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# Selecting Household Water Treatment and Safe Storage (HWTS) Options

Technical Brief  
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# Technical Brief: Selecting Household Water Treatment and Safe Storage (HWTS) Options

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*This document is part of a collection of resources for learning and training about household water treatment and safe storage (HWTS). To access CAWST’s other HWTS resources, visit [cawst.org/resources](http://cawst.org/resources).*

## 1 Introduction

There are many methods used around the world for **household water treatment and safe storage (HWTS)**. Sometimes, it can seem overwhelming to identify available options and decide which ones are most appropriate for your context. As well, decision making about HWTS can take place at many levels, from central governments to independent non-profit organizations or businesses, to individual households.

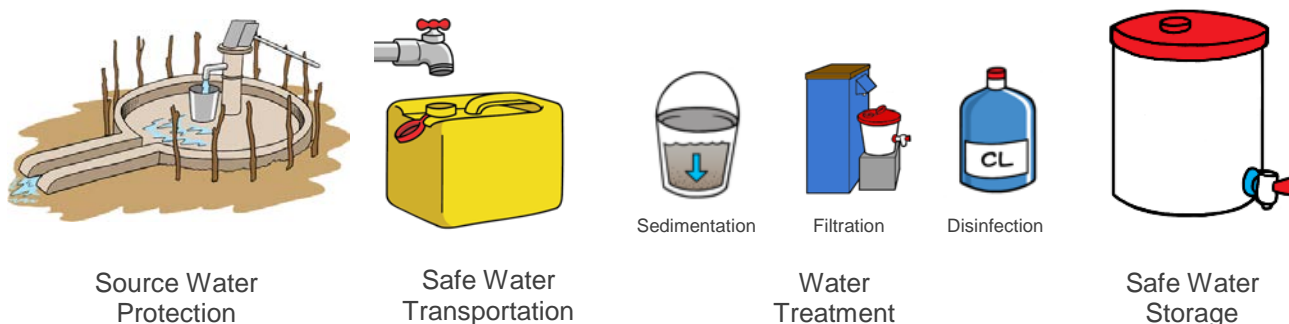
There is no perfect way to select HWTS options. There are, however, some general principles you can use to increase the likelihood of engaging meaningfully with communities to select appropriate HWTS systems that meet their needs.

In this technical brief:

- We explain why HWTS selection should take place within a multi-barrier approach to safe drinking water.
- We give some steps you can follow to identify, evaluate, and test HWTS options with your potential user groups.
- We describe criteria you can use to assess the appropriateness of different options for your context.

Key words in this document are marked in a bold font. If you are reading this on a screen, you can go to the definition of key words by clicking on them while holding the Ctrl button. If you are reading a printed copy, please refer to Section 6: Definitions.

## 2 Considering the Multi-Barrier Approach



*Multi-Barrier Approach to Safe Drinking Water*

HWTS selection should occur within a **multi-barrier approach** to safe drinking water. The multi-barrier approach uses a combination of barriers (behaviours and technologies) to:

- *Protect the water source* from contaminants – for example, by properly siting latrines, restricting animal access to the water source, and using safe waste disposal methods.

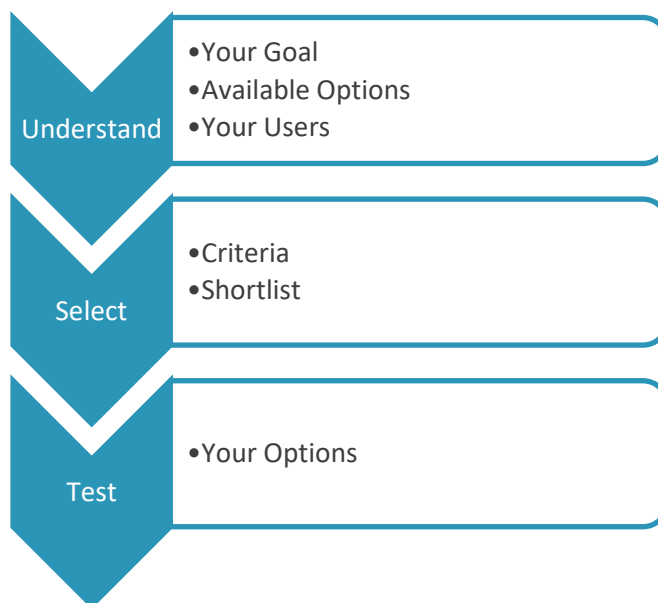
- *Transport the water safely* to the home and within the home – for example, by monitoring distribution networks, using clean containers with lids, and handling water safely every time it is transferred to a glass or another container.
- *Treat the water* to remove or inactivate contaminants – for example, by using household water treatment systems. Multiple barriers (sedimentation, filtration, and disinfection) can be applied based on the identified risks.
- *Store and handle the water safely* to prevent contamination before and after treatment – for example, by using a clean container with a lid and tap to store treated water in the household.

Instead of selecting a single technology in isolation, consider how to combine multiple barriers (behaviours and technologies) to protect drinking water all the way from the source to the user’s glass. For example, after assessing local risks to water safety and identifying your available options, you may decide to use a household water filter, followed by chlorine disinfection and the use of a safe storage container. You may also identify measures you can take to increase water safety at the source or during transportation. Adding barriers over time helps to ensure that drinking water stays safe, even if one barrier fails. Refer to *CAWST Technical Brief: The Multi-Barrier Approach to Safe Drinking Water* for examples of barriers you can use to protect and treat drinking water.

### 3 Guidelines for HWTS Option Selection

There is no perfect way to select suitable HWTS options. However, certain practices—such as engaging your users in the selection process—will increase your likelihood of selecting appropriate solutions that will be used **correctly, consistently, and continually**.

Some general steps you might want to follow are:



## 3.1 Understand your Goal, Options, and Users

### Understand your Goal

Most HWTS initiatives fit within a broader program with specific goals and objectives. Your HWTS initiative may be part of:

- A business with specific targets for profit and/or social impact.
- A public health or WASH program run by a nongovernmental or governmental organization with a defined vision or mandate.
- A community, household, or committee-led initiative with goals related to health, livelihoods, or community beautification.

It is important to understand the goals of the program/business you are working within, and the goals of the community you are serving. These broader goals will influence the criteria you use to assess available HWTS options. For example, if you are working within a business and one of your key measures of success is the profit you make from product sales, you will want to select HWTS methods that have tangible goods you can sell. If you are working with a community initiative with the goal of helping people create affordable WASH solutions using locally-available materials, your criteria for selection could be very different.

Many HWTS initiatives aim to achieve goals such as high rates of HWTS uptake, sustained use of HWTS products, improved drinking water quality, and/or improvements in health. Achieving any of these goals requires long-term behaviour change resulting in correct, consistent, and continued use of HWTS in people's homes.

### Learn about Available HWTS Options

Start by finding out which HWTS options are available in your country or region. Look at local markets, national markets, and, if necessary, consider what you can make or import. Learn about any low-tech methods of water treatment that are popular or possible in the region, such as sedimentation, boiling, filtering through cloth, or solar disinfection (SODIS). You may also want to explore combining multiple HWTS methods.

#### **How do you find local HWTS options?**

Here are some ways you can discover local HWTS options:

- Consult lists of water treatment products approved by the national bureau of standards, or equivalent agency.
- Ask national WASH sector groups about products they recommend, especially if there is a HWTS working group.
- Visit CAWST's HWTS Knowledge Base, available at: <https://www.hwts.info/>.
- Visit local markets.
- Ask individuals and households about the methods they use or have seen.
- Ask other WASH businesses and NGOs in your region about their HWTS initiatives.

## Understand your Users and their Context

First, define who your potential users are. This will depend on the scale of your initiative (for example, a few households, many households, or multiple communities), as well as the goal of your initiative (for example, reaching the most vulnerable households with safe water, reducing diarrheal disease rates in a given community, or making profit through HWTS sales).

Learn as much as you can about the people who will be using the HWTS systems. Your goal is to understand your potential users and their context so you can identify the most important criteria for their HWTS options.

You may discover that your target users represent several distinct groups with different water sources, preferences, financial resources, behaviours, or priorities. If so, try to break them into distinct groups and explore each one separately.

### What should you learn about your users?

Here are some examples of information you can learn about your potential HWTS users:

- Occupation and income
- Current WASH practices
- Current water source and treatment solutions
- Space in their home for HWTS systems
- Where they buy their household products
- What HWTS options they have tried
- What they can afford to pay or are currently paying for HWTS systems



Methods for learning about your users and their water supply systems include:

- Household visits and surveys.
- Focus groups.
- Questionnaires.
- Observations of potential risks and sources of contamination.
- Water quality testing at the water source and in users' homes. Refer to CAWST's *Drinking Water Quality Testing Manual*.

The methods you choose will depend on many factors, including geography, number of potential users, and your level of familiarity with the households. You or one of your partners should visit some households in person. You should also gain a basic understanding of the water quality at the source(s) your potential users rely on. At a minimum, it is helpful to know the **turbidity** and microbiological contaminant levels of the water source. You may also want to test for any chemicals known to be an issue in the area, such as arsenic or fluoride.

## 3.2 Select Criteria and a Shortlist of Options

### Select Criteria

Given the information you have learned about your users and their context, you can now work with them to decide which criteria are most important. Create a list of the criteria that matter most to your potential users. See Section 4 for more information about some of the most common criteria for HWTS selection. You may identify additional criteria beyond those described in this technical brief.

#### **Example of Criteria: India**

Poulos et al. (2012) provided a survey to 506 consumers in India. The survey asked consumers to make a series of decisions about which HWTS products they would prefer, given different variables. The most important criteria for survey respondents, in order of importance, were:

- Type of product (filters were preferred to other methods).
- Effectiveness of the product at removing pathogens.
- Retail outlet (department store and weekly markets were preferred).
- Time required to treat 10 litres of water.

#### **Example of Criteria: Ethiopia HWTS Selection Study**

The Water Expertise Training Centre at Ethiopia Kale Heywet Church (EKHC) conducted several household water filter trials and engaged with community members to learn about the criteria that were most important to them.

Criteria chosen by community members included:

- Temperature of the water coming from the filter (preference for cool water).
- Durability of the filter (must not be easily destroyed by rats).
- Amount of water filtered per day and flow rate (require at least 40 litres).
- Taste of water.
- Safe storage (some wanted a portable safe storage container).
- Affordability.

This informal study was conducted in 2017. For more information about the criteria and the technologies selected, contact Martha Gebeyehu, Water Expertise Training Centre Coordinator ([martha.gebeyehu1234@gmail.com](mailto:martha.gebeyehu1234@gmail.com)).

## Select a Shortlist

Now you know which technologies are available and you have a list of criteria that are most important for your users. The next step is to assess the available options against the criteria. Your goal is to identify two or three HWTS systems (a shortlist of options) that meet most of the selected criteria and are most likely to meet your users' needs.

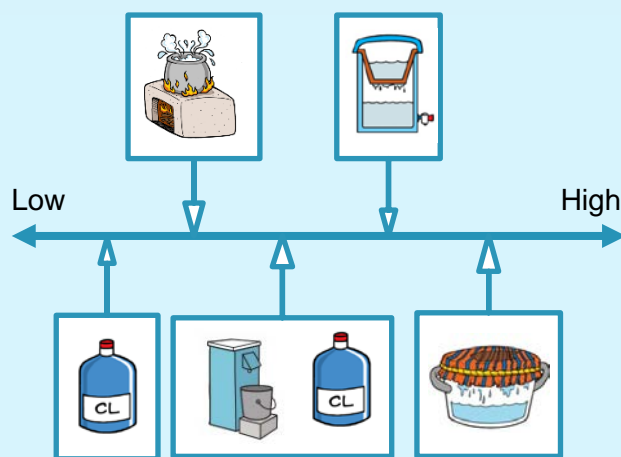
You will need to do research and collect information to assess how well different HWTS options meet your criteria. Whenever possible, look for information published by independent third-party organizations. Do not rely on information published by product manufacturers, as these may give biased reports about performance and ease of use. Here are some suggested resources you can consult:

- *CAWST Fact Sheets* and *CAWST's HWTS Knowledge Base* (<https://www.hwts.info/>) summarize important details (cost, size, treatment mechanism, maintenance requirements, and more) for a wide range of low-cost HWTS options.
- Reports from the *WHO International Scheme to Evaluate Household Water Treatment Technologies* show how well HWTS options submitted by manufacturers perform against WHO health-based guidelines. Refer to the link in "Additional Resources."
- Talk to businesses, community members, nongovernmental organizations, and government in your region. Get feedback about HWTS options they have tried, and why they were successful or not.

Again, there is no single perfect method for creating a shortlist of HWTS options. In general, you are more likely to select appropriate HWTS systems if you involve your potential users in the process. The following boxes describe participatory activities you can use to prioritize options based on your criteria.

### Activity: Ranking Lines

Make a line on the floor with tape or string for each of your priority criteria (for example, performance, ease of use, appearance). Write or draw each HWTS option on separate cards, and ask the group to order them along the lines, for example from lowest to highest performance. Repeat for each criterion, keeping track of the top three options each time.







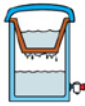


Note: the example shown is not based on a real situation and does not reflect how CAWST rates different HWTS options. Rankings will be situationally specific.



### Activity: Matrix Scoring

Create a simple matrix or table to assess how well each HWTS option meets your criteria. Draw or write the HWTS options across the top of the table as column headings, and write the criteria across the left-hand side as row headings. As a group, assign scores for how well the options meet your criteria, and then sum the scores. You will need to agree on how scores will be assigned (for example: rating from 1-5, with 5 meaning over 99% removal of all pathogen types and 1 meaning under 60% removal of at least 2 groups).

Note: the example shown is not based on a real situation and does not reflect how CAWST rates different HWTS options. Rankings will be situationally specific.

							
Pathogen removal	4	5	2	5	5	3	5
Water volume	4	4	3	3	3	3	4
Appearance	1	4	1	1	5	1	0
Portability	4	0	3	2	3	4	3
Affordability	3	2	5	4	3	3	2
<b>Total</b>	<b>18</b>	<b>15</b>	<b>14</b>	<b>15</b>	<b>19</b>	<b>14</b>	<b>14</b>

### Activity: Weighted Matrix Scoring

This is a similar method to matrix scoring. Before scoring the HWTS options, your group will assign multipliers to each criterion so that the most important criteria will have a greater impact on the final score. For example, if your group decides that “looks pretty” and “water volume” are twice as important as the other criteria, then you would multiply all values for “looks pretty” and “water volume” by 2 before you sum your final scores.

### 3.3 Test your Options and Choose the Best One(s)

#### Test the Options

You now have a shortlist with several of the most promising HWTS options. It is time to get feedback from your users. A typical process for testing options and collecting initial user feedback includes the following:

- Identify 8–15 households willing to test one of your shortlisted HWTS systems. It is ideal to have around three to five households testing each system.
- Train household members to use and maintain their HWTS systems.
- Give users several weeks to get to know their HWTS systems and practice using them on a daily basis.
- After 2–4 weeks, gather feedback from the users in focus group discussions or individual questionnaires. Visit households to observe how they used the filters, how well they are performing, and how well they fit with users' home layouts and lifestyles.

#### Select the Best Option

Use feedback from the test households to make a final decision about which HWTS system(s) you will offer to your target users. Note that you may wish to offer more than one option, especially if you have distinct groups of target users.

#### **Aqua Clara Kenya: Different Filters for Different Markets**

Aqua Clara Kenya (ACK) offers a range of WASH products to customers in urban and rural Kenya. Over time, ACK began offering different HWTS products to different markets. In rural areas, ACK markets the biosand filter. In urban and peri-urban communities, where people's water supplies and preferences are quite different, ACK offers two models of hollow fiber membrane filters. These are slightly more expensive, but better meet the criteria of peri-urban and urban customers.

For a detailed description of ACK's HWTS initiatives, read *CAWST's HWTS Case Study: Biosand and Membrane Filter Implementation by Aqua Clara Kenya*.

Now you can begin planning and implementing your HWTS initiative. Monitor user feedback carefully as you begin to increase the scale of your sales or distribution, and use information you collect to improve your approach, the system you implement, and the support you provide to users. Refer to *CAWST Technical Brief: Implementation of Household Water Treatment and Safe Storage (HWTS)*.

## 4 Criteria for HWTS Option Selection

There are many different criteria you can consider when selecting the most appropriate HWTS systems for your context. Users and implementers might prioritize these criteria differently based on their unique goals and circumstances.

In CAWST's HWTS materials, we group criteria for HWTS selection into four main categories:



### Performance

- Can the system produce an appropriate quantity and quality of drinking water?



### Ease of Use

- Are operation and maintenance requirements appropriate for the users?



### Feasibility

- Is the system practical to sell or distribute to users, given its cost, manufacturing requirements, and availability?



### Acceptability

- Does the system fit with users' expectations, norms, and preferences?

### 4.1 Performance

Performance describes how well the HWTS system works, and is a very important factor to consider. Research has shown that using a microbiologically effective HWTS system is important for the success and health impact of HWTS initiatives (Clasen, 2015; Rayner, Murray, Joseph, Branz, & Lantagne, 2016).



Criteria to assess performance include:

- **Effectiveness:** How well does the system remove or inactivate microorganisms? If another priority contaminant is a concern in your region (for example, arsenic or fluoride), how well does the system remove it?
- **Pre-treatment water quality:** What type of water can the system treat? Some HWTS systems perform best when certain conditions for pre-treatment water quality are met. For example, SODIS is most effective when water has low turbidity, and biosand filters work best when the water source has no chlorine residual.

- **Capacity:** Can the system process enough water to meet daily household needs? Depending on the technology, capacity is described through parameters such as flow rate, batch volume, and time to treat.
- **Lifespan:** How long does the system last? How long will it continue producing the required water quality and quantity?

Remember that you can combine multiple HWTS methods to increase the effectiveness of your system. You should consider your entire HWTS system when assessing its performance.

## 4.2 Ease of Use

To achieve the best possible health impacts, HWTS systems must be used correctly, consistently, and continually (Clasen, 2015). If the system is difficult to use or maintain, households will be less likely to use it on an ongoing basis. Remember that the same HWTS system may be easy for some users, and difficult for others.



Criteria to assess ease of use include:

- **Operation:** What must the households do to use the system on a daily basis? Consider who will be responsible for operating the system: women, men, children, or a mix of family members. Will the system be easy for them to use?
- **Maintenance:** How often does the system need to be maintained, and what supplies are required? Consider who will be responsible for maintenance, and what they must do to maintain the system on a regular basis. How much support and guidance will they require to know when maintenance is needed and how to do it?
- **Repair and replacement:** How frequently will the system components need to be repaired or replaced? How will users know when the system has failed and needs repair, and how will they obtain the required parts and services?

## 4.3 Feasibility

Feasibility describes how practical it is to procure or manufacture, transport, and supply the HWTS system within the local context. If the option you choose is difficult to import, manufacture, or distribute, this will affect the sustainability of your initiative.



Criteria to assess feasibility include:

- **Availability:** How easily can you find and purchase the HWTS system in your region? Is it consistently available? Remember to consider the availability of consumables and spare parts that will need to be replaced over time.
- **Cost:** How much will the HWTS system cost, for your group/organization, and for users? Is the cost reasonable? In your assessment, remember to include costs for transportation, user education, support, maintenance, and repairs.
- **Size and weight:** How big and heavy is the HWTS system? Is it feasible to transport and distribute it using local transportation methods? Is its size and weight appropriate for the users—for example, if they move often or if their homes have limited space?

- Manufacturing requirements: If you plan to manufacture the product, what facilities, expertise, and funds are required?
- Regulations: What policies, import tariffs, and other regulations could affect the feasibility of procuring and distributing this HWTS option?

## 4.4 Acceptability

Acceptability describes how well the HWTS system meets user expectations and preferences. Acceptability of a product can be highly variable within and between communities.



Like ease of use, acceptability is important for achieving correct, consistent, and continued use of HWTS. If the HWTS system does not fit users' lifestyles or meet their expectations, they will be less motivated to use it consistently. Personal preferences and social norms often strongly influence whether people adopt and sustain a new behaviour such as household water treatment.

Criteria to assess acceptability of an HWTS system for a given community include:

- Documented uptake: How common is the HWTS system in the community, region, or country? Is the technology or approach already familiar to local implementers and users?
- Taste, smell, and colour: Does the treated water meet users' expectations for how water should look, taste, and smell? Some users strongly dislike the smell and taste of chlorine, for example. Other users may dislike the "flat" taste and warm temperature of boiled water.
- User preferences: What other factors affect how users perceive the HWTS system and its benefits? For example, are users looking for a flashy, high-tech solution that will give them prestige and respect? Do they have opinions or preferences based on their experiences with HWTS options? Do they understand how the system works and believe that it is effective? Does the system conflict with cultural or religious practices and expectations?

## 5 Summary

When selecting HWTS options, consider the following principles:

- Use a multi-barrier approach to keep water safe from source to sip.
- Involve your potential users in the selection process, and take time to understand their context and preferences.
- Evaluate available options based on the criteria that are most relevant for your potential users.
- Test several HWTS systems and invite user feedback before you begin to sell or distribute products at a bigger scale.

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## 6 Definitions

**Correct, consistent, and continued use:** This describes the conditions required for HWTS systems to have the greatest health benefits for a household. Household members are less likely to have improved health from their HWTS system if they use it incorrectly, inconsistently, or only for a short period of time.

**Household water treatment and safe storage (HWTS):** Activities by which household members treat and store water in their homes. Also commonly referred to as managing water at the point-of-use (POU).

**Multi-barrier approach:** Adding as many barriers (control measures) as possible to reduce the likelihood of drinking unsafe water. Each barrier adds an incremental health risk reduction.

**Turbidity:** The “cloudiness” or “dirtiness” of water. Turbidity is caused by suspended solids, such as sand, silt, and clay, floating in water. Light reflects off the particles, making water look cloudy or dirty. Turbidity is often measured in nephelometric turbidity units (NTU).

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## 7 Additional Resources

**CAWST HWTS Knowledge Base.** Available at [www.hwts.info](http://www.hwts.info).

- A knowledge base for point-of-use water treatment solutions, from technology options to implementation best practices.

**CAWST HWTS Education and Training Materials.** Available at <https://resources.cawst.org>.

- Technical briefs, lesson plans, presentations, posters, and other resources for learning and training about HWTS.

**World Health Organization: Publications and Documents Related to Household Water Treatment and Safe Storage.** Available at: [www.who.int/water\\_sanitation\\_health/water-quality/household/household-publications/en](http://www.who.int/water_sanitation_health/water-quality/household/household-publications/en).

- Resources related to national HWTS policies, the Scheme to Evaluate Household Water Treatment Technologies, water quality guidelines, water safety planning, and more.

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## 8 References

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