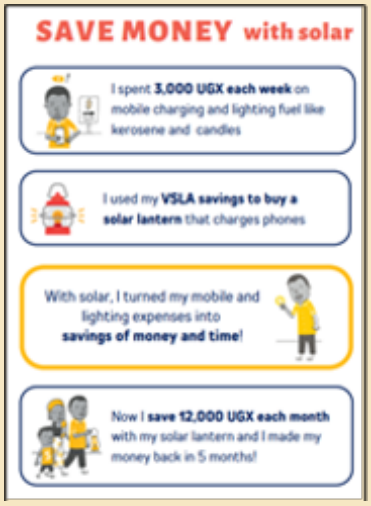
WHAT ADDITIONAL FIELDWORK WAS INVOLVED?

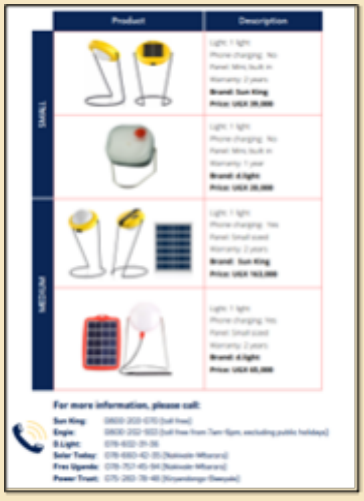
The team also used a questionnaire to assess participants' knowledge about solar benefits, local solar options, certified products, and barriers to access.

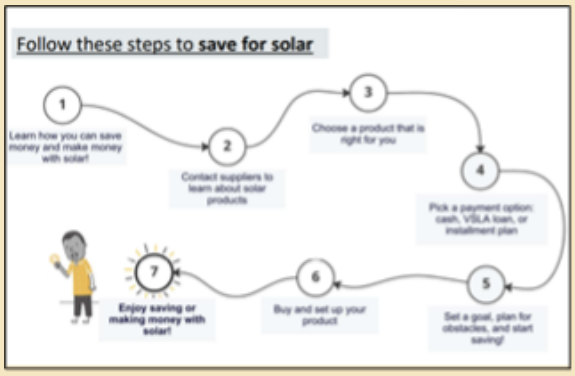
The data collected from these activities were used to refine and design the final experiment.

For instance, in response to the feedback, the team simplified informational flyers and provided more precise information on vendors selling solar products in the beneficiary's area. Further, the complexity of the third trial tested (both in terms of beneficiary involvement and human effort requirements) precluded it from being used in a full experiment, though some features were retained. The team ultimately implemented a combination of trials one and two. The final materials contained:









4.2 Define your evaluation method

General Information

WHO SHOULD BE INVOLVED?

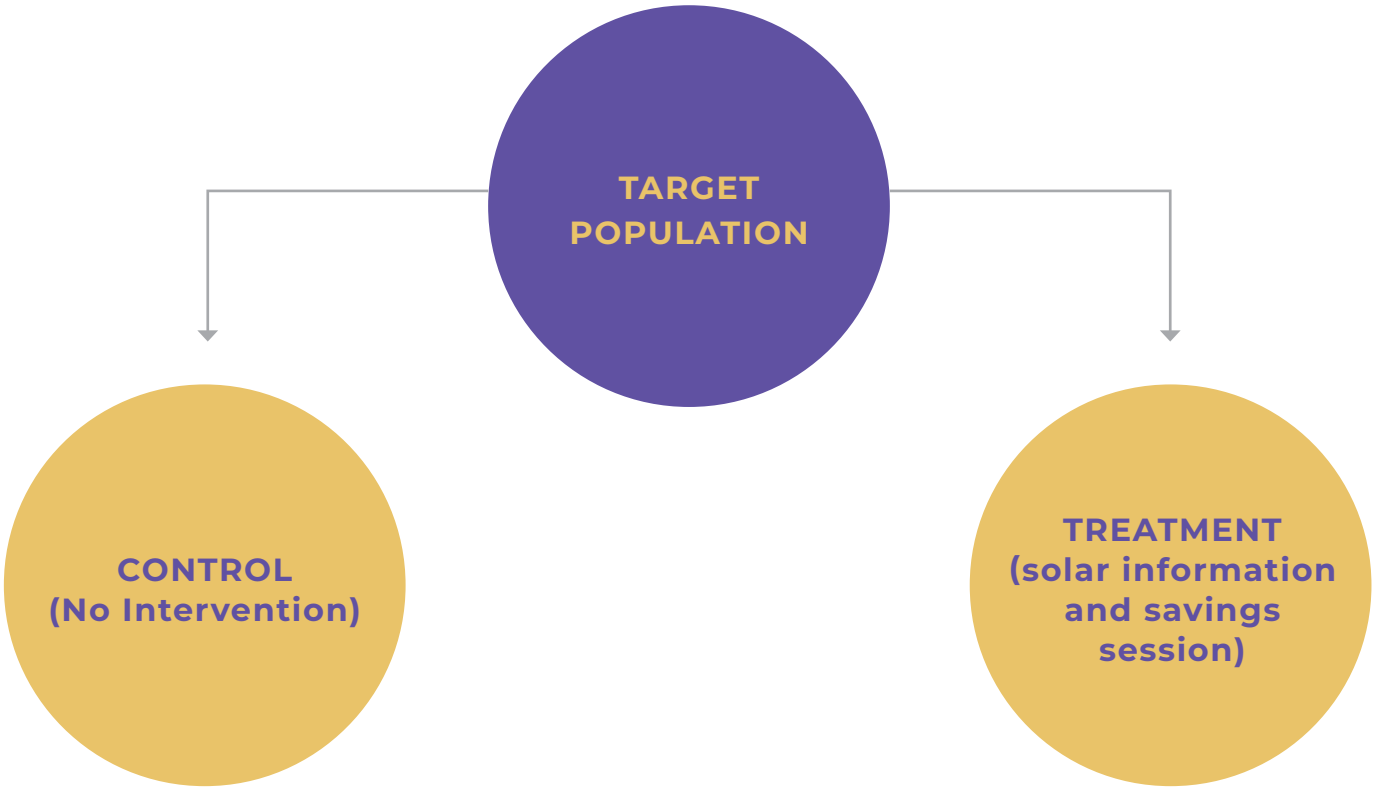
- A statistician or evaluation specialist to define the evaluation method and data needs.
- A behavioral scientist to define and design core activities to be completed within the evaluation.
- An ethics review board to review potential ethical issues within evaluation activities.

The time has come to implement your solution and understand the impact. After all, if you don't collect data after you've rolled out the intervention, how can you claim it was a success? Evaluations are designed to understand what works, for whom, and under what circumstances.

There are different types of evaluation designs, so consult with relevant stakeholders about priorities before finalizing your design. In this toolkit, we present experimental methods as the gold standard for assessing impact, but they are not the only evaluation method.

Experimental methods – used in our Uganda case study – use two or more groups that are randomly assigned (meaning participants have an equal likelihood of getting into any given study group). This type of methodology is the basis of randomized controlled trials (RCT).[24]

In an RCT, experimental groups should differ only in their exposure to the solution so that it will be clear that your experiment led to behavior changes. Split your audience into at least two groups – one that receives the intervention (the treatment group) and one that does not (a control). RCTs are most useful when your intervention produces clear, measurable results. An RCT might not be appropriate if you don't have many people on which to test the solution or have resource constraints (e.g., human capacity, expertise, costs).



A FIELD EXPERIMENT

In Uganda, we designed and conducted an RCT after testing several solutions using pre-pilots. The team chose to implement the second solution pre-piloted. In our RCT, 312 VSLAs in two refugee camps were randomly assigned to either a treatment group that received the intervention or a control group (50% each). We embedded information sessions in VSLA meetings to provide participants access to high-quality solar products. These sessions consisted of:

- Information about savings and productive benefits of solar devices.
- Practical support to identify and access high-quality (certified) solar products.
- Establishing an attainable savings goal and committing to this verbally with the support of the VSLA.

Our hypothesis was that these information sessions would increase both knowledge about and demand for solar products within the refugee communities. We measured the effect of this intervention on:

- Monetary contributions towards a solar savings goal at each VSLA meeting,
- Total amount saved for a solar product, and
- Length of time spent saving up for a solar product.

To measure changes in household behavior over time, we designed and administered ~1,000 in-person surveys to participating households both before and after the solution was tested.

If you can't run an RCT, you can opt for quasi- or non-experimental methods. Let's look at some options, keeping in mind that these methods cannot provide causality (i.e., you cannot know whether your solution caused any impact you detect):

METHOD	DESCRIPTION	EXAMPLE
Pre-post	You measure the effect of a solution on participants before and after implementation, then assess whether your solution led to an improvement.	You conduct a baseline survey (pre-test) to understand participant behaviors and attitudes toward solar products. Then you implement your solution (e.g., a radio program to provide regular and reliable information on solar products). Afterwards, you query the same group of participants to see whether the radio program influenced their knowledge and interest in solar products. If the post-test score is higher than your pre-test score, you might say your solution was responsible for this change.
Difference-in-difference	You allocate people to either a treatment or control condition. Whether individuals are exposed to the treatment and control conditions is determined by nature or by other factors outside your control. You then take baseline measurements before a solution and measure its effect after—both for the treatment group and the control group (the latter is to see what would have happened in the absence of your intervention).	You conduct a baseline survey (pre-test) given to both a treatment and control group to understand their behaviors and attitudes related to solar product knowledge and interest before your intervention. Then you implement your intervention (e.g., a radio program to provide regular and reliable information on solar products). Afterwards, you query the same group of participants to understand changes in their knowledge and interest in solar products. The difference between the change in your treatment and control groups is the impact of your intervention.
Cost-benefit analysis	You weigh the benefits of one or more solutions to see if their monetary value justifies their monetary costs. For details on aggregating cost data, see here and here.	You want to understand the costs and benefits of a radio program to provide regular and reliable information on solar products. You aggregate the costs of airtime, equipment costs, human effort costs for radio hosts, among other expenses. You then compare these against the potential benefits of the radio program—for instance, the savings of people who purchase a solar product after hearing the radio program.
Case study analysis	You detail the implementation and impact of your solution. Via interviews and surveys, you gather impressions from stakeholders (beneficiaries, service providers, community groups) to see if the solution is beneficial based on the experiences of those involved. From this, you identify factors that contributed to the success or failure of the solution.	You outline a detailed account of your implementation of a radio program to provide regular and reliable information on solar products. You are interested in evaluating the effectiveness of this radio program on beneficiary interest levels and savings rates. You note when it was unveiled, its design, the stakeholders involved, its costs, challenges faced, and its impact based on information compiled. Based on the information obtained, you provide explanations for its success or failure and opportunities for future improvements.

TOOL: EVALUATION PLAN

Use the *Evaluation Plan* template to map out what type of evaluation method you will use to understand the impact of your chosen solution.

THE GOAL:

Partition who will (or will not) receive your solution among your target population and what it will look like in practice.

Reminder: Gender

Don't forget to consider gender when constructing outcome metrics. For example, if one of your metrics is the number of households that have purchased solar products, consider disaggregating by sex of head of household. If your solution design involves a communications element, consider the resources in *Block 9 of this toolkit*

STEPS:

Decide on your evaluation method. Will it be feasible to run an RCT, or should you opt for a quasi-experimental method? Understand how many people you need to recruit using the sample size calculator here.

Decide on units of measurement. First, decide how many groups of people you need. For instance, if you are testing two solutions and want a control group, you need to create three groups. Next, decide whether you are interested in quantifying changes among individual residents or if you want to measure changes in behavior at the household level.

POTENTIAL PITFALLS

Before implementing and evaluating your project, consider these potential pitfalls:

Ethics: While behavioral science can lend value to your work, it's important to use behavioral insights responsibly. For example, in attempting to increase the sales of solar products, you could exaggerate their benefits (as a solution to all participants' problems) and fail to articulate their costs (e.g., the time and effort required to maintain them) or shortcomings (for instance, their inability to power all electrical devices). This would be an unethical way to try to change behavior.

Evaluation effects: This is a phenomenon in which people change how they behave because they know they're being watched or because of the attention paid to them. This can happen both in your treatment group (the group getting the solution) and in your control group (which does not get the solution). As an example, your solution provides households with savings boxes to set money aside for solar product down payments. While the solution is being tested, you find that households save diligently. However, as soon as it stops, savings plummet.

To mitigate evaluation effects, avoid explicitly announcing the onset of your solution testing to your target population. Make sure your staff are trained to be impartial so that they don't treat the treatment and control groups differently.

Bias: This is when only certain people are allocated to each group, leading to skewed impacts. Suppose you have three experimental groups, two treatment groups, and one control group. All high-income individuals that live in urban areas end up in the treatment groups, while low-income rural individuals end up in the control group.

To mitigate potential biases, it can help to randomly assign your population to either a treatment or a control group.

4.3 Implement solution and analyze impact

General Information

WHO SHOULD BE INVOLVED?

- A fieldwork coordinator and support staff to organize the logistics of solution implementation, address potential issues, and coordinate activities with all stakeholders.
- A data analyst or evaluation specialist to clean, import, organize, and analyze impact of solution from survey data.
- A behavioral scientist to draft questions for baseline and endline surveys, and monitor implementation.
- A data collection firm to perform data collection for baseline and endline surveys

When you implement your solution, it can help to work alongside a research institution to monitor progress and mitigate issues. These bodies will measure the technical details of your solution design and its participants, such as whether people leave the trial before it's finished. Elements to consider during implementation include:

- *Fieldwork details: Defining field protocols, designing surveys or other data collection instruments, reaching out to local partners and influential figures, designing quality control guidelines.*
- *Staffing: Training field staff and hiring companies to monitor implementation, data collection, and analysis.*

UGANDA EVALUATION ROADMAP	
Pre-pilot (413 observations)	**August 2022**
Sampling (312 VSLAs – 1,248 members)	**August-September 2022**
Baseline survey (1,057 participants)	**September-December 2022**
Solution roll-out	**March-June 2023**
Endline survey (309 VSLAs – 1,297 members)	**May-June 2023**

Now that you've implemented your solution, it's time to measure its impact. Did it increase SHS purchases? Did it decrease reliance on traditional cooking fuels? There are several basic analyses you can perform. Here are some recommended resources on the topic: ***TEST Framework***, ***DIME Wiki***

RESULTS FROM THE FIELD EXPERIMENT IN UGANDA

After the solution was implemented, participants:

- Had an increased demand for certified solar products (aspiration) (+8 pp);
- Increased their use of a solar savings goal (+32 pp) and felt more confident in their ability to foresee and overcome savings obstacles (+27 pp);
- Increased their weekly savings toward solar by 2,129.63 shillings ($0.60) per week; and
- Increased the degree to which they contacted companies about solar products (+7 pp).

After analyzing your impact, you can write up your solution and results in a report or research paper. The information you've gained will be valuable to practitioners tackling similar challenges.

5. Scale: Apply learnings to a broader audience or different issue.

This section represents the end of the pipeline, where interventions found to be efficacious in a local setting are translated for broader population-level impact. The techniques required to scale development and evaluation can be resource-intensive. This section offers an overview of the different strategies and potential challenges.

5.1 Decide on your scaling strategy

How can you increase clean energy access technology uptake further? Scaling up can mean:

a. **Increasing the reach of a solution to more people.** For example, after successfully using reminders to increase household savings for solar products, you may want to expand this solution to everyone in a village.

b. **Adapting an existing solution to a novel audience.** You now want to expand your successful reminders solution to a village in a different part of the country.

c. **Adapting an existing solution to a different behavior**. You now want to apply your successful reminder solution to increase bean-soaking practices for individuals who already own solar products.

5.2 Map out challenges

You can't assume that just because a solution worked with one group, in one context, that it will also work well elsewhere. Let's look at a few challenges that could affect your solution's scaling success.

POTENTIAL CHALLENGE	IMPACT	EXAMPLE
External validity	Solution results do not generalize to a broader population	You successfully used a VSLA to increase the amount of money residents set aside for a solar product downpayment. You decide to introduce this model to other villages in the region, to no effect.
Backfiring	When scaled up, solution results have the opposite impact	You successfully used VSLAs to increase savings for solar products. However, when scaled, fewer households save for solar products relative to pre- solution.
Loss of fidelity	The solution at scale isn't delivered as intended (as the original experiment was designed)	You attempt to scale up the VSLA loan solution to other villages. Your original solution ensured that VSLAs were comprised of mainly women, and this was a key entry point and determinant of the solution's success. However, when you scale it up, you do it with VSLAs that are mainly made up of men.

5.3 Review what to do before you scale

General Information

STAKEHOLDERS AND TEAM MEMBERS NEEDED TO IMPLEMENT THIS ACTIVITY:

- Project team: Participate in brainstorming sessions
- Behavioral scientist: Identify potential challenges and feasibility of scaling behavioral solutions
- Energy subject matter expert: Investigate the technical feasibility of scaling energy access solutions
- Government counterparts: Provide input on receptiveness to scaling
- Local collaborators: Provide input on their capacity to scale

Before you scale up your solution (and to anticipate the challenges), ask yourself the following questions:

IS THERE BUY-IN?

- It's important to consider whether your solution was truly effective before you consider scaling it up. Additionally, it matters whether your client perceives the solution to be successful (i.e., could they see visible changes?) and view it as valuable. This will help increase buy-in, making scaling up more feasible.
- The political context and support from relevant representatives are also important.

HOW SIMPLE (AND COSTLY) IS MY SOLUTION?

- This includes taking into account costs associated with training, evaluation, and the resources needed to deliver the solution to inaccessible parts of a population. If you need extensive resources (e.g., special expertise or equipment), it will be more challenging to scale.
- Lower-cost solutions are often more practical to scale.

IS THE CONTEXT SIMILAR?

- Is the context in which your solution took place similar to the context in which it will be delivered if scaled?
- If not, can you adapt your solution to the local context? Can your solution be adapted to different age groups, cultures, or geographic regions? Can you easily change the delivery method (e.g., from print to social media campaigns)? Can you adapt the solution without losing what made it successful in the first place?

DOES YOUR TEAM HAVE THE CAPACITY TO DELIVER THIS SOLUTION AT SCALE?

- Human capacity, effort, and commitment required of partners (e.g., partner organizations and government);
- Adequate financial resources and a willingness to invest; and
- Experience scaling.

Conclusion:
What next?

This last toolkit stage provides resources to help you as you implement your solution.

5.1 Hiring external parties

You may choose to outsource some responsibilities to external parties, including groups that can conduct fieldwork to uncover barriers on your behalf, execute pre-pilots, implement your solution, and analyze the data generated.

- Learn how to draft Terms of Reference to hire a private firm ***here***.
- Learn how to draft Terms of Reference to hire a consultant ***here***.

5.2 Collecting data

Data is at the heart of this toolkit. As data provides you with the requisite information to make informed decisions about your project, getting this step correct is critical. When working for public institutions, the treatment of the data is extremely important. Make sure you have a formal agreement with the institution to be able to access and manipulate their data. If the institution cannot share confidential information, you may ask the internal teams to identify each participant with a random ID to be able to link the data to one person. A second option is to agree that the public institution will perform the analysis and that the WB team will provide a protocol for them to follow.

- Learn how to design a questionnaire ***here.*** Review examples of the types of questions you may want to include in Appendix D ***here***.
- Learn how to collect data from the field ***here*** and ***here***.
- Learn how to collect data from secondary sources ***here***.

5.3 Creating a communications campaign

Communications campaigns are often a key component of any behavior change initiative. Their design can underly their success. Refer to the diagram below to help sequence a successful communications campaign relative to project activities.[25]

5.4 Disseminating results

If your results are not adequately disseminated, they can't translate into actionable changes by policymakers and others. Refer to the table below for guiding questions to ask before sharing results. For more suggestions, read ***this document.***

IS THE INFORMATION EASY TO UNDERSTAND?	ARE YOUR FINDINGS RELEVANT?	IS YOUR STORY ATTRACTIVE?
Simplify. Can you simplify complex statistics or outcomes? Can you eliminate jargon?	Define applicability. Are you disseminating your results to those who can use it?	Justify. Do you provide convincing results to back up your claims?
Declutter. Can you use pictures or graphs instead of long blocks of text?	Tangibility. Can you point to results that decision makers can see for themselves?	Tailor. Have you provided tailored suggestions for different audiences (e.g., policymakers, practitioners)?
Target. Can you circulate your results through mediums that are most accessible to decision makers?	Highlight relevance. Are your findings relevant to a salient policy problem? Do you articulate this link?	Be action oriented. Can decision makers easily understand how they can use your results?

Acronyms

Ci-Dev	Carbon Initiative for Development Trust Fund
EAST	Easy, Attractive, Social, and Timely framework
eMBeD	World Bank's Mind, Behavior and Development unit
ICS	Improved Cookstoves
SHS	Solar Home Systems
VSLA	Village Savings and Loan Association
NGO	Non-Governmental Organization
RCT	Randomized Controlled Trial

Appendix: How did we implement these steps for clean cooking?

ABOUT THE CASE STUDY

The World Bank's Carbon Initiative For Development-Ci-Dev Trust Fund and the Mind, Behavior, and Development Unit (eMBeD) conducted a behavioral diagnostic in Rwanda, where stove stacking was high. Stove stacking refers to the practice of households continuing to use traditional fuels even after they purchase ICS. It includes, for instance, relying on ICS for quick tasks and traditional methods for slow cooking. Stove stacking undermines the benefits of ICS distribution, perpetuates indoor air pollution, and depletes natural resources. The diagnostic aimed to uncover why people stove stacked and why they failed to become interested in, purchase, or sustainably use ICS more generally. It also sought to identify opportunities to increase cooking with ICS. And eMBeD experimented with how to decrease household reliance on traditional fuels through behavior change.

1. DEFINE

Before delving into a solution, the eMBeD team first had to understand baseline cooking practices in Rwanda.

Households are responsible for the lion's share of energy use in Rwanda;[26] they rely almost exclusively on biomass for cooking, with higher dependencies in rural areas. Though households are increasingly purchasing ICS, they remain a supplemental cooking modality. A strong fidelity to traditional fuels has kept indoor air pollution rates stubbornly high, with disproportionately adverse effects on women and girls.[27] Current biomass use also stands in the way of Rwanda's

ambition to halve the number of households relying on firewood for cooking by 2024.[28] Given the stark urban-rural divide, eMBeD focused its efforts on low-income Rwandan households in rural and peri-urban areas.

After exploring the context and holding exploratory meetings with decision makers and country counterparts, the team defined the problem related to behavior change and its policy goal.

Problem statement: Despite purchasing ICS, most households "stove-stack," combining an improved cookstove and a charcoal stove to meet daily cooking needs.

Policy goal: To improve population health through a reduction in indoor air pollution.

After the team gained a general idea of the problem, they conducted a desk review to understand key stakeholders, relevant behavior change interventions, and pertinent energy policies. The desk review broadly investigated the application of behavioral insights to boost the adoption and sustainable use of more energy efficient technologies. The desk review was key to hypothesizing barriers to ICS interest, uptake, and use that the team would need in Stage 2.

The desk review uncovered the following stakeholders most pertinent to the uptake of ICS.

USERS	GOVERNMENT	SUPPLIERS	INFLUENTIAL FIGURES	DEVELOPMENT PARTNERS
Households with ICS	Department of Energy	Concessionaires	Village chiefs	Development banks
Households without ICS	Secretary of environment	Importers		Financial institutions
	Prime Minister's Office	Retailers		
		Distributors		

Despite a rising interest in clean cooking by consumers,[29] stove stacking is ubiquitous.[30] The literature suggests that, among other factors, mismatches between ICS capacity and cooking needs,[31] unreliable fuel supply, and the costs of clean fuels[32] contribute to the practice. Foods that require long cooking times are especially strong drivers of fuel stacking.[33]

Rwanda has implemented several energy policies to decrease traditional fuel use. For instance, it implemented its Biomass Energy Strategy to support the transition to low carbon energy access technologies by disseminating energy efficient cookstoves to 80% of the rural and 50% of the urban population by 2030.[34,35] eMBeD's work sought to complement the distribution of ICS by increasing household dependence on ICS as the primary cooking modality.

2. DIAGNOSE

The desk review gave the team a general idea of typical cooking practices and ICS procurement. From here, they were able to brainstorm the typical journey households take to learn about, buy, and use ICS.

Next, it was time to validate households' decision-making processes through fieldwork. The Stage 1 desk review informed the design of the instruments used. Fieldwork sought to understand the decision-making processes of households, their life contexts, and attitudes and perceptions toward adoption or sustained use of ICS. It was also designed to uncover barriers that impede progress at each stage of the journey map. To complete fieldwork, the team conducted the following types of validation in peri-urban and rural areas of Rwanda:

- Semi-structured interviews with:
  - Staff of an ICS supplier (N=10)
  - 1 charcoal seller and 2 ICS sellers in a local marketplace
  - 3 active and 2 dormant ICS customers (female household head) in a peri-urban area
  - 1 active ICS customer (female household head) in a rural area
- 1 marketplace observation in the operating area of an ICS supplier
- Focus group discussions
  - 2 mixed-gender discussions with 6 people each (one for active customers and one for dormant customers) in each peri-urban and rural area

The project team spoke with ~40 individuals in total.

The fieldwork uncovered the following five main barriers impeding households from learning about, purchasing, and using ICS. If not attended to, these barriers would work in concert to thwart ICS adoption.

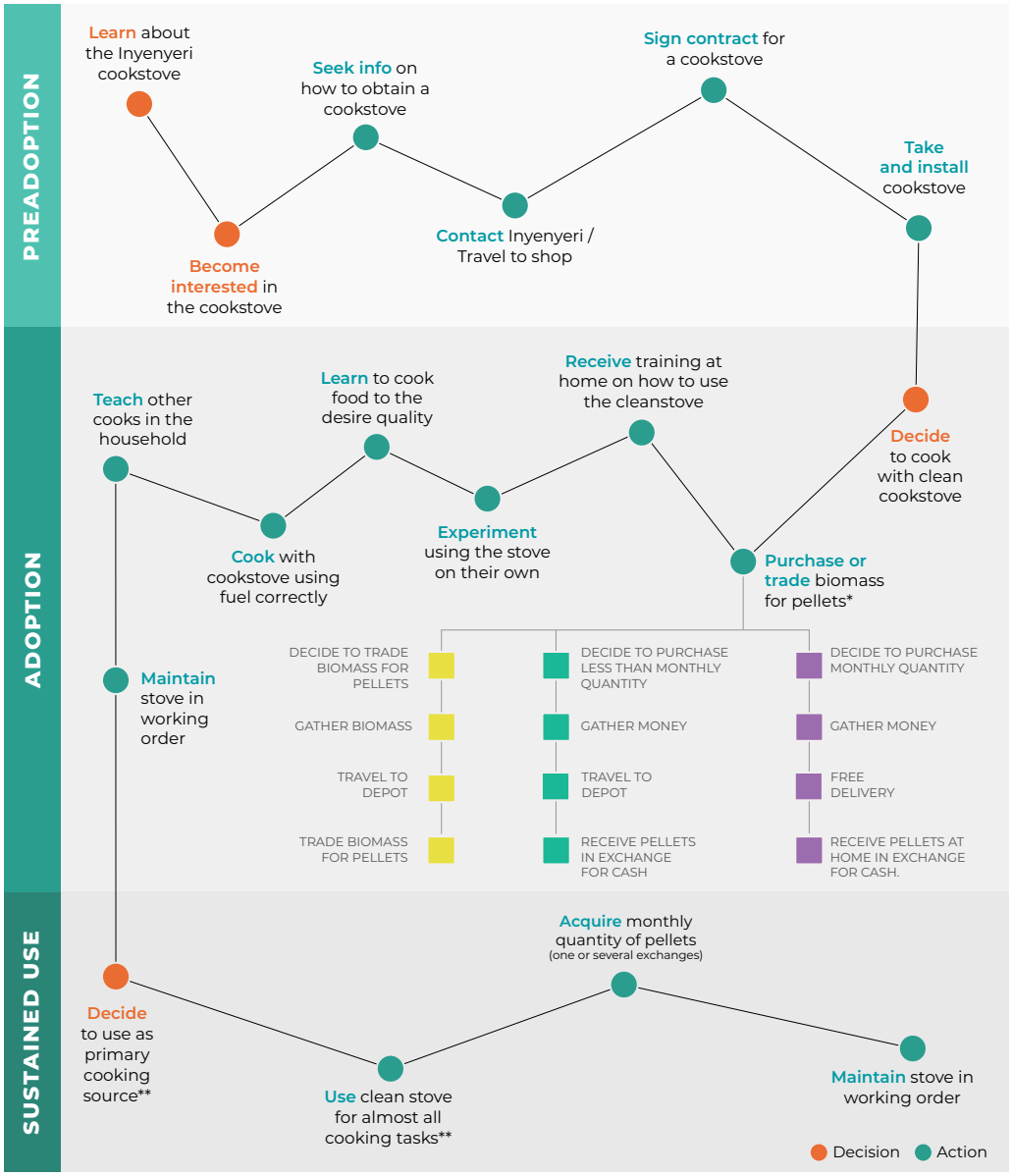
BEHAVIORAL BARRIER		EXAMPLE
Related to interest and knowledge of product	Overweighting of negative events	Due to lack of training, domestic workers have a limited ability to operate clean stoves without errors. This can reinforce or confirm negative perceptions by household heads about domestic workers' ability to operate the technology.
	Lack of confidence in domestic worker's skills to operate stove	Female household heads do not have time to train or oversee domestic workers. In the absence of such support, household heads are reticent to allow workers to use ICS and do not trust them to do so.
	Time and attention constraints	Residents often lack the time and capacity to learn how to use ICS. Traditional cooking methods require no learning curve.
Related to purchase of product	Difficulty saving	Residents may lack mechanisms that support long-term savings
Related to sustained use	Incompatible cooking norms	ICS are too small to cook for large groups of people, so residents will often use ICS in addition to traditional cooking methods.

Given the ubiquity of stove stacking, the eMBeD team decided to attempt to increase the sustained use of ICS. Despite ICS becoming increasingly common, households found it difficult to continually use them. Traditional cooking practices were a strong barrier to uptake. Many households that had an ICS continue to used traditional fuels for certain foods, like dried beans. Households with

limited time and mental bandwidth also found it difficult to undo ingrained cooking habits. To that end, eMBeD prioritized two of the above behavioral barriers:

- Incompatible cooking norms
- Time and attention constraints

Fieldwork led to the creation of a journey map, which included each and every stage someone had to take to purchase and use an ICS.



* Different non-exclusive options available, i.e., customers may rely on one or more of these options

** Requires knowing an alternative to slow cooking beanswith a charcoal stove, either:

- Soaking beans overnight
- Using a finishing container *(Neither of this approaches are currently known to customers)*

3. DESIGN

Once the team selected two behavioral barriers to prioritize, it was time to brainstorm potential solutions. A desk review provided several ideas, including the following:

POTENTIAL SOLUTION	EVIDENCE FROM THE LITERATURE
Encourage savings through role models	Research suggests that showing beneficiaries videos of peers who emphazised the importance of setting goals and working toward them and highlighting their perseverance, determination, and reliability increased beneficiaries' own aspirations.[36]
Encourage savings through soft commitment devices	Despite resource constraints, households are often able to save small sums of money. In Mexico, people who set savings goals and tracked their progress with calendars significantly increased their savings.[37]

After several brainstorming sessions, the team produced the following set of potential solutions, each targeting a specific behavioral barrier uncovered through fieldwork.

BEHAVIORAL		POTENTIAL SOLUTION(S)
Related to interest and knowledge of product	Overweighting of negative events	• Enabling stove use by domestic workers through training, demonstrations, and ICS ambassadors
	Lack of confidence in domestic worker's skills to operate stove	• Enabling stove use by domestic workers through training, demonstrations, and ICS ambassadors
	Time and attention constraints	• Trainings on income-generation benefits of ICS for selling food • Time-limited offers on ICS purchases during rainy season • Enabling stove use by domestic workers through training, demonstrations, and ICS ambassadors
Related to sustained use	Incompatible cooking norms	• Habit formation of energy efficient cooking practices

Based on the barrier selected above (incompatible cooking norms) and the feasibility and scalability of each solution, the team chose to implement the following broad type of solution:

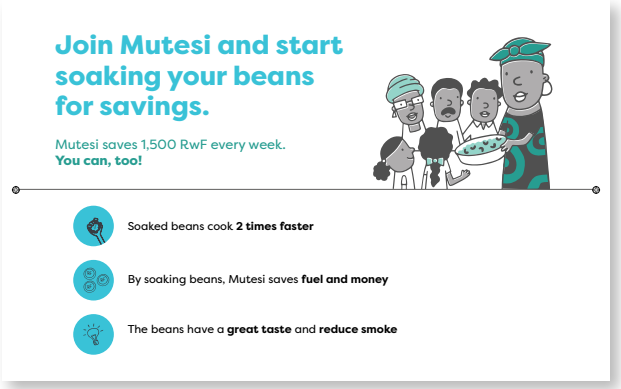
- Habit formation of energy efficient cooking practices

The eMBeD team designed several solutions around the goal to increase habit formation of energy efficient cooking practices. Because the goal of increasing energy-efficient cooking practices is broad, the team specifically narrowed it down to one specific behavior: helping households develop a habit of pre-soaking beans. Our fieldwork suggested that households were averse to bean soaking due to misconceptions that pre-soaked beans are not nutritious

or tasty. Slow-cooking beans using traditional fuels was also an expected practice and a strongly engrained habit.
The team brainstormed several design ideas pursuant to the target behavior (helping households develop a habit of pre-soaking beans). These ideas drew on the EAST framework.

Index cards containing information about the benefits of bean-soaking, as well as how to soak beans, were created. The information was framed in various ways, with environmental, health, social, and savings benefits highlighted in different iterations.

- Simplified information made bean soaking **easy**
- Emphasizing specific benefits of ICS made using them more **attractive and social**

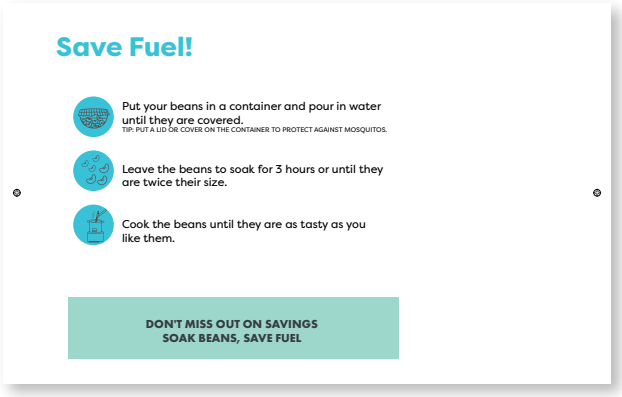


Bean-soaking container: A plastic container with a fitted lid in which to soak beans was given to participants.

- Giving households a dedicated container to soak their beans in made it **easier**

Bean-soaking demonstration: Bean soaking was demonstrated to groups of participants.

- Demonstrations took the guesswork out of the process, making it **easy.**



Video: A video featuring peers cooking with ICS was shown to participants .

- Showing participants images of their peers using ICS to cook a variety of food made the practice of cooking with ICS more **social.**

WhatsApp groups: Participants were connected through a WhatsApp group and encouraged to communicate about bean soaking by sharing pictures of their cooking and discussing their experiences.

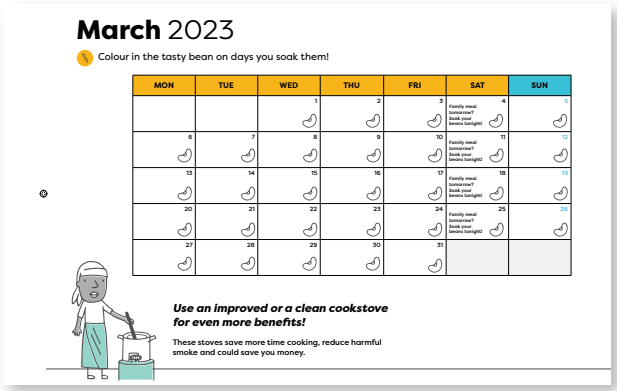
- This made the practice of bean soaking more **social.**

Pledge: Participants were asked to commit to soaking beans by signing a pledge card.

- This commitment made the practice of soaking beans more **social**

Calendar: Participants were given a calendar to hang in their kitchen and asked to use it to track bean soaking by sticking stickers on the days they soaked beans. The calendar also contained reminders about other energy-efficient cooking practices.

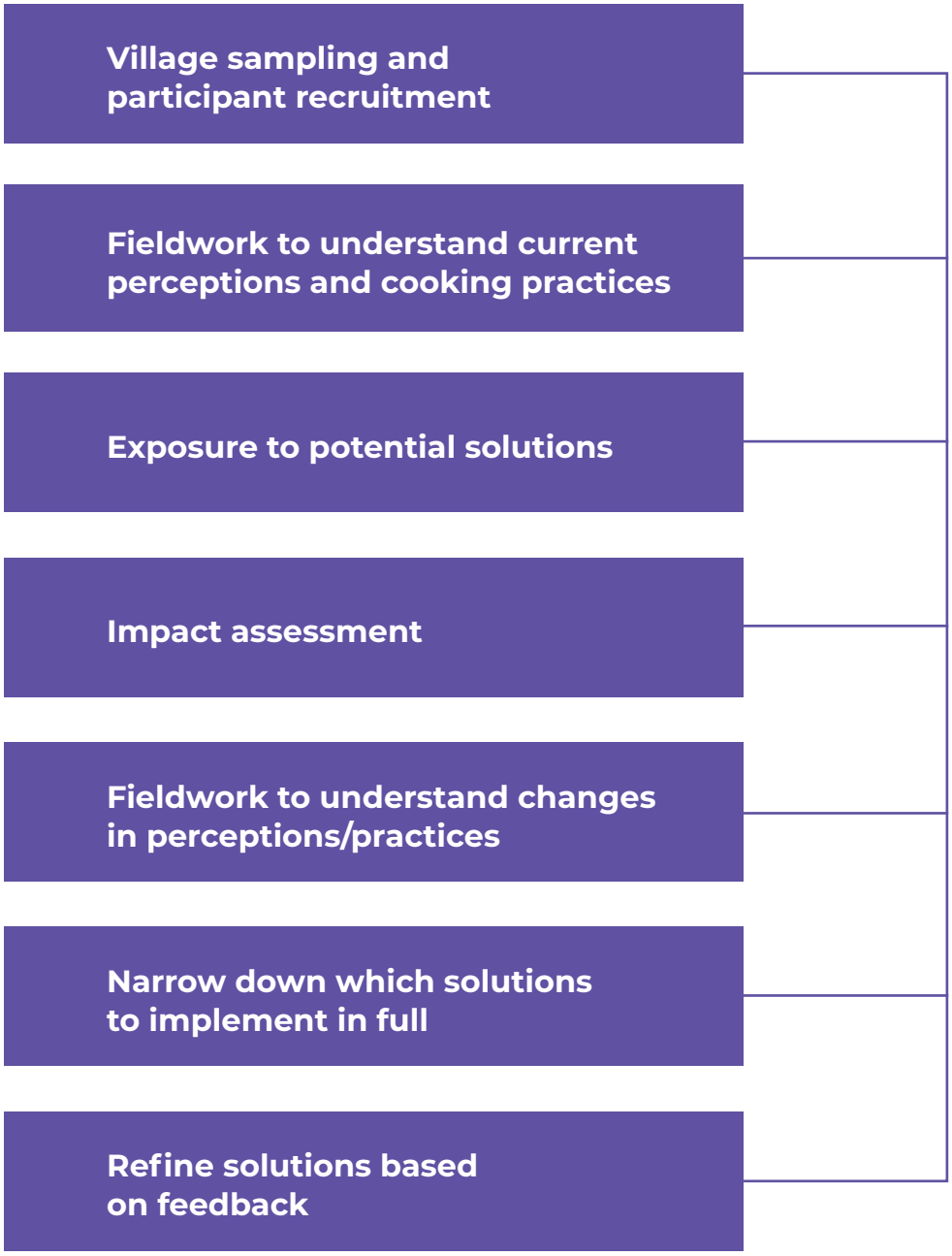
- The calendar provided a **timely** reminder to households



4. IMPLEMENT AND EVALUATE

With seven potential solutions designed, it was time to conduct pre-piloting sessions to further narrow down which solution to implement and evaluate. The pre-pilot studies were aimed at reducing charcoal use and increasing bean soaking.

Rollout of pre-pilot:



How many participants? 100 households in five villages across three districts in Kigali were selected in districts containing the highest proportion of charcoal users. Villages within districts were selected at random. Twenty participants were recruited per village.

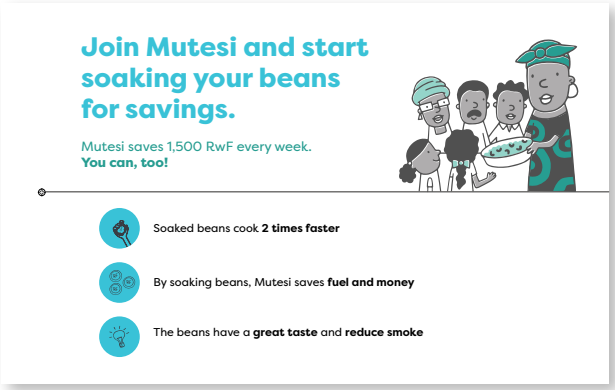
Participant characteristics: Participants had to live in a peri-urban location in Kigali, primarily use a charcoal stove to cook beans, and own a mobile phone. These were different participants from those in the full evaluation that took place later.

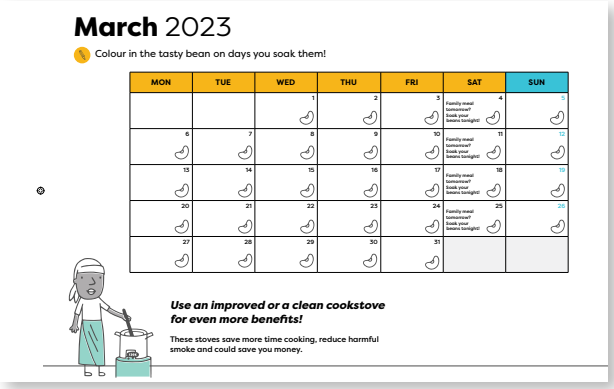
What fieldwork was involved? Pre-pilots included several types of fieldwork, which were conducted both before and after the solutions were tested.

- Focus group discussions were held to understand current cooking practices and attitudes, perceived norms, and intentions from the solution with 10 people from each village.
- In-depth interviews were conducted to understand current cooking practices and perceptions and attitudes toward the solution with five people from each village.
- The team also tested a baseline questionnaire (five people per village) to assess interview length and the degree to which people understood the questions.

What did the pre-pilot look like? Each village was exposed to combinations of two or more solutions outlined at the end of Stage 3. A follow-up study was conducted two weeks later to assess the impact of the solutions in reducing charcoal usage and promoting bean soaking.
The data collected from these activities were used to refine and design the final solution. For instance, the team needed to reduce the complexity and increase access to solutions. Based on feedback from

participants and quantitative findings, the team chose to implement the bean-soaking container intervention alongside a demonstration. As complementary components, the solution also included the index cards and calendar.





With a strong solution chosen, it was time to design the evaluation methodology. The team chose to run an RCT in the hope that they could definitively attribute any changes in beneficiaries' behaviors to the solution implemented.

Evaluation goal: Increase the use of ICS and decrease stove stacking by households through the adoption of a bean-soaking habit.

Evaluation design: RCT in which villages were randomly assigned to one of two conditions:

- Control: Business-as-usual control with no intervention
- Treatment: Cooking group tutorial

Target sample: 2,000 households in 400 peri-urban villages across 3 districts in the province of Kigali with the highest proportion of charcoal users.

Solution design: To try and establish a bean-soaking habit, beneficiaries (the primary household decision makers for cooking) received group tutorials, which included:

- Index cards summarizing the main benefits (e.g., savings, air pollution, and health) of bean soaking and encouraging households to join others that were already bean soaking.
- Group demonstrations of bean soaking to allow beneficiaries to taste pre-soaked beans prepared on an ICS.
- Discussions to ensure that beneficiaries had the right tools (e.g., containers) for soaking beans and could replicate the demonstration.
- Calendars for beneficiaries to take home to track their bean-soaking practices. Beneficiaries were asked to write a pledge to soak their beans on the calendar.

Outcomes measured:

- Fuel use and expenditure
- Time taken to cook beans the last time they were cooked
- Technology demand (ICS ownership and use as the main stove)

The above outcomes were tracked via household self-report surveys supplemented with stove use monitors (for a subset of 132 households). Household surveys were conducted both before and after the intervention in both the control and treatment groups to assess changes in cooking habits.

Here's an overview of the timeline across which the solution was implemented and evaluated

INTERVENTION ROADMAP	
Pre-pilot (100 households across 5 villages)	July 2022
Sampling (400 villages)	August-September 2022
Baseline survey (2,809 participants)	November 2022
Solution roll-out (2,000 participants)	April-June 2023
Endline survey (2,502 participants)	June-July 2023

Once the team administered the endline survey, it was time to assess the solution's impact.

The eMBeD team ran an ANCOVA analysis comparing treatment and control villages over the study period. It measured the impact of the tutorial on household fuel use and expenditure, time taken to cook beans the last time they were cooked, and technology demand (ICS ownership and use as the main stove).

Summary of results

- Bean cook time decreased by 41 minutes.
- The intervention successfully instilled a bean-soaking habit in participants (+1.41*** points on five-point Likert), with bean soaking increasing by 51 percentage points.
- Post-interventions, participants' attitudes toward savings from bean soaking significantly increased (+0.52*** points on five-point Likert).
- Participants' desire to own an ICS increased (+11-13*** pp), which is expected to increase ICS sales.

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