

Full-paper for the 16<sup>th</sup> Waternet, 2015

## **Sub-theme: Sustainable Water Distribution and Sanitation**

### *Smart Water Solutions*

*Innovative low-cost and locally produced water technologies that reduce cost of rural communal supply and increase options for Self-supply.*

### **Keywords**

Rural water supply, Low cost technologies, Rope pump, Self-supply, Smart Water Solutions

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### **Introduction and context**

After reaching the MDG for water, the new challenge will be to reach the water related SDG which also have effect on food. Despite improvements, still 30 - 40% of the hand pumps in sub-Saharan countries are not functioning. The main challenge is how to reduce cost and make sure communities can manage maintenance and to increase access to water for productive uses. One option is to apply Smart Water Solutions (SWS). These are a range of innovative and low cost water technologies that can be produced with local skills and materials. This paper argues that a wide scale application of SWS can both reduce the cost of rural Communal water supply but also scale up the options for Self-supply at family level. The result of Self-supply will be improved health, income generation, ownership of the water point and an increased level of food security.

### **Reducing cost of Rural water points**

Smart Water Solutions can result in a reduction of the cost of rural water points. A major part of the rural water points in Africa consist of machine drilled boreholes and imported piston hand pumps that cost 5.000 to 10.000 USD per water point and deliver water to an average 250 people resulting in a per capita cost of 20-40 USD. In areas with softer soils and water

levels of less than 40 meters, the cost of water points could drastically reduce to 1500 USD or even less by using SWS such as manual drilling and Rope pumps.

### **The Rope pump**

An example of a Smart Water Solution is the Rope pump, an ancient technology that, with new materials and designs, is now a very effective pump option. There are over 110,000 Rope pumps worldwide used by an estimated 4 million people. The commercial approach started in Nicaragua in 1990 and now 70.000 Rope pumps are installed covering about 50% of the rural water supply of Nicaragua. The use of these pumps as an alternative to imported piston pumps reduced the cost of rural water points by 60%. The number of people in Zimbabwe, Tanzania, Ethiopia and other countries that have water with Rope pumps is now 2 million and is rapidly growing. Rope pumps are fit for families and small communities, can be produced with local materials and are easy to repair because of its simplicity and low cost. If properly produced, installed and maintained, they function for 15 years or more.

### **Results**

#### **The effects of Smart Water Solutions**

Nicaragua. The effect of the Rope pumps used for Self-supply is that the accumulated incomes of all families with a pump was over 100 Million US\$ in 12 years. This is due to time savings, less health related cost and productive uses.

Bolivia. Over 20.000 family wells are drilled with the EMAS or Baptist method. Total cost of a pump and a well of 10 to 40 m deep is 100 to 400 US\$.

Tanzania More than 2500 small communities and schools have water with hand drilled boreholes and a Rope pump. The shift from machine drilling to hand drilling and from imported piston pumps to locally produced Rope pumps reduced the cost of water points in southern Tanzania from 4000 US\$ to ca 1500 US\$. Some 4000 Rope pumps were sold (thus without subsidy) to private families that have hand dug wells and who use it for Self-supply. Users do the maintenance and of the some 10.000 Rope pumps installed in Tanzania since 2004, some 90% are working. Loans for a well and or a Rope pump of 200\$ to 500\$ are generally paid back in 1 year or less.

Zimbabwe. A number of 8800 Siphon filters were disseminated during the 2009 Cholera outbreak. None of the families that used the filter did have cholera. Evaluations of an EU funded project in Zimbabwe indicate that a single Rope pump provides water and food for 10 families.

Ethiopia. The Rope pump was introduced in 2005 and local governments and NGOs disseminated free pumps. Some workshops started to copy with low quality in production and installation and sales went down. In 2013 a program started to improve the Rope pump quality via training and in 2014, 10.000 pumps were ordered by a local government. The Rope pump is now part of the National policy to scale up water access with Self-supply and has become the mainstream technology for water supply.

### **Water quality**

Water quality can be improved with conventional and new Home Water Treatment (HWT). Options such as Water guard, Aguatabs or Plation which eliminate harmful bacteria. Options such as Life straw family, pot filters, Siphon or table top filters eliminate both turbidity and harmful bacteria. A one-time investment in a 20-25 US\$ water filter is often earned back in 6 months because of reduced health related cost or less fuel for boiling water. If water is contaminated with chemicals like arsenic, HWTs can be combined with low cost rainwater harvesting.

### **Water quantity**

Water quantity can be increased with storing rainwater in the ground (The 3R approach) with recharge options that cost less than 0.1 US\$ per m<sup>3</sup> or storage tanks that cost 1 bag of cement per m<sup>3</sup>. Hand dug wells or manual drilled boreholes can be combined with locally produced hand pumps with cost starting from 50 US\$ / system. With a well cover, an apron and a (locally produced) hand pump part of the over 3 million (open) wells in Africa can be upgraded to an improved water source and so count as an MDG7 water point.

### **Business development**

Options like underlining, Tube recharge, zero cement latrines etc, can (after training) be made by communities and families themselves. Options like Piston pumps, Plation and Siphon or table top water filters need to be imported. Options like pot filters, table top filters, manual well drilling, EMAS, Canzee and Rope pumps can be produced and repaired by the local private sector generating incomes and creating business and employment. At the user side; investigations indicate that a hand pump for Self-supply 'automatically' increases yearly family incomes with 100 US\$ or more due to reduced health cost, time saving and productive use.

### **Discussion:**

*If Smart Water Solutions are so good, why are they not yet widely widely?*

Some of the reasons are:

Lack of awareness. Organizations and governments often do not have updated information on new options or do not know which options are proven and therefore do not include them in development plans. It takes publicity and demonstration in real situations to make stakeholders aware of what is available and which options are adequate in their situation. There are also many wrong assumptions about 'Appropriate Technologies' being 'stone age' solutions. For example: some people remember the Rope pump from 30 years ago when it was introduced in Africa as a low lift pump only fit for families. Sometimes Rope pumps do not count for an improved water source since it is an 'open' pump and the well can be contaminated. Experiences indicate that both assumptions are incorrect.

Simple is not easy. An important condition for sustainability is repairability. Whatever technology is installed, the users should be willing and able to pay for repairs and

replacement! Options such as Rope pumps seem and are simple but ‘Simple is not easy’. In practice many errors are made in the introduction, construction and installation. In technology ‘the devil is in the detail’. For instance a small error in a bushing can cause the handle to break within two months. If it is made and maintained right, a bushing can last for 20 years as has been proven in Nicaragua.

Lack of training facilities and payment options. For scaling-up a critical mass is needed with good functioning technologies in real situations. This requires funding for start up and training. This training can be done in water Training Centres like the so called SMART Centres in Tanzania, Malawi and Mozambique that have demonstration and training capacity. Many SWS could be included in vocational training through national vocational education such as TEVET. Regarding payment; People who cannot pay in one time need payment options like small loans.

## **Conclusion**

Some of the lessons learned when introducing SWS:

- ‘Simple is not easy’. Although options like Rope pumps are simple, good quality is essential in order to ensure the lifespan of the pump
- Involvement of local private sector is essential and creates a ‘profit based sustainability’.
- Training; All SWS require professional training both on technical and non-technical aspects. These trainings can take place through a SMART Centre.

Based on the above, it can be said that, when introduced well, the Smart Water Solutions can greatly contribute to achieving the water, sanitation and food related SDGs!

## **References**

More information on Smart Water Solutions can be found in the following references:

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## Examples of Smart Water Solutions



Lining hand dug wells to avoid collapsing



Fabrication of well-reducer rings which allow the installation of pumps on wells with a large diameter



Deepening a hand dug well with the tube bailer, through inserting a filter screen at the bottom of the well. This allows wells that dry up to provide water year round.



Manual Drilling with SHIPO method. A well can be drilled for a cost of \$200 - \$1500/well. The price depends on the local geology.



Rope pump – Model 1. A hand pump that is locally produced by trained companies. The cost ranges between \$70 and \$130/pump, depending on the model. The Rope pump can pump from up to 35m of depth and is easy to maintain.



Rope pump – Pole model. The Pole model is often used for irrigation and can be mounted on any size of well.



## Examples of Smart Water Solutions (cont'd)



Wire cement water tank. Constructed from baked bricks, cement and galvanized wire. Can be used for rainwater harvesting or to store water from (hand)pumps. Cost of a tank of 2000 liters is \$40 - \$60.



Tube recharge. A low-cost way to recharge (rain)water into the soil which can lead to higher water levels in (dry) wells.



Low pressure drip irrigation. The hoses need a head of 70cm and can be directly mounted to the outlet of a Rope pump.



Household Water Treatment with a Tulip Filter. This is the Table Top model of the filter. The cost is \$14 - \$18 for a set and can filter up to 7000L.