

1.2 Action Plan for Surface Run-off Water Harvesting Technology

1.2.1 About the Technology

Most precipitation that falls on human settlements is lost to the atmosphere through evapotranspiration, or runs into rivers away from settlements before it can be used. However, if the rain is collected using appropriate infrastructure, it can contribute greatly to the volume of freshwater available for human use. This is particularly relevant in arid and semi-arid regions, where the little rainfall received is usually very intense and often seasonal (Elliot et al 2011).

Surface runoff water harvesting is the collection, accumulation, and storing of storm-water for its eventual reuse. It can also include other catchment areas from manmade surfaces, such as roads, or other urban environments such as parks, gardens and playing fields. Small reservoirs with earthen bunds or embankments to contain runoff are built from soil excavated from within the reservoir to increase storage capacity and a spillway or weir allows controlled overflow when storage capacity is exceeded (Elliot et al. 2011). The reservoirs can vary in size from less than a hectare to up to 12 ha.

Surface runoff water harvesting is a good alternative to using piped drinking water. If properly designed, surface runoff catchment systems can collect large quantities of rainwater. The technology involves harnessing surface run-off from ground surfaces and directing the water into a retention earth pan (dam) for storage. Harnessing of the surface runoff involves construction of channels to direct water into the retention dam and sediment traps to reduce sediment loading into the dam. The dam is usually constructed by excavating the earth followed by impoundment and water proofing the surface either using impermeable clay soil or polythene sheets. The water can then be used directly for livestock, irrigation or for drinking, after appropriate treatment. The technology can be applied for small household dams or large communal dams. The cost of construction a surface runoff water harvesting system (including harvesting channels, sediment traps and storage dam) for serving 200 households is estimated based on expert knowledge, to cost about US\$75,000. Detailed information on the technology is presented in the technology Fact-Sheet; Annex 1.1 of the TNA Report I.

A cost-benefit analysis was done by first identifying both direct and indirect costs and benefits associated with current water sources and the implementation of the surface water runoff harvesting technology, based on establishing a surface runoff harvesting unit for supplying water to 200 families. The Net Present Value (NPV) for a 10 year period was Kshs 71,031,195 indicating that the surface water harvesting technology has large cost benefits and it is therefore viable, despite the high initial cost, which was identified as a major barrier.

1.2.2 Target for Technology transfer and Diffusion

The targets for the transfer and adoption of the surface run-off water harvesting technology for adaptation to climate change in the water resources sector are to establish 100,000 community surface run-off rainwater harvesting systems, each with a capacity of 30,000 m³ for serving two hundred households, by the year 2017. In order to achieve these targets the stakeholders and players to be involved include policy makers in the water and finance sectors, who will be responsible for formulation and implementation of relevant policies; relevant government ministries and departments including ministries of Water and Irrigation,

Agriculture, Housing and Human Settlements, whose role will be to provide technical and extension support; and manufacturers of technology components, wholesalers and retailers, technicians and experts in water and irrigation sector. The implementers will include women and youth groups at local level, who will also benefit from socioeconomic opportunities including employment; CBOs and NGOs dealing with water issues at local and national levels, who will provide technical and community sensitization and education services; and community leaders who will be key players in the transfer and diffusion of the technologies in the water sector.

1.2.3 Barriers to Technology's Diffusion

The most important financial and economic and non-financial barriers to the adoption of surface water harvesting technology in Kenya were identified as high initial cost of implementing the technology, lack or inadequate access to financial resources, inappropriate land tenure, unfavorable local geology and insufficient capacity among the local communities.

The high initial cost is associated with high cost of material and labour for the construction of harvesting channels, sediment traps and storage dam, estimated to cost US\$75,000 for a system serving 200 households. It is also associated with high cost of obtaining financing for individuals and communities since financial institutions charge interest of up to 30% on credits. Analysis of the barriers showed that the high cost of materials is as a result of high VAT (16 %) and that the high labour cost is due to lack of government subsidies through provision of mechanized equipment for dam construction. The effects of the high initial cost for surface runoff water harvesting are inadequate water for domestic use and livestock which lead to malnutrition and associated poor health for the communities. The other effect is negative impacts on gender and children education since women and children are forced to spend many hours of the day looking for water, which lead to loss of opportunities. Barrier decomposition found lack of or inadequate access to financial resources to be a sub-barrier of the high initial cost barrier.

The inappropriate land tenure barrier is associated with small land holdings by many individual households leading to lack of land for establishment of surface runoff water harvesting facility, lack of community land for establishment of community surface runoff water harvesting facilities due to allocation of available community land for other social or individual uses and also due to the location of land being inappropriate for surface runoff water harvesting. Analysis of the insufficient capacity among the local communities barrier showed that the lack of community capacity is easily complemented by availability of technical experts from relevant government departments. However, since unfavourable Local Geology barrier is a killer (non-starter) barrier, it was not analysed further.

1.2.4 Proposed Measures and Enabling Framework

The measures and enabling framework for overcoming barriers to the adoption and diffusion of surface water harvesting technology were identified through stakeholder consultation, review of relevant policy documents, expert knowledge and analysis using objective trees for each barrier according to Boldt et al. (2012). The identified economic and financial and non-financial measures and framework for overcoming the barriers to the adoption and diffusion of surface water harvesting technology are:

- (i) **VAT waiver for construction materials.** This will result in lowering of the construction cost of surface runoff water harvesting systems and hence make the initial cost of the technology low. This will be done through introduction of appropriate policy to waive VAT, currently at 16%, on materials used for implementation of run-off water harvesting systems.
- (ii) **Introduction of low interest credits.** Low interest credits will increase access to affordable financing for communities and individuals for development of surface runoff water harvesting systems. This will be done through introduction of appropriate policy to encourage lowering of interest rates by financial institutions and provision of low interest government credits.
- (iii) **Providing appropriate subsidies.** Subsidies include availing free government technical and professional services and advice, and subsidized mechanized equipment and fuel to help lower labor costs during the implementation.
- (iv) **Repossession of community land in private hands.** Through enforcement of relevant land laws, community land in private hands will be reverted back to the community and be availed for surface runoff water harvesting technology projects.
- (v) **Change of cultural values** through sensitization on the negative economic impacts of sub-division of land into small units. It will also involve introduction of appropriate land policy to discourage subdivision of land into small uneconomic units and protect community land from land grabbers.

The impact of implementing the identified measures is availability of adequate water for domestic use and livestock which will consequently result in improved women welfare and children education and improved nutrition and health for the communities. The overall results are lower poverty levels and child mortality and improved local economy.

1.2.5 Proposed Action Plans for Surface Run-off Water Harvesting Technology

The proposed action plans for surface run-off water harvesting technology include introduction of VAT Waiver on materials for construction of water harvesting systems; introduction of government subsidies on mechanized equipment and fuel; and provision of low interest rate credits to communities implementing surface run-off harvesting systems (Table 1.3). The enabling framework for these measures will involve introduction of appropriate policies in consultation with the Central Bank and Ministry of Finance. The other enabling framework are putting in place appropriate land policy to limit size of land subdivision in order to avail land for putting up the water harvesting system and to repossess community land in private hands in order to make land available for community water harvesting projects.

The projected timeframe for implementing the measures is between 0 to 10 years, with introduction of low interest credits and repossession of community land in private hands taking place within the first two years, the development and implementation of land policies for guiding land subdivision happening over a 10 year period and the implementation of the remaining measures occurring over 0-5 year period. It is estimated that the implementation of the Action Plan will cost KShs 4.05 Billions with financial measures taking the bulk of cost (Table 1.3). The main sources of funding include GoK, Private sector through corporate responsibility initiatives, developments partners (such as World Bank; DANIDA; CIDA; JICA) and contribution by the local communities.

The indicators of success include reduced VAT on material for water harvesting systems and consequent reduction on cost of materials for surface run-off water harvesting systems, availability of low interest credit and of mechanized equipment and subsidized fuel to communities and, availability of land for surface run-off water harvesting system. The risks associated with the implementation of the action plan are:

- (i) Lack of political goodwill for VAT waiver,
- (ii) Inadequate available technical and financial resources for provision of mechanized equipment and fuel subsidies,
- (iii) Lack of goodwill by the financial institutions to provide low interest rate credits,
- (iv) Resistance to change by community and high population density, whose associated pressure on land may complicate land policy implementation,
- (v) Lack of political will and Legal challenges during the repossessioning of community land.

The implementation of the Action Plan will result in wide adoption and diffusion of surface runoff water harvesting technology and lead increased water availability and associated enhanced socio-economic development, gender empowerment and lower poverty rates in the arid and semi-arid areas.

Table 1.3: Proposed Action Plans for Surface Run-off Water Harvesting Technology

| Measure | Why measure | Main Actor (s) | Time Frame (Years) | Indicative Cost (Million KSh)* | Source Funding | Indicators of success | of cators of |
|---|---|---|----------------------|--------------------------------|--|---|--|
| VAT Waiver | Currently VAT on materials stands at 16% and is a major factor contributing to high initial cost of the technology. Waiving of VAT will lead to low cost of materials which will make surface run-off water harvesting technology affordable | <ul style="list-style-type: none"> • Policy formulation (Ministry of Water & Irrigation; Ministry of Finance; Kenya Revenue Authority (KRA)) • Policy implementation (KRA; suppliers & retailers) • Technology implementation (Retailers and suppliers; Local communities) | Within first 5 years | 2000 | <ul style="list-style-type: none"> • GoK | <ul style="list-style-type: none"> • Reduced VAT on material for water harvesting systems • Reduced cost of materials for surface run-off water harvesting systems | <ul style="list-style-type: none"> • Lack of political goodwill |
| Government subsidies on mechanized equipment and fuel | In order to lower the labor costs for building a run-off harvesting system, appropriate subsidies including provision of mechanized equipment and fuel subsidies will be put in place | <ul style="list-style-type: none"> • Funds allocation (Ministry of Finance); Mechanized equipment and fuel (Ministry of Public Works) • Technical support (Ministry of Water & Irrigation; Local NGOs & CBOs) • Technology implementation (Local communities) | Within first 5 year | 500 | <ul style="list-style-type: none"> • GoK • UK/Netherlands Climate and Development Knowledge Network (CDKN) | <ul style="list-style-type: none"> • Mechanized equipment and subsidized fuel available to communities • Reduced labor costs for surface run-off water harvesting systems | <ul style="list-style-type: none"> • Inadequate available technical and financial resources |
| Introduction of low interest rate credits | Currently, interest rates on credits from local financial institutions stand at 25 to 30 % which is well above what local communities can afford. To make credit affordable appropriate policy will be put in place in consultation with the Central Bank in order to lower interest rates for credits to individuals and individuals implementing surface run-off harvesting systems | <ul style="list-style-type: none"> • Policy formulation (Ministry of Finance; Ministry of Water & Irrigation) • Policy implementation (Ministry of Finance; Ministry of Water & irrigation; Local financial institutions) • Technology implementation (Local youth and women groups and community organizations) | Within first 2 year | 1500 | <ul style="list-style-type: none"> • GoK • Private sector through corporate responsibility initiatives • GEF (Adaptation Fund); AfDB (African Development Fund) | <ul style="list-style-type: none"> • More individuals and community groups accessing credits from financial institutions | <ul style="list-style-type: none"> • Lack of goodwill by the financial institutions |

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|--|--|---|-----------------|-------------|---|--|--|
| Development of land policy on minimum land size and land consolidation | The current unlimited sub-division of land is an impediment to the adoption of surface run-off water harvesting technology. There is need to develop appropriate policy to limit size of land subdivision in order to avail land for putting up the water harvesting system. | <ul style="list-style-type: none"> • Policy formulation (Ministry of Lands & Settlements) • Policy implementation (Ministry of Lands & Settlements; County authorities) | Within 10 years | 30 | <ul style="list-style-type: none"> • GoK • EU (Global Climate Change Alliance fund) | • Land for surface run-off water harvesting system available and secured | <ul style="list-style-type: none"> • Resistance to change by community • High population density and associated pressure on land |
| Total (Million KShs) | | | | 4030 | | | |

*Indicative costs were arrived at during brainstorming sessions with stakeholders and input from various experts