

3.3 Action Plan for Technology 2: Rainwater harvesting from rooftops for drinking and household uses (RWH)

3.3.1 Description of the Technology

Rainwater harvesting from rooftops is a simple, inexpensive technology that promotes sustainable water management. This technology can be adopted as a household project or in hospitals, schools, housing complexes etc. Collected water can be used for non-potable uses or for potable supply with appropriate treatment. The technology requires a little/ or no energy because capture systems often use low-volume, non-pressurized, gravity fed systems or low power pumps. Further, it would reduce runoff that can cause surface water pollution and urban flooding. In drought-prone areas or where the surface water/groundwater is saline or polluted, rooftop rainwater harvesting is the only sustainable alternative for ensuring continued access to safe drinking water. Therefore, roof top rain water harvesting (RWH) is the best approach for communities potentially vulnerable to climate change and also for rain water conservation.

In addition to the above, this technology would provide social development, economic wellbeing and environmental sustainability as described below. Construction of rooftop rainwater harvesting systems provides employment to persons having required skills. Local people can easily be trained and mobilized to implement this technology. Construction materials are readily available and system provides water at the point of consumption, and family members have full control of their own system. The RWH technology facilitates women by providing water which is otherwise brought from distanced water sources. It reduces their physical hardship and mental stress as well as time required to fetch water from other water sources. The saved time can thus be used for other productive purposes such as domestic work, agriculture and livestock activities, and child care. Rain water harvesting from the roof tops would reduce the total volume of runoff from the roofs. Installing a rainwater harvesting system would reduce the water supply costs and also provides significant savings as a storm water management tool. Appropriately designed rainwater harvesting systems will have minimal maintenance costs associated with its upkeep and therefore will show the best long-term relationship between cost and financial benefit. Rainwater is soft, which means less detergent is used and released into the environment. Also, rainwater harvesting systems with a connected vaporization system can raise site humidity and create a healthier microclimate. This is ideal for city areas dealing with air pollution²⁴. Considering all the above facts, this technology was identified as an adaptation method for water sector for climate change.

A roof top rainwater harvesting system consists of three basic elements: Roof top - the catchment area, gutters - conveyance system, and storage tank. The effective roof area and the roof material affect the water

²⁴ LaBranche-Tucker *et al*, 2009

quality and efficiency of collection. Drain pipes, roof surfaces and the storage tank should be constructed by chemically inert, non toxic materials in order to avoid adverse effects on water quality.

3.3.2 Target for technology transfer and diffusion

The target for the technology is installation of 400 roof top rain water harvesting systems for households/schools/hospitals/suitable buildings in the dry zone, within a period of ten years. Priority will be given to areas where surface water is scarce/ polluted and ground water quality is poor. Detailed targets for technology transfer and diffusion are; Program for decision/policy makers to enable securing required funds and preparation of a strong proposal with the assistance of stake holders, to obtain additional funds from donor agencies; Improve capacities of Department of Health and NWSDB; Formulate standards/ codes/certificates for roof top rainwater harvesting systems and a scheme for annual license; Formulate a clear mechanism to prioritize sites for interventions and collect necessary data (needs, rainfall data, quality of rain water, urgency and results of climate change modeling etc); Prepare a priority list based on above data; Awareness creation on the technology as means for water conservation and a flood minimizing; Awareness creation on good operation and management practices; Technical assistance for good operation, management, and for water treatment; Installation of 300 RWH systems based on priorities identified; Based on the results of monitoring and evaluation, next 100 RWH systems will be installed from year 8 to 9, Evaluation of success in years 2,3,5,6,7,9

Overall target will be achieved by end of 2023 if the project will be commenced in 2013.

3.3.3 Barriers to the technology's diffusion

Existing overall enabling framework: Since time immemorial Sri Lanka has been using rain water for both domestic and agricultural purposes for many centuries. According to the Act No. 13 of 1992, NWSDB is vested with the responsibility of providing various services related to water supply schemes. Institutionalized rainwater harvesting became a practice in Sri Lanka in 1995, under the World Bank funded Community Water Supply and Sanitation Project (CWSSP). This project initiated the emergence of the Lanka Rainwater Harvesting Forum (LRWHF), the 1st NGO directly working towards the promotion of rainwater harvesting in the country. Later, the Southern Development Authority (SDA), Dry Zone Development Project funded by IFAD and 3rd and 4th ADB water and sanitation project also contributed in rainwater harvesting for domestic use. LRWHF has conducted demonstration projects, awareness programs and training in all districts in order to promote this technology. The National rainwater rain water policy and strategies was enacted in 2005. A

bill was gazetted in 2007, to amend the UDAL Law No 41 of 1998, to facilitate rainwater harvesting in new buildings²⁵.

Identified barriers for meeting the targets transfer and diffusion:

Eleven barriers are identified and they are classified as Economic & financial and non-financial. The barriers identified are given below. Due to aesthetic considerations, roof top harvested rainwater has no demand. Inefficient enforcement of national rainwater harvesting policy has lead to contamination of water due to no water quality monitoring.

The list of key barriers and hierarchy classification for technology 2 is given in table 3.8.

Table 3.8: List of key barriers and hierarchy classification for the technology 2

| Technology Name: Rainwater harvesting from rooftops for drinking and household uses | | | |
|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------------------------|
| No. | Key Barriers Identified | Priority Rank | Category of Barriers |
| 1. | High capital cost | 1 | Economic and financial |
| 2. | No benefit during extended dry seasons with respect to the investment | 9 | Economic and financial |
| 3. | Lack of sustainability of roof top rain water harvesting systems due to poor management practices | 2 | Technical/Institutional & organizational capacity |
| 4. | Lack of standards, codes and certification for roof top rainwater harvesting systems | 3 | Technical/Policy and legal |
| 5. | Poor understanding of importance of rain water harvesting from roof tops as a water conservation method for water scarcity due to climate change | 5 | Information and awareness |
| 6. | Poor dissemination of information on rainfall data | 11 | Information and awareness |
| 7. | Lack of prioritized areas for installation of roof top rainwater harvesting systems | 4 | Information and awareness |
| 8. | Lack of confidence in roof top rainwater harvesting technology | 7 | Social, cultural, behavioral/Information and awareness |

²⁵ Rainwater harvesting, Practioners Guide for Sri Lanka, 2009

| | | | |
|-----|-----------------------------------------------------------------------------|----|--------------------------------------------------------|
| 9. | Due to aesthetic considerations, roof top harvested rainwater has no demand | 8 | Social, cultural, behavioral/Information and awareness |
| 10. | Inefficient enforcement of national rainwater harvesting policy | 6 | Policy, legal and regulatory |
| 11. | Possibility of water contamination | 10 | Institutional and organizational capacity/ Technical |

3.3.4 Proposed Action Plans for the Technology

The Proposed Action Plan for Rainwater harvesting from rooftops for drinking and household uses is provided in table 3.9.

WATER SECTOR

Technology Action Plan for Technology 2

Table 3.9: Proposed Action Plan for the Technology 2: Rainwater Harvesting from Rooftops for Drinking and Household uses

| Action 1: Obtain additional funds and Reduce high capital cost | | | | | |
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| Justification for the action: The barrier related to this action is ' <i>High capital cost</i> '. | | | | | |
| Government has not identified this technology as a priority area, although this technology helps to solve certain negative effects of climate change. i.e. water conservation to overcome water scarcity, minimize erosion and flooding during heavy rains by diverting reasonable volumes of rainwater into storage tanks. | | | | | |
| Sub Action No | Priority Rank | Responsibility for Implementation | Time frame | Cost (US \$) & Funding Source | Indicators |
| I. Advocacy of policy makers and legislators for implementation of adaptive measures with respect to climate change | V. High | <ul style="list-style-type: none"> • M/ Water Supply & Drainage | 0-1 years | 0.01 M Domestic | (i) Awareness programs on possible socioeconomic benefits through the technology-2. (ii) Policy makers and legislators consider implementation of adaptive measures with respect to climate change as a priority area when taking policy decisions |
| II. Allocate sufficient funds from annual budget for diffusion of this technology | V. High | <ul style="list-style-type: none"> • M/ Water Supply & Drainage • M/Environment | 1-2 years | ---- | (ii) 50% increase of funding in the annual budget within the second year for diffusion of technology 2. |

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| | | and Natural Resources | | | |
| III. Mechanism for additional funding from donor agencies | V. High | <ul style="list-style-type: none"> NWSDB | 0-1 years | 5000 International | (i) Completion of three stake holder meetings. (ii) Completion of a strong proposal for obtaining grants/loans by end of year -1. |
| IV. Promote research on development of low cost, better quality roof top rainwater harvesting systems | V. High | <ul style="list-style-type: none"> Universities Research Institutes | 0 - 2 years | 0.01 M International | (i) Availability of methodology for low cost, better quality roof top rainwater harvesting systems by end of year 2. |
| V. Subsidy scheme for storage tanks to those registered with the NWSDB. | V. High | <ul style="list-style-type: none"> NWSDB INGOs, NGOs | 3-9 years | 1 M International | (i) Provide storage tanks at a subsidized rate (50 % price reduction) from year-3 to year 9. |

Action 2 : Provide potable water during extended dry seasons at subsidized rates

Justification for the action: The barrier related to this action is '*no benefit during extended dry seasons with respect to the investment*'.

Roof top rainwater harvesting system requires considerable financial commitment by the household, but the rain water collected during the rainy season may not be sufficient for extended dry seasons. Therefore it is needed to provide them potable water at subsidized rates.

| Sub Action No | Priority Rank | Responsibility for Implementation | Time frame | Cost (US \$) & Funding Source | Indicators |
|------------------------------------------------------------------|---------------|------------------------------------------------------------------------------|------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------|
| I. Provide water during extended dry seasons at subsidised rates | V. High | <ul style="list-style-type: none"> NWSDB INGOs, NGOs | 3-9 years | 10000 International | (i) Provide water during extended dry seasons at subsidized rates (50 % price reduction) from year-3 to year 9. |

| Action 3: Raising knowledge on operation and management practices of rooftop rainwater harvesting systems | | | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------|------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Justification for the action: The related barrier is ' <i>Lack of sustainability of roof top rain water harvesting systems due to poor management practices</i> '. The importance of good operation and maintenance practices is poorly understood by the community due to lack of training/guidance/ information. | | | | | |
| Sub Action No | Priority Rank | Responsibility for Implementation | Time frame | Cost (US \$) & Funding Source | Indicators |
| I. Awareness creation on good operation and management practices | High | <ul style="list-style-type: none"> • NWSDB • Lanka Rain water Harvesting Forum • Dept. of Health | 2-9 years | 3.5 M International | (i) Conduct awareness programmes annually from year-2 until end of the project. |
| III. Establish demonstration models and prepare audio-visuals on operation and maintenance of roof top rainwater harvesting systems | V. High | <ul style="list-style-type: none"> • NWSDB • Lanka Rain water Harvesting Forum | 0 -2 years | 1 M Domestic and International | By end of year 2: (i) Availability of demonstration models in the three districts selected (ii) Availability of audio-visuals on operation and maintenance of roof top rainwater harvesting systems |
| Action 4: Formulate standards, codes & certification and also annual license for roof top rainwater harvesting systems in Sri Lanka | | | | | |
| Justification for the action: The barrier is ' <i>Lack of standards, codes and certification for roof top rainwater harvesting systems</i> '. Many consumers use contaminated water and certain storage tanks have become mosquito breeding sites. There is also a possibility of using inappropriate roof materials by technology users. | | | | | |

| Sub Action No | Priority Rank | Responsibility for Implementation | Time frame | Cost (US \$) & Funding Source | Indicators |
|----------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------|------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------|
| I. Develop or formulate standards/ codes/certificates for roof top rainwater harvesting systems and a scheme for annual license. | High | <ul style="list-style-type: none"> • Urban Development Authority • NWSDB | 0-1 years | --- | (i) Availability of accepted standards for Sri Lanka for roof top rainwater harvesting systems, by end of year-1. |

Action 5 : Awareness creation on roof top rain water harvesting technology as a method for water conservation and minimizing flash flood s

Justification for the action: Barrier is *'Poor understanding of importance of rain water harvesting from roof tops as a water conservation method for water scarcity due to climate change'*.

It is necessary to address the issue of lack of/inadequate programs for dissemination of knowledge on benefit of this technology as a water conservation and flood minimizing method for climate change.

| Sub Action No | Priority Rank | Responsibility for Implementation | Time frame | Cost (US \$) & Funding Source | Indicators |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------|-------------------------------------------------------------------------------|
| I. Create awareness on this technology as water conservation and a flood minimizing technology. Include this activity under Action 3-1. | High | <ul style="list-style-type: none"> • NWSDB • Urban Development Authority • Lanka Rain water Harvesting Forum | 2- 9 years | Included under Action 3-1 | (i) See indicators under Action 3-I. |
| II. Include "rooftop rainwater harvesting technology" into G.C.E (O/L) school curriculum | High | <ul style="list-style-type: none"> • Dept of Education • National Institute | 0-1 years | --- | (i) By end of year 1, introduction of this technology in the GCE (O/L) school |

| | | of Education (NIE) | | | curriculum as a method for water conservation and minimization of flash floods. |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------|------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Action 6 : Revise data dissemination policies of Met department in order to provide free access to rainfall data | | | | | |
| Justification for the action: Barrier related to this action is ' <i>Poor accessibility for information on rainfall data</i> '. There is no free access for rainfall data for previous years. | | | | | |
| Sub Action No | Priority Rank | Responsibility for Implementation | Time frame | Cost (US \$) & Funding Source | Indicators |
| I. Revise the data dissemination policies of Meteorology department | High | Met department | 0-1 year | --- | (i) Availability of rainfall data for previous years, free of charge from end of year-1. |
| Action 7: Formulate a clear mechanism/strategy /protocol for prioritization of areas for diffusion of this technology and prepare a priority list | | | | | |
| Justification for the action: Barrier – ' <i>Lack of prioritized areas for installation of roof top rainwater harvesting systems</i> '. | | | | | |
| Sub Action No | Priority Rank | Responsibility for Implementation | Time frame | Cost (US \$) & Funding Source | Indicators |
| I. Formulate a mechanism/strategy/protocol to prepare a priority list | High | • M/ Water Supply & Drainage | 0-1years | --- | By the end of year-1: (i) Availability of a policy/strategy to prepare a priority list. |
| II. Collect data on needs, rainfall data, quality of rain water, urgency and results of Climate change modeling etc. and prepare a priority list | High | • NWSDB • CEA | 0-2 years | 0.02 M Domestic | (i) By end of year-2, availability of data on: needs, rainfall data, quality of rain water, urgency and results of Climate change |

| | | | | | |
|--------------------------------------------------------|------|---------|--------|-----|-------------------------------------------------------------------------------------------|
| | | | | | modeling etc. (ii) Availability of a priority list by end of year-1 |
| III. Provide the priority list to relevant authorities | High | • NWSDB | Year 2 | --- | Availability of a priority list at authorities handling this technology by end of year 2. |

Action 8 : Increase the confidence in roof top harvested rain water as a potable water source

Justification for the action: Barrier related to this action is '*Lack of confidence in roof top rainwater harvesting technology*'. It is necessary to implement suitable steps to convince the community that the harvested rain water can be used as potable water.

| Sub Action No | Priority Rank | Responsibility for Implementation | Time frame | Cost (US \$) & Funding Source | Indicators |
|----------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------|------------|-------------------------------------|------------------------------------------------------------------------------------------------|
| I. Provide water quality analytical services for harvested rain water at a regular basis and at a nominal rate | High | • NWSDB • Lanka rainwater harvesting forum | 3-9 Years | 1 M Domestic and International | Availability of biannual analytical reports on water quality of harvested rain water |
| II. Free monitoring service on health conditions for persons consuming harvested rain water. | High | • Dept. of Health | 2-9Years | 0.5 M Domestic and International | Availability of annual reports on health conditions of persons consuming harvested rain water. |

Action 9: Increase the demand for roof top harvested rain water

Justification for the action: '*Due to aesthetic considerations, roof top harvested rainwater has no demand*' is the barrier related to this action and awareness creation is necessary.

| Sub Action No | Priority Rank | Responsibility for Implementation | Time frame | Cost (US \$) & Funding Source | Indicators |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------|------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I Create awareness through guide books, TV programs, leaflets and posters on roof top rainwater harvesting systems and information on use of rain water harvesting systems in other countries. | High | <ul style="list-style-type: none"> NWSDB Lanka rainwater harvesting forum | 0-9 years | 1 M Domestic and International | (i) From end of year 1, availability of guide books, TV programs, leaflets and posters on roof top rainwater harvesting systems and information on use of rain water harvesting systems in other countries. |
| Action 10: Strict enforcement of national rainwater harvesting policy | | | | | |
| Justification for the action: Barrier related to this action is ' <i>Inefficient enforcement of national rainwater harvesting policy</i> '. | | | | | |
| The reason is poor involvement of Urban Development Authority, Municipal councils, and NWSDB in this regard. | | | | | |
| Sub Action No | Priority Rank | Responsibility for Implementation | Time frame | Cost (US \$) & Funding Source | Indicators |
| I. Effective enforcement of national rainwater harvesting policy. | Medium | <ul style="list-style-type: none"> UDA Municipal councils NWSDB | 0-9 years | --- | (i) Number of certificates issued per year for new buildings from year 1. |

| Action 11: Good operation and management of rainwater harvesting systems to minimize possible contamination of rain water. | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------|------------------------------------------------------------------------------------------------------|
| Justification for the action: Barrier related to this action is 'Limitations of the technology-2 due to contamination of water'. | | | | | |
| Harvested rain water contaminated with <i>E. Coli</i> is reported at certain occasions. Lack of capacity for treatment of harvested water is a barrier. | | | | | |
| Sub Action No | Priority Rank | Responsibility for Implementation | Time frame | Cost (US \$) & Funding Source | Indicators |
| I. Build capacity of Health Department and NWSDB | Medium | <ul style="list-style-type: none"> • NWSDB • M/Health | 0-1 years | 5000 Domestic | (i) By end of year 1, sufficient capacity at NWSDB and Health Department pertaining to Technology 2. |
| II. Provide Technical assistance for good operation and management, and for water treatment. | Medium | <ul style="list-style-type: none"> • NWSDB • Dept. of Health • Lanka rainwater harvesting forum | 2-9 years | 5000 Domestic Domestic | (ii) By year 2, technical assistance by NESDB and Health Department |
| Total Cost of Technology 2 | | | | | Approx: US \$ 8.07 M |

V. High = Very High