Technology Fact Sheet

Technology fact sheet for rain water harvesting technology[i]

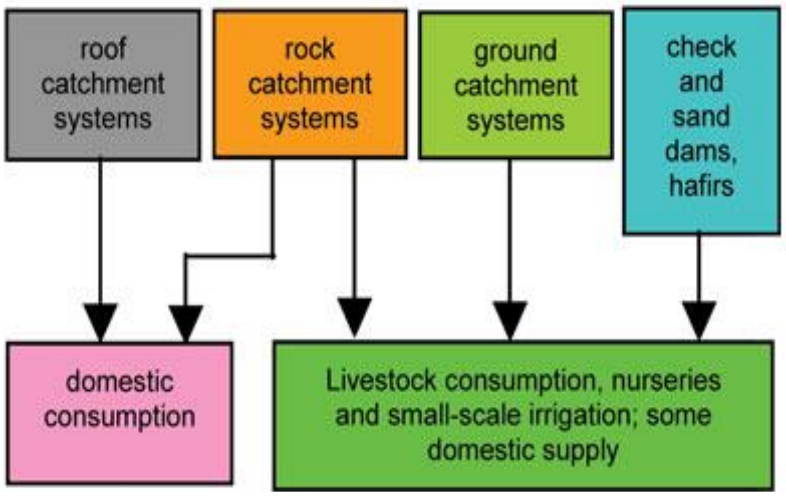
1) Introduction

Rainwater harvesting (RWH) is now back after having been ignored for decades. For arid and semi-arid regions, domestic rainwater harvesting has a proven track-record of providing water next to the house. That water has both domestic and economic uses. This fact sheet gives an overview of systems, component technology, planning and management and the potential effects and impacts.

Many families need water for animals, vegetables, crops and trees. Where groundwater and surface water sources are in short supply, rainwater may be a sustainable alternative or supplement. Roof harvesting of rain is the most common, but also other hard surface areas are used.

Rainwater harvesting can be categorized according to the type of catchment surface used, and by implication the scale of activity (Figure 1).

Figure 1 Small-scale rainwater harvesting systems and uses



2) Technical requirements

Rainfall data is required, preferably for a period of at least 10 years. The more reliable and specific the data is for the location the better the design will be. Domestic water consumption and demand varies substantially by country. Socio-economic conditions and different uses of domestic water are among the influencing factors. Where water is very scarce, people may use as little as a few litres per day. An estimate of the amount of water required for economic and productive uses should be added. In general, roof rainwater harvesting is only able to provide sufficient water for a small vegetable plot.

3) Status of technology and its future market potential

Rainwater systems can be classified according to their reliability, yielding four types of user regimes:

- Occasional - water is stored for only a few days in a small container. This is suitable when there is a uniform rainfall pattern with very few days without rain and when a reliable alternative water source is available.
- Intermittent - in situations with one long rainy season when all water demands are met by rainwater. During the dry season, water is collected from other sources.
- Partial - rainwater is used throughout the year but the 'harvest' is not sufficient for all domestic demands. For example, rainwater is used for drinking and cooking, while for other domestic uses (e.g. bathing and laundry) water from other sources is used.
- Full - for the whole year, all water for all domestic purposes comes from rainwater. In such cases, there is usually no alternative water source other than rainwater, and the available water should be well managed, with enough storage to bridge the dry period.

User regimes to be followed depends on many variables including rainfall quantity and pattern, available surface area and storage capacity, daily consumption rate, number of users, cost and affordability, and the presence of alternative water sources. The storage reservoir is usually the most expensive part of the rainwater harvesting system such that a careful design and construction is needed. The reservoir must be constructed in such a way that it is durable and watertight and the collected water does not become contaminated.

All rainwater tank designs should include as a minimum requirement:

- a solid secure cover
- a coarse inlet filter
- an overflow pipe - a manhole, sump, and drain to facilitate cleaning
- an extraction system that does not contaminate the water, e.g. a tap or pump.

Storage reservoirs for domestic rainwater harvesting are classified in two categories:

- surface or above-ground tanks, most common for roof collection, and
- sub-surface or underground tanks, common for ground catchments systems.

Materials and design for the walls of sub-surface tanks or cisterns must be able to resist the soil and soil water pressures from outside when the tank is empty. Tree roots can also damage the structure below ground. The size of the storage tank needed for a particular application is mainly determined by the amount of water available for storage (a function of roof size and local average rainfall), the amount of water likely to be used (a function of occupancy and use purpose) and the projected length of time without rain (drought period).

Rainwater harvesting is an accepted freshwater augmentation technology in many parts of the world. While the bacteriological quality of rainwater collected from ground catchments is poor, rainwater from properly maintained rooftop catchment systems, which are equipped with tight storage tanks and taps, is generally suitable for drinking and often meets the WHO drinking water standards. This water is generally of higher quality than most traditional water sources found in the developing world. Rooftop catchment of rainwater can provide a good quality water which is clean enough for drinking, as long as the rooftop is clean, impervious and made from non-toxic materials and located away from over-hanging trees.

4) Contribution of the technology to protection of the environment

Rainwater harvesting is one of the most promising alternatives for supplying water in the face of increasing water scarcity and escalating demand. The pressure on water supplies, increased environmental impact from large projects and deteriorating water quality, constrain the ability to meet the demand for freshwater from traditional sources. Rainwater harvesting presents an opportunity for the augmentation of water supplies allowing t the same time for self-reliance and sustainability.

Rainwater harvesting in urban and rural areas offers several benefits including provision of supplemental water, increasing soil moisture levels for urban greenery, increasing the groundwater table via artificial recharge, mitigating urban flooding and improving the quality of groundwater. In homes and buildings, collected rainwater can be used for irrigation, toilet flushing and laundry. With proper filtration and treatment, harvested rainwater can also be used for showering, bathing, or drinking. The major benefits of rainwater harvesting are summarised below:

- rainwater is a relatively clean and free source of water
- rainwater harvesting provides a source of water at the point where it is needed
- it is owner-operated and managed
- it is socially acceptable and environmentally responsible
- it promotes self-sufficiency and conserves water resources
- rainwater is friendly to landscape plants and gardens
- it reduces stormwater runoff and non-point source pollution
- it uses simple, flexible technologies that are easy to maintain
- offers potential cost savings especially with rising water costs
- provides safe water for human consumption after proper treatment
- is low running costs
- Its construction, operation and maintenance are not labour-intensive.

5) Climate

The rain water harvesting technologies are suitable for all climates. In many regions of the world, clean drinking water is not always available and this is only possible with tremendous investment costs and expenditure. Rainwater is a free source and relatively clean and with proper treatment it can be even used as a potable water source. Rainwater harvesting saves high-quality drinking water sources and relieves the pressure on sewers and the environment by mitigating floods, soil erosions and replenishing groundwater levels. In addition, rainwater harvesting reduces the potable water consumption and consequently, the volume of generated wastewater.

6) Financial requirements and cost

Valid data on the economic efficiency of rainwater harvesting systems is not possible. Dependent on the regional conditions (water and wastewater prices, available subsidies), the amortisation period may vary between 10 and 20 years. However, it should be taken into consideration that for the major investment (storage and pipework) a period of use of several decades is expected.

The associated costs of a rainwater harvesting system are for installation, operation and maintenance. Of the costs for installation, the reservoir as well as storage tank represents the largest investment which can vary between 30 and 45% of the total cost of the system dependent on system size. A pump, a pressure controller and fittings in addition to plumber's labour represent other major costs of the investment.

In general, a rainwater harvesting system designed as an integrated element of a new construction project is more cost-effective than retrofitting a system. This can be explained by the fact that many of the shared costs can be designed to optimise system performance and the investment can be spread over time.

7) Reference

1. DIN 1989-1. 2002. Rainwater Harvesting Systems – Part 1: Planning, Installation, Operation and Maintenance. German Institute for Standardisation, Berlin, 2002.
2. Gould, J. and Nissen-Petersen, E. (1999) Rainwater Catchment Systems for Domestic Supply: Design, construction and implementation. IT Publications, London.
3. Rainwater Harvesting Project at the Development Technology Unit of School of Engineering, University of Warwick, UK http://www.eng.warwick.ac.uk/DTU

[i] **This fact sheet has been extracted from TNA Report - Adaption for Indonesia. You can access the complete report from the TNA project website http://tech-action.org/**