RAINWATER HARVESTING (RWH) FOR YEMEN

TECHNOLOGY DESCRIPTION

TECHNICAL DESCRIPTION

Roof Rainwater Harvesting (RWH) is a sustainable, cost-effective method for collecting and conserving rainwater, particularly valuable for agriculture in arid regions like Yemen, where rainfall is limited and irregular. A typical rooftop RWH system comprises four main components:

1. Collection Surface: The rooftop acts as the catchment area for capturing rainwater.
2. Conveyance System: A network of gutters and downpipes directs rainwater to the storage system.
3. Filtration System: Filters like mesh screens, first-flush diverters, and sand or gravel filters clean the water to ensure suitability for use.
4. Storage System: Filtered water is stored in tanks, cisterns, or reservoirs to prevent loss and contamination.

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

The Technology Readiness Level (TRL) is 5-7. RWH in Yemen is in the validation and demonstration phases. This means that while the technology has been tested and validated under controlled environments or in pilot projects, it has not yet been fully deployed nationally. Some systems may be operational in specific areas, but broader, real-world implementation across Yemen is still limited. The TRL indicates there are still some technical, logistical, or infrastructure gaps preventing nationwide deployment.

Commercial Viability with a Commercial Readiness Index (CRI) of 7-8: The CRI suggests that the RWH systems are commercially viable and nearing high readiness. There is likely strong support within institutional frameworks, adequate financing channels, and high acceptance among communities, making RWH a commercially attractive solution. This high CRI indicates that, although the technology is not yet fully deployed, the foundational conditions for scaling—such as policy integration, funding support, and social acceptance—are well in place.

CLIMATE RATIONALE OF THE TECHNOLOGY

Yemen is one of the most water-stressed countries with an availability of only about 125 m^3 per person annually and has one of the lowest per capita water availabilities in the world at 75 m^3 annually, far below the international water poverty line of 500 m^3. Annual rainwater varies between 67,000 and 93,000 mcm but evapotranspiration exceeds rainfall for most of the year. Two-thirds of the country is classified as hyper-arid with less than 50 mm of rainfall per year, and most of the rest is classified as arid with less than 200 mm of rainfall. Average rainfall above 250 mm is only found in the western mountainous regions, where most of the population is concentrated, with some areas receiving more than 800 mm.

With climate change, floods and droughts are becoming more frequent and severe. Rainfall patterns are also becoming more unpredictable, and sea levels are rising. These changes not only threaten the ecosystem and livelihoods of people – particularly the poorest and most vulnerable – they also pose a major impediment to economic and social development. So, it is important to incorporate water security and climate resilience strategies into country development plans. Implementing RWH systems offers a sustainable, adaptable, and community-driven approach to enhance water security, support livelihoods, and promote environmental conservation in the face of climate change.

By capturing and utilizing the limited and irregular rainfall effectively, Yemen can mitigate the pressures on its overstressed water resources and build resilience against future climatic uncertainties.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIMELINE

The preliminary target is to support the local communities in reaching a target of storing 100,000 m^3 of rainwater per year by 2030. The local communities in the highlands depend on groundwater for their water demands and rainwater for their agricultural and livelihood activities. Therefore, it is necessary to enhance their capacity to utilize the rainwater efficiently.

AMBITION FOR TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

The ambition is a TRL 8-9: The primary ambition would be to move RWH from the current TRL 5-7 to TRL 8-9. This would signify that RWH systems are not only validated in a real-world setting but also fully operational, reliable, and standardized across Yemen.

The ambition for CRI would be to maintain or strengthen the current CRI at 7-8, aiming for CRI 9. This would represent a fully mature, commercially viable RWH sector, where systems are consistently funded, accepted, and supported by institutions and communities.

EXPECTED IMPACTS OF THE TECHNOLOGY

The implementation of a RWH system has several anticipated impacts, both environmentally socially, and economically. They are:

- To provide an alternative water source during periods of water restrictions or droughts, contributing to a more resilient water supply for communities. so, helps in managing excess rainwater, especially during heavy rainfall events.
- To reduce runoff minimizes soil erosion for maintaining soil health, preventing land degradation, and protecting aquatic ecosystems from sedimentation.
- To alleviate the pressure on municipal water supplies and groundwater aquifers.
- To reduce the extraction of water from natural sources, helps maintain the flow levels in streams, protecting aquatic habitats and biodiversity.
- To promotesa more sustainable approach to water usage, ensuring that freshwater resources are preserved for critical needs and future generations.
- To reduce the transportation of pollutants (like pesticides, fertilizers, and oils) into natural water bodies, enhancing the overall quality of local waterways.
- To empower communities, promoting self-sufficiency and encouraging local involvement in water management practices.
- Rainwater harvesting systems are cost-effective, provide quality water, lessen dependence on wells, and are easy to maintain.
- To reduce soil erosion and flood hazards by collecting rainwater and reducing the flow of stormwater to prevent urban flooding.
- To store water underground is environment-friendly; groundwater is not directly exposed to evaporation and pollution. No land is wasted for storage purposes and no population displacement occurs. Harvesting rainwater mitigates the effects of drought. Rainwater is mostly free from harmful chemicals, which makes it suitable for irrigation purposes.

- Rainwater Harvesting increases the productivity of aquifers resulting in the rise of groundwater levels and reducing the need for potable water.
- Local people can be easily trained to implement such technologies, and construction materials are usually readily available.
- Use of rainwater harvesting technology promotes self-sufficiency and has a minimal environmental impact. Rainwater harvesting and its application to achieving higher crop yields can encourage farmers to diversify their enterprises.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

Yemen faces significant water scarcity challenges due to its arid climate, overexploitation of groundwater, and infrastructure limitations. To address these issues, Yemen has established a legal and regulatory framework governing the water sector. Below are the key legislations and by-laws that regulate water resources management, usage, and conservation in Yemen:

1)The National Water Sector Strategy and Investment Program (NWSSIP 2005–2009): This strategy proposed a set of institutional, financial, and other measures, which aim at addressing discrepancies in the five sub-sectors to protect the interests of all stakeholders in the resources. The program aimed to address the following main problems in the five sub-sectors[1], water resources, water and sanitation in urban areas respectively rural areas, irrigation, environment, and human:

- ✓ The low water resources availability and groundwater overdraft;
- ✓ Vulnerability of irrigated agriculture;
- ✓ Inefficient service and inadequate coverage;
- ✓ High fiscal subsidy or water supply and sanitation in urban areas;
- ✓ Poor sustainability of water supply and sanitation in
- ✓ rural areas.

2) National Water Sector Strategy and Investment Program NWSSIP II Update (2008) for the period (2008–2015) : During the process of monitoring and evaluation of NWSSIP implementation, it was realized that some performance indicators were unattainable during the main constraints for the limited progress were the restricted implementation capacities through the utilities and lack of finance. Therefore, NWSSIP I has been updated for the period (2008–2015) to the program NWSSIP II.

Its revised goal is “to improve the Yemeni population’s sustainable and economically efficient use of the nation’s scare water resources” through the following key objectives:

- ✓ Strengthen institutions for sustainable water resources management;
- ✓ Improve community-based water resources management;
- ✓ Increase access to water supply and sanitation service;
- ✓ Increase returns to agricultural water use;
- ✓ Recover control over groundwater abstraction in critical water basins;
- ✓ Establish the WSS program as wide sector approach mechanism for implementing the investment programme of NWSSIP Update;

[1] Water resources management, urban water supply and sanitation, rural water supply and sanitation, irrigation and watershed management, human and environmental aspects

- ✓ Establish a M&E unit at MWE to ensure effective control of the NWSSIP II implementation. The M&E function has been confined to the urban sub-sector scope using the Performance Information and Indicators System (PIIS) which is still successfully in use at some LCs.

The implementation of the NWSSIP II investment program failed due to misaligned donor funding mechanisms and the limited capacity of implementing agencies. Political instability and security issues further disrupted or halted most investment efforts in recent years.

3)The Water Law No. (33) was established in 2002 as orderly legislation to prevent water resource depletion and organize the various water uses. Unfortunately, implementing this law and by-law has been interrupted due to 28 YEMEN WATER SECTOR – DAMAGE ASSESSMENT STAGE III PART 1 – RESILIENCE STRATEGY REPORT

the long period between issuing the law in 2002 and the by-law in 2009, besides other political and social aspects that needed to be considered.

4)Water Law No. (41) of December 2006 provides regulations and guidelines for efficient economic water use and its protection. It further determines the rights for the use of water resources.

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

1. Develop Financial Mechanisms: Establish subsidies, low-interest loans, or grants to support the construction and implementation of rainwater harvesting systems, particularly in rural agricultural areas where water scarcity is critical.
2. Integrate into IWRM Strategies: Incorporate rainwater harvesting technology into Integrated Water Resources Management (IWRM) strategies and plans, ensuring its alignment with national water resource policies and climate resilience goals. This integration will promote the adoption of rainwater harvesting as a sustainable solution for water management and agricultural development.

USEFUL INFORMATION

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LINKS TO TNA REPORTS

https://tech-action.unepccc.org/country/yemen/