40th WEDC International Conference, Loughborough University, UK, 2017

LOCAL ACTION WITH INTERNATIONAL COOPERATION TO IMPROVE AND SUSTAIN WATER, SANITATION AND HYGIENE SERVICES

Practical ideas to reach SDG6

Henk Holtslag, Jim Mc Gill

BRIEFING PAPER

Of the unserved for water some 80% live in rural areas (UNICEF 2015). Even if people have water from improved water sources, water becomes re-contaminated in transport or unsafe storage at home. Communal rural water supply often is a machined drilled borehole with an imported hand pump but for groups of less than 250 people, this is costly. With the limited funds and a fast growing population in Subsaharan Africa the question is, how can we reach "the last mile" - the remote and small communities, the poorest? One solution is innovation as practiced by so called SMART (Simple, Market-based, Affordable, Repairable Technologies) Centres which are WASH training centres disseminating SMARTechs like Manual drilling, locally produced hand pumps, recharge to store rainwater in the ground, low cost water filters etc. The combination of innovative technologies and the training of the private sector in local production has much potential to assist in reach the SDG6 but also SDG1 and SDG2. Based on 30 years field experiences 6 practical ideas for rural and peri urban areas.

Idea 1. Safe drinking water with HWT

Waterborne diseases can be reduced by improved Hygiene and Safe drinking water and Household Water Treatment(HWT) can make water safe to drink at the point of use. Widely used HWT options are boiling and chlorine but both have disadvantages. For instance Chlorine does not eliminate Cryptosporidium and in general has a low consistent use for several reasons. Studies indicate limited effect if treatment options are not used 100% of the time. (Brown. 2012). Options which are effective are water kiosks, chlorine dispensers and new, effective, and attractive water filters. Examples are Swach, Pureit and Kent filters in India, NAZAVA filters in Indonesia, Tunsai filters in Cambodia or Tulip filters in Ethiopia, Malawi and Tanzania. The cost of these filters range from 15-30 US$ and they make water safe to drink at a cost of 1 to 2 US$ /person / year. The logic is that if everyone ,now without safe drinking water, would treat water at the household level with a HWT option such as a water filter, the water quality problems - especially the ones caused by bacteria and viruses - would be solved.

Suggestions;

a. Awareness & marketing; Large scale campaigns on the need for hygiene, the fact that clear water can be unsafe and the need for HWT. "Seduce" families to invest in a filter, not with health arguments but with aspiration, peer pressure, and trust. (Hystra. 2012) This is the task of Governments and NGOs.

b. Supply chains; Get new products in existing or new commercial supply chains. Offer a range of attractive, proven effective and affordable treatment options so people can choose. (Heierli. 2012)

To convince families to buy a filter a novel idea is the so called Try & buy system, where familie can try a filer for a month before they buy it. This is a task for the private sector.

c. Payment options; Families who cannot pay in one time should have payment options via mobile phones, micro credits,.

d Support the poorest

Support real poor families with a one-time subsidy, programs similar to the bed nets? Give a filter to pregnant women? In general free or subsidized filters should not disturb markets but support the supply chain. One option is the use of vouchers whit which a family can get a filter in the filter shop.

d. National policies to scale up HWTS; To scale up HWTS it is essential that Government, NGOs and private sector cooperate and that there are policies in place. An example is Ethiopia and Malawi with a national strategy to drastically scale up HWTS.

Idea 2. Increase sustainability of communal rural water supply

There are some 1 million hand pumps in Africa often on a machine drilled borehole. These systems normally serve 250 people and have initial investment cost of 3.000 to 10.000US$ which in general is subsidized 90 to 100% by Governments or NGOs. Communities then need to pay for maintenance and repairs using the VLOM (Village Level Operation and Maintenance) concept. However 35% or more of the pumps / wells are not functioning because this VLOM concept often fails. This situation should and can improve for both existing and new systems.

Suggestions

a. Repair existing systems. Before repairing broken pumps ensure sustainable management. If people are not capable or not willing to pay for maintenance there is no use to repair. Maintenance models are UDUMA (Vergnet) the Blue zone (Fairwater), Prepaid systems (Practica) "circuit riders". Another option is to change from VLOM to FLOM, from village level to Family Level Operation and Maintenance. Make one family responsible for (the collection of money for) maintenance. Experiences in Mozambique are promising.

b. **Deliver service;** For communities of ?1000 people or more consider to install a piped system, in general people are prepared to pay for service, for water that is delivered at the house.

Idea 3. Reduce cost of new communal rural water supply

An estimated 60% of the rural and peri urban people in Africa live in areas where ground water levels are 35 meters or less and where the geology is such that wells can be drilled by hand. Options include Augering, Sludging, Percussion and Jetting, and new hand drilling options like SHIPO drilling can even drill through very hard layers. Hand drilled tube wells for communities cost 500-2500 US$ depending on depth, casing diameter and geology. **If made well, hand-drilled wells have the same quality as machine drilled boreholes but for the same depth cost 50 to 70% less.** (UNICEF, EW Practica, 2009). **F**rom water levels to 35 meters deep ,water can be pumped up with low-cost and locally produced hand pumps like EMAS or Rope pumps. Canzee pumps can pump from 20 m deep. Water points with hand drilled wells and locally produced hand pumps can deliver water for up to 150 people so at a cost 10-30 US$ /person, which is 2 to 3 times lower than machine drilled boreholes in similar settings. An example is Tanzania. Over the last 10 years some 3000 wells were manual drilled and equipped with Rope pumps. Compared to machine drilled wells and Afridev pumps, this combination reduced cost of rural water points from 4000 to 1500 US$ so from 40 to 15U$/capita. (around 0.25US$/ cubic meter). If well done and management is in place, these waterpoints meet the Financial, Institutional, Economical, Technical and Social sustainability criteria. (The so called FIETS criteria). This is proven by studies (Maltha 2015) and field visits in Njombe in Tanzania. Rope pumps installed in 2005 on 28 meters deep wells are delivering water to 250 people and are working well now and will still work in 10 years. This because the maintenance is simple and spares are affordable and available. Often a woman is responsible for the maintenance and gets paid something. When a new rope is needed, she collects extra money and buys the rope in Njombe. (Holtslag.2016)

Suggestions

a Awareness

Publicity on examples like Tanzania, not just on success but also on failures. There are "Simple is not easy" lessons from Rope pump projects in Ghana, Uganda, Ethiopia and Mozambique.

Information for NGOs, Governments and the local private sector on new options.

b. Consider manual drilling for new wells. If new boreholes are planned, investigate if manual drilling is possible. If so this can drastically reduce the total cost of a water point.

b Supply chain; Build up supply chains of a range of new products like pumps, storage tanks, irrigation, filters etc. including options that are affordable for poorer families.

c Training; Main actions to build up supply chains are the 3 Ts (Training, Training, Training) Training of local entrepreneurs (masons, well diggers, metal workshops) in production, repairs, quality control, marketing and business skills is essential. Essential is a good quality of products and services, for instance by means of certification of producers. Each country should have at least one WASH innovation / training centre where knowledge is centralised. Include knowledge in Vocational training such as is happening in Tanzania and Ethiopia. See also Idea 6.

Idea 4. Improve existing and make new family wells (Self-supply)

In Africa an estimated 200 million people still collect water from unimproved sources like lakes, rivers or open hand dug wells. Wells are often made by families, partly or completely at their own expense and is called Self-supply.

Open wells can be improved with a simple well cover and a low cost hand pump like a Canzee, EMAS or a Rope pump. With new low-cost drilling technologies like EMAS, Baptist, Mzuzu options, new tube wells can be made. The government of Ethiopia promotes Self-supply and wants to reach 20 million people in the coming years with improving existing and making new wells combined with low cost pumps like Rope pumps. They see advantages of family wells, as it avoids the "eternal" maintenance problems, experiences indicate that families take care for their own pump. (Maltha 2015).
Another difference between communal and family wells is that communal wells are often 0.5 to 2 miles from the house so water is used for drinking water and domestic use but water from a family well is nearby and often also used for animal watering or irrigation. So an effect of family wells is increased food security and more family incomes in this way reducing rural poverty. Studies in Nicaragua indicate that for poor families a well in the garden doubles income. A 100 US$ hand pump on that well increases yearly incomes again by an average of 220US$ (Alberts. 1998).
To guarantee that 3 litre/person/day is safe to drink it is strongly recommended that family wells are combined with a Household Water Treatment option like chlorine or a filter. Starting with a well families can climb the "Water ladder" see also Fig. 1. An example. Around 2001 many families in Sebaco, Nicaragua received or bought a 100 US$ Rope pump for domestic use and cattle watering. In 2010 these families had more trees around the house, improved houses and are now connected to a piped water system. With the increased incomes among others caused by the Rope pump families now have money to pay for a piped water system. Many families in Sebaco still use the Rope pump for cattle.
In short (improved) family wells result in ; access to an improved water source (SDG6) + more food security (SDG2) + more income (SDG1).

Suggestions

a Upgrade existing hand dug wells; Many of the 3-5 million hand dug wells in Africa dry up in the dry season. Sometimes this can be prevented by simple options like *Tube recharge*, (a 10US$ groundwater recharge system to inject up to 500 m3 rainwater in the ground near wells). Options to make wells deeper are Underlining or Well pipes with a Tube bailer that can prevent wells from drying up. An improvement is installing a windlass or a hand pump. A bucket and rope is a cause of the (re)contamination of a well. Installing a 80 dollar hand pump can improve water quality by 60%. (Gorter. 1998). Another improvement is to install a well cover and apron. Cost of these are 30-80US$. With these upgradings, open wells become an "improved water source" and so count for the SDG6. It is recommended that drinking water from shallow wells is treated with a HWT option like a filter

b Make new low cost wells; Where water levels are less than 35 meters deep and soils permit digging or hand drilling, there is a high potential for hand dug and hand drilled wells. Some ideas;

- Mapping. Make "drillability" maps indicating where hand drilling is possible. Organisations like UNICEF and Practica have performed surveys on potential for manual drilling in some countries in West Africa and mapping could be expanded to all countries.
- Reduce cost of hand dug wells by making smaller diameters. The volume to dig out of 0.9 metre is 45% less than that of a well of 1.2 metres diameter.
- Use new technologies such as: *Well ventilator* to bring fresh air in the well during digging. Other options are *Underlining, Well pipe, Soil punch & Tube bailer, Tube recharge, Well reducer rings.* (SMART Centre Group. 2016)
- Scale up Manual drilling. Manual drilling is safer and sometimes cheaper than hand digging. For instance with the EMAS method in Bolivia tube wells are made at a cost of 400US$ for 40 Meters deep well, including drilling, casing and hand pump. Over 30.000 wells have been drilled with this option even to 80 meters deep. With the Mzuzu, drill complete wells of 10 m deep can be made at a cost of 250US$ incl, casing and pump.

c. Support Family systems

A proposal that NGO and Governments interested in Reaching the SDG6 invest 30% of their Budget for rural water supply in supporting family wells and HWT. An indication of cost is 30 US$ /cap.
This is similar to subsidies to people who already have an improved water source, See also Idea 5

d. Use "Family power"; an example. With the "Waterclub" concept of the organisation Water for all International, (WFA) families themselves have drilled some 4000 wells. The organisation WFA trains a few person of a group of 10 families (a water club) who all want a family well. Than the families do all the work and help each other. The cost for this type of water supply ranges from 10 to 30US$/capita.

d. Compare drilling options. Compare options like Rota sludge, Baptist, SHIPO, EMAS, Mzuzu drilling in similar geological situations to see which is the most cost-effective option and to see which option has most potential for the local private sector to become a business.

Idea 5. Different use of subsidies

Communal rural water points with machine drilled boreholes cost 5000 - 13000 US$ (UNICEF, EW, Practica 2009) although prices are lowering. The cost of imported hand pumps like an Indian M2, an Afridev or Blue pump, installed on such a borehole, ranges from 500 – 2000 US$. In general wells with these hand pumps are used by 250 people and the investment cost is funded (subsidized) by governments and /or NGOs which means a subsidy of 20 - 60US$ per capita. Machine drilled boreholes for communities of less than 250 people have higher per capita cost. For instance such system for 50 people would cost 100-200 US$ per capita. If water for all is a Human right than maybe another human right is that all should have similar subsidies so in order that all have an equal share, funds, subsidies could be divided so there is *some for all instead of all for some*.

Suggestions

a Urban rich support the rural poor; The water price in urban areas could increase a bit and with the extra money water supply in rural areas can be subsidised.

b The same subsidy for all; People who are not yet served, should receive a similar subsidy per capita (ca 30US$) as people who are already served. Especially in rural and peri urban areas this subsidy could be in kind and be used for Family systems (Self-supply), see Idea 4. For example, if a family of 6 persons invest in making their well and rainwater harvesting/ groundwater recharge system, government and / or an NGO could support with a well cover and a hand pump with a total cost of 150 US$ so 25US$/capita.

c Compensate high cost systems; Where the cost/capita of water access is very high because low cost options are not possible (for instance where water layers are very deep or in rocky areas), people should get support to install cost effective options.

d Increase product range so people can choose; Offer several water supply options (gravity system, piped system, rooftop harvesting, hand drilled well and low cost hand pump) and inform communities about Life Cycle Cost (long term cost including… replacement) of each option so they can choose the options they can manage and…afford.

e People pay for "luxury"; If low cost options like a hand pump is possible but people want a higher cost option like a piped system, an expensive electric pump etc, they should pay the additional cost.

Idea 6. WASH centres in each country

For all actions mentioned above, support of NGOs and governments is essential, but to take action they have to know, see and become convinced of the potential of innovation. Government can play a role in control of quality by means of certification, develop supply chains, train the local private sector in production and repairs, develop policies, do monitoring and evaluation. Good technicians, designers, managers and other skills are needed for whatever technology is used. To inform NGOs and governments to train technicians, to coach entrepreneurs etc. there is a need for one or more WASH training centres in each country. Centres where knowledge is concentrated, where there is demonstration of existing and new technologies and where there is capacity for training in technical and non technical aspects

An example of the effect of a WASH centre like the SHIPO SMART Centre in Tanzania. Results after 10 years are 0.5 million people with improved water sources, by means of 3000 hand drilled wells and 11.000 Rope pumps of which some 6000 for Self-supply. These were made by 35 private pump and drilling companies. The cost/cap of rural water supply reduced from 40 to 15US$. (Maltha. 2015).

New technologies, lessons learned and innovative approaches are in place. What is lacking is large scale capacity building and WASH centres Like SMART Centres or WET centres are proven concepts for capacity building. As the saying goes, to help the poor do not give a fish but a fish rod. We need to make another step; teach how to make the fish rod, so in the future families, communities, companies can solve part of the water problems with local and affordable solutions.

Suggestions

a Create one or more WASH training centres in each country. Centres with knowledge, demonstration and capacity for training. Examples of such centres are the SMART Centres (coordinated by MetaMeta) in Tanzania, Malawi, Mozambique and Zambia and WET Centres (coordinated by CAWST) in Nepal, Ethiopia, Zambia and other countries.

Conclusions

1. To reach the "the last mile", the small communities, lower cost water technologies are needed.
2. The SMART Centre approach results in a **"profit based sustainability"** For the local private sector the production and repairs generate income so will go on after projects stop.

3. To reach the SDG6 new technologies and approaches are needed. For Rural areas there are a range of effective and proven new solutions. The challenge now is a massive dissemination. What is needed is a Marshal plan for capacity building (IWA Stockholm 2016)
4. Besides the SDG6, the SMART Centre approach has also much potential to assist in reaching SDG1 (Reduction of rural poverty) and SDG2 (Increase food security) in Africa and other continents.

References

- Acra (2012). Appropriate Technologies for Rural Water Supply. 'The Conference on Rope pumps Technology'. SHIPO, Njombe, Acra.
- Alberts, J.H. and v. d. Zee, J.J. (2002). 'A multi sectoral approach to sustainable rural water supply in Nicaragua. Role of the rope handpump'.
- Danert 2015. Manually Drilled Boreholes. Providing water in Nigeria's Megacity of Lagos and beyond Drilling sector in Nigeria.
- Gorter. A Randomised trial of the impact of rope pumps on water quality .Published in *Journal of Tropical Medicine and Hygiene*, 1995; 98:247-255
- Holtslag.H, McGill. J (2015). 'Improving self-supply water sources as a key to reach the water related SDG'. 38th WEDC International Conference, Loughborough, Loughborough University.
- Haanen, R. and Kaduma, L. (2011). 'Low Cost Water Solutions (sharing six year experience in private sector and sponsored programme)'. 6th Rural Water Supply Network Forum 2011. Uganda**:** 4.
- Hystra (2013). 'Marketing innovative devices for the base of the pyramid'.
- UNICEF, EW, Practica Technical note 3 Manual drilling 2009
- Maltha. A 2015. Assessment of SHIPO Tanzania . www.smartcentretanzania.com
- Olschewski, A. van Donk, M., Maillo J. (2015). 'Innovative mechanisms for improving self-supply services'. 38th WEDC International Conference, Loughborough, Loughborough University.
- IRC 1995 Nicaraguan experiences with the Rope pump. http://www.washdoc.info/docsearch/title/113703
- Simavi. 2012. FIETS criteria (Financial, Institutional, Economical, Technical and Social). See www.simavi.org
- Mekonta, L (2015). Great expectations: self-supply as a formal service delivery model for rural water in Ethiopia. 38th WEDC International Conference, Loughborough, Loughborough University.
- Rosendahl, R. (2015). 'The impact of Rope Pumps on Household Income in Mzuzu, Malawi'. Water Resource Management Group. Wageningen, Wageningen University. BSc.
- RWSN (2015). 'Accelerating Self- supply (ACCESS).' Retrieved October 20, 2015, from http://www.rural-water-supply.net/en/self-supply.

Information SMART Centre approach and SMARTechs www.smartcentregroup.com

SMART Centre group www.smartcentregroup.com WET Centres

Information on 3R (Retention, Recharge, Reuse) www.bebuffered.com www.waterchannel.org

Information; Water, sanitation Solutions www.akvo.org

Booklets in the Smart series on Sanitation, Water harvesting Hygiene, Finance and Disinfection www.akvo.org , www.irc.org

Contact details

Name of Principal Author; Henk Holtslag
Address De Zeis 60 7335KB Apeldoorn
Tel: 0031555414156
Email: henkholtslag49@gmail.com
www: www.mzuzusmartcentre.com

Name of Second Author; Jim Mc Gill
Address; Po Box 112 Mzuzu Malawi
Tel: 0026599951860
Email: mcgillwatsan@gmail.com
www: www.mzuzusmartcentre.com

Figure 1; In Europe many farmers climbed the "Water ladder" between 1900 and 2000. They started with a hand dug well and a bucket, lateron a hand pump, than a borehole and electric pump and step 4 was a connection to the piped water system. Are the same steps not also valid for Africa?

Manual drilling with the SHIPO drill option

The Rope pump, one of the locally produced and low cost hand water pumps