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Final Report

SUSTAINABLE IMPLEMENTATION OF SOLAR THERMAL PASTEURIZATION SYSTEMS IN RURAL AREAS OF BANGLADESH

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Country: Bangladesh	**Technology: Solar Thermal**
Project Duration: 26 months	**Category: Pilot-Project**

Caption for Picture 1 on front-page:
The picture shows one of the six project sites in Southern Bangladesh. A young boy pumps the water from the nearby pond into the systems feed- tank. The pond-water is arsenic free and will be disinfected in the solar-thermal collector seen in the background.

A project-video (3:24 min.) is available under the following link: http://youtu.be/Oqu2mcIuK90

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Contents

1. Summary

Bangladesh is full of water. But most groundwater is contaminated with high levels of arsenic, salinity or iron. The consumption of this water leads to severe health damage that occurs only years later. The goal of this innovative pilot-project was to create sustainable access to safe water for the people living in the hotspot-areas. At six sites in Southern Bangladesh solar-water-disinfection-units were installed. Instead of using ground-water the widely available surface water from ponds is purified. The sustainable operation model with community-groups is a key element of the project.

People in rural communities in Bangladesh usually fetch their drinking water from tube-wells, hence from a groundwater source. In many areas this water is naturally contaminated with arsenic, salinity and/or iron. Drinking arsenic contaminated water has a long-term negative health-impact (such as cancer, blindness, skin-problems, irritation of the nervous system).

Instead of using ground-water, the applied technology in this pilot project is operated with surface-water from surrounding ponds. This water-source is widely available and is not contaminated with arsenic, salinity or iron. On the other hand, it contains high levels of microorganisms and organic matter. The implemented solar-powered water-disinfection units (SoWaDis) are able to disinfect microbiologically contaminated pond-water and therefore can be considered an adequate solution. The SoWaDis-systems were originally developed at SPF Institut für Solartechnik Rapperswil in Switzerland. Within this project totally ten solar-systems were implemented at six different sites in Southern Bangladesh.

After an initial phase of operation the water disinfection-systems were handed over to the communities for independent operation and ownership. The experiences regarding this sustainable community-operation-model are positive. By now over 2000 people are directly benefitting from the project. Apart from this direct impact the pilot-project has a strong demonstration character and will help other organizations in the water-sector in Bangladesh to develop similar projects. Especially in areas where treatment of ground-water is expensive and complicated, surface-water-treatment can be an excellent alternative.

Since the time-plan was affected by the heavy political unrest in the second project-year, WaterKiosk Foundation and the local implementation partner have agreed to extend the monitoring of the project until the end of 2014 at their own costs. The goal is to further survey and train the community-groups with the operation during this extended period. During this extended monitoring phase the WaterKiosk Foundation will assess its future expansion of activities in Bangladesh. The political situation has fortunately calmed down in January 2014 after the elections. There is much hope that life will turn back to normality and NGO’s can resume their work to the benefit of the population.

2. Objectives

The main goal of this project is the sustainable supply of safe drinking water for the population in Southern Bangladesh.

The original goal was to implement ten single systems at ten different sites. This goal had to be revised during the first months of the project[1]. The number of operational sites was reduced to six, though the number of total systems remained the same (10 systems distributed to the 6 locations). Therefore the same amount of beneficiaries could be reached as originally planned[2]. The reason for this adaption was the fact that the development and operation of every single site/location turned out to be more complex than originally assumed. The concentration on fewer locations with the same amount of disinfection systems helped to channel efforts and to work more effectively, especially regarding a sustainable operation of each site.

The planned operational model included two different approaches. One of them was the community approach, where the beneficiaries operate the system by themselves as a sort of a user-cooperative. This included financial contributions for ongoing operation and provisions for future maintenance. The other one was the more commercial approach with a water-kiosk respectively with water-delivery-services. The experiences made during the project showed that the community-run approach was working well for rural communities. On the other hand the commercial approach with water-vendors appeared to be more challenging. Willingness to pay for water in rural Bangladesh is still very low whereas in the more urban locations it is already common. Based on these experiences the focus regarding the operational-model was set to the community-groups. At one of the more urban sites (Odarhat) it was possible to also implement the commercial approach with water-vending services.

Further objectives included the training of a local team that is now able to install and maintain the SoWaDis-systems independently. Additional (originally not planned) achievements of the project are the further technical development of the water-purification-system and the video-documentation.

[1] The project sponsors were informed at an early stage of the project about the revised goals.
[2] Each system produces roughly 300 litres of drinking water per day on average. Assuming a consumption of 1.5 litres per person this leads to 200 people served by one system. The ten systems that were implemented at six different sites delivering water for over 2000 people.

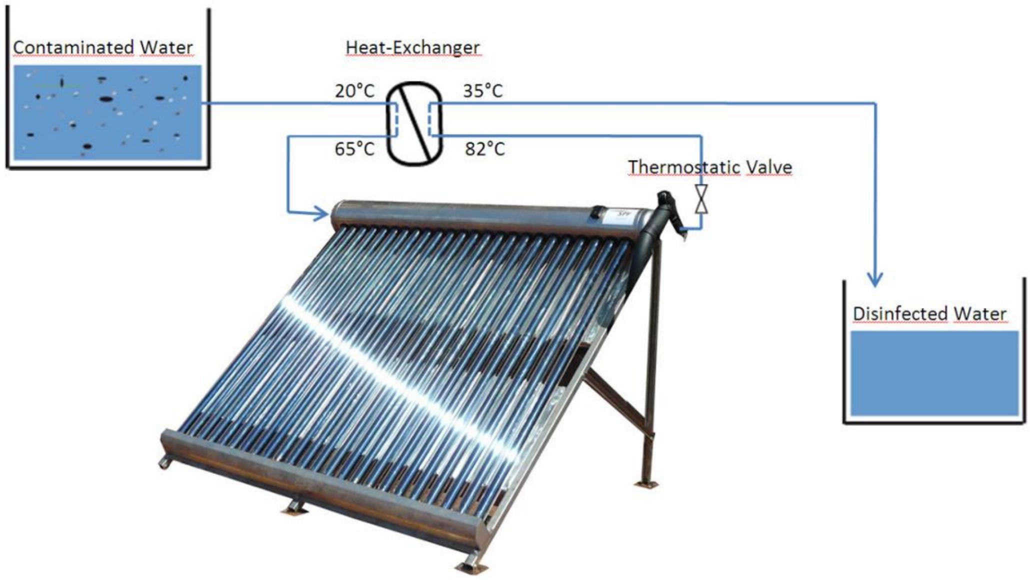
3. Technical Solution / Applied Method

The applied technical solution for water-treatment at the different project sites is called SoWaDis (Solar Water Disinfection). The technology is documented on the foundation's webpage: www.waterkiosk.org/sowadis. The technical development of the SoWaDis-plant has started over five years ago. By now more than four years of field-testing in various developing countries (Mozambique, Tanzania, Bangladesh) have been conducted and around 50 systems have been implemented[3]. The systems are successfully operated in rural schools, small hospitals and in community groups. The system is very simple to maintain and operate. This simplicity of operation is the main advantage compared to many other water-disinfection/treatment systems.

SoWadis is a solar-thermal pasteurization system that heats water up to 82°C in order to disinfect the water. During the development stage of the system a detailed study was conducted in collaboration with the world renowned Swiss water-research institute EAWAG to define the effective process of disinfection. The main result of the study was that it is sufficient to heat water up to 75°C for an exposure time of 5 minutes to make it safe to drink. During the project the water-quality was regularly tested by the official national water-testing laboratory (http://www.icddrb.org/). This laboratory tests were complemented with easy-to-use water-quality-tests that also work without laboratory-equipment. It was shown that the treated water by the SoWaDis-system fulfilled the national standards for drinking water quality (the national standards are derived from international standards from WHO).

The main treatment stages of the SoWaDis system are described as follows:

1. The contaminated water is stored around two meters above ground.
2. The contaminated water flows into the heat-exchanger and gets preheated from around 20°C to 65°C.
3. The preheated water flows into the solar collector.
4. In the collector the water is heated up to 82°C. This is the process where the water is thermally disinfected.
5. A thermostatic valve on the collectors outlet opens when 82°C are reached. When the temperature drops below it is closing again. The water is exposed to this temperature for a minimum of 10 minutes.
6. The disinfected water flows through the heat exchanger, cooling down from 82°C to around 35°C and preheating the collectors inlet (hydraulically separated).
7. Finally the disinfected water flows into the water storage.



Picture 2: Functionality scheme of the solar thermal water disinfection system SoWaDis (SolarWaterDisinfection) that was developed at SPF Institut für Solartechnik from Hochschule für Technik Rapperswil, Switzerland.

[3] 2014 at least another 45 systems will be implemented in Tanzania.

The treatment of the surface pond water in Bangladesh created some technical challenges at the beginning of the project. The simple pre-filtration- and pasteurization process from the existing SoWaDis-technology was not enough to reach drinking water quality. The water remained turbid and also didn't have the desired taste and smell. The standing open ponds had different characteristics from the sources for which SoWaDis had been used before (e.g. open intakes, rainwater-harvesting, rivers etc). Since the ponds in Bangladesh are usually aligned with a lot of trees along their banks a lot of organic matter (such as leaves) falls into the pond, which then is decomposed. To deal with this challenging water-source the SoWaDis system had to be extended with other process-stages such as flocculation, fast-sand-filtration and an active carbon filter. After an initial phase of experimentation the system finally delivered the desired quality characteristics. This extension of the SoWaDis-system is an important achievement of the project and will be of great use in many future projects, in- and outside of Bangladesh.

In Picture 3 the various stages of the applied extended water treatment process are shown. In a first step the microbiologically contaminated pond-water is pumped from the pond to the flocculation tank (1,2,3). The pumping is usually done in the evening and flocculation takes place over night. For the flocculation process around 60-80mg alum[4] is added per cubic-meter. The costs for alum are only 6-8 Taka per batch. In some sites electrical pumps are used, in others manual treadle or diesel-pumps (depending on the availability of electricity). With 1 KW pump and a 3/4" pipe connection it takes about 15-20 minutes to pump 1000 liters.

After the pond-water has gone through the flocculation stage it is pumped in the morning up into the gravity-tank (4). At the same time the bottom portion (flocculated material) is drained from the tank. From the top tank the water flows automatically through the fast-sand-filter and an activated carbon filter (5 and 6). The sand filter is back-washed every 2-3 days, depending on the water-quality. The material of the activated carbon filter and also of the sand-filter is replaced once a month and costs 500 Taka each. After these stages the water will be pasteurized/disinfected in the solar-collector (7). Finally the water will flow into the safe-water-tank (8).

The total additional costs for the extended system are around 40'000 Taka (ca. 490 USD), consisting of a pump (15'000 taka), tank 1000 litres (10'000 Taka), carbon-filter (2500 Taka), a fast-sand-filter (5000 Taka) and some additional piping/connections (7'500 Taka). In the next chapter the economics for a financially sustainable kiosk-operation are derived (Results -> Scaled-up implementation and kiosk-economics).

Picture 3: Different components and process stages of the further developed SoWaDis-System 2.0.

[4] Hydrated potassium aluminium sulphate (potassium alum)

4. Results

Supply of 2000 people with safe drinking water & demonstration impact

The direct result of the project is – according to the original objectives - the supply of over 2000 people with safe drinking water. This goal was reached by installing and sustainably operating the water disinfection plants at the six project-sites. The innovative project has a strong demonstration effect, showing to other national and international organizations in Bangladesh that there is an excellent alternative to the common approach of using tube-well water which is often contaminated with excessive saline, iron and arsenic. The six single project-sites are described in more detail on the following pages.

Development of SoWaDis 2.0

As described in the technical chapter an important project result was the further development of the SoWaDis system. This achievement was originally not part of the project-objectives. The local implementation team was challenged in the beginning of the project, because only after the first installations it became clear that the SoWaDis-system in its original form was not able to treat the pond-water in a sufficient way to achieve drinking water quality. It was necessary to adapt the system, adding a flocculation-stage, a pressurized sand-filter and active carbon filter. After several months of testing the improved system was developed to a stage where it was able to produce the desired drinking water quality. This further development of the system will be of great use in many future projects, in- and outside of Bangladesh.

Sustainable operation

The experiences made within the project show that the demand for the produced safe water by private households in the rural areas at all sites is high, but the willingness to pay for this is still low. Selling water in rural areas of Bangladesh to the bottom of the pyramid respectively the poorest of the poor remains a challenge. This stays in contrast to the more urban areas in Bangladesh where water-vending services are already widely accepted. At the more urban style site in Odarhat it was possible to create a commercial customer base consisting of restaurants and shops in the area. These shops pay for the delivery of 25-liter-buckets between 40 and 60 Taka (around 0.5 USD), which are delivered by a bicycle-taxi. The small shops and tea-stalls resell the water in cups to their customers. If the costumers consume other things like food, the water is often given for free.

The discussion hold with the rural communities suggested that the operational model with private-households should not be based on sales per unit (selling of bottles/buckets). Instead, a community-based contribution model where tasks and costs are shared between the beneficiaries had higher chances for a successful implementation. As described on the following pages, most sites are now operated with this community-based approach: Around 20-25 families organize themselves as a community-user-group in order to sustainably operate the system and to cover running costs. For a more detailed insight on the operation model and its economics, the next section "scaled up implementation" should to be consulted. The experiences made so far with this operation model are quiet positive, even though in the project-areas (low purchasing-power and perceived good alternative drinking water sources) quite a lot of effort was needed to sensitize the groups. It is planned to continue project monitoring with a focus on sustainable operation the end of 2014, since the project was delayed by the political unrest in the country.

Project documentation with a short-video

The project was documented with a short-video and photographs by a professional filmer/photographer from Dhaka, Bangladesh. The video was produced in order to disseminate the results to a wide range of organisations (link: http://youtu.be/Oqu2mcIuK90) and hence widen the impact of the project.

Local production

The possibilities for the local production of the SoWaDis-2.0-system have been checked. The production of the heat-exchanger can be done locally at the local engineering school Mawts (http://www.mawts.org/). Also the components needed for the additional process-stages (fast-sandfilter and activated-carbon-filter) can also be manufactured locally at Mawts or even directly by Prism. The solar-collector is locally available, but all products are imported from Asia. So for a larger distribution it is probably advisable to import directly, instead of depending of another importing-company. BOS-components (balance of systems, such as: valves, fittings, pumps) are all locally available and were already purchased locally for this project.

Capacity building: local installation-/operation team

At the beginning of the project the local implementation partner was trained to install and operate the SoWaDis-systems. The local team is now well familiar with the characteristics of the system and knows how to independently troubleshoot eventual technical problems that could occur.
The systems were installed at various branch-offices from the local implementation partner (a micro-credit-organization). Apart from the “centralized” installation team in Dhaka and Noakhali, also the local staff at the rural branch offices was trained to operate the systems and build awareness among the end-users.
The team of the local-partner is now also able to identify new potentially suitable locations, build up the complete system and train the local people to operate and maintain the plant.

Scaled-up implementation and kiosk-economics

The project has underlined the challenges of building up a financially sustainable water service in poor rural communities. People in these areas tend to supply themselves always with the cheapest source of water, although this usually is not the safest source. Lack of education is preventing many people to differentiate between different qualities of water. This again results in limited willingness to pay for improved water sources. For a small NGO it is very challenging to change the education level and the behaviour patterns of their target groups. Another challenge is the fact that other NGO’s often supply new water-access for free, which makes it tough to build-up a water-business in the same area.

Regarding the scaled up implementation of the waterk-kiosk-aproach these “lessons learned” are very important. The most potential for a scaled-up implementation is seen in in areas where people are already now consuming pond-/surface-water, this occurs mainly because ground-water in these areas has a very high salt-concentration. In order to run a financially self-sustained operation model, peri-urban areas should be targeted first, since there is a higher education-/development-level and hence higher willingness to pay for safe water. For more details see also the chapter “future prospects”.

In most of the kiosk-sites of this pilot-project (compare following chapters) the manpower- and material costs are covered directly by the community. Hence the operation model per se is sustainable, but initial investment is not intended to be paid back. As follows the full economics of the water-kiosk-operation are shortly summarized:
The running costs for a water-kiosk with a daily output of 1000liter (= 50 buckets) are estimated to be around 200 Taka per day (2.62 USD). This consists of manpower- and material-costs. The operation tasks of around four hours per day (4 times 30 Taka = 120 Taka) include sales-work and system-operation, like mixing the alum for flocculation, pumping the water from the different tanks and cleaning the filters in regular intervals. The material costs are mainly for the flocculation-material, the sand-filter- and activated carbon-filter-replacement and the electricity-consumption for pumping (80 Taka p.d.). See also previous chapter for costs of system-components and consumables.

Looking at a future operation-model that is completely financially self-sustained a simple cost-calculation is performed as follows:
It is estimated that the total initial investment for a water-kiosk could get down in the near future to 1700 USD (production costs). With a target price of 40 Taka per 20-liter bucket a maximum daily turnover of 2000 Taka can be reached (26.2 USD). Compared to other locations in Bangladesh a bucket price of 40 Taka seems to be a reasonable reference price for a non-branded water-product. Realistically the daily average-sales will be well below the 50 buckets (1000 litres). With an average sales-rate of 65%, the daily sales-volume corresponds to 1300 Taka. Subtracting the daily O&M-costs of 200 taka a net profit of 1100 taka (14.4 USD) can be achieved. Adding another 10 Taka per bucket for distribution service and another 7 Taka for general services (like control of general processes and water-quality) the daily net profit comes down to 550 Taka (7.2 USD). This is the amount that can be used for paying back the system. The static payback-time of the system for these assumptions remains below one year (1700 USD divided by 7.2USD p.d. = 236 days).

Awareness-building and sensitization

At all project sites various workshops were held with the end-users/communities in order to integrate them well into the project. It was very important to design an operation-model that was well accepted by the end-users.

The workshops helped to build awareness about unsafe sources of drinking water (mainly arsenic). Since the negative effects from arsenic usually occur many years after consumption, it is challenging to explain people why they should not drink arsenic contaminated water. Many large government programs in Bangladesh are working in this field in order to sensitize the population. For the success of this project it was crucial that people understood the negative impact of arsenic contaminated water. Only this way they would be motivated to change their habits and be willing to financially contribute to the operation of the solar-water-disinfection systems. After decades of consuming tube-well water, using pond-water for drinking-purposes meant another big mental change for most of them. The intensive phase of awareness-building and close collaboration with the end-users made it possible that the new water-purification-systems were accepted and appreciated. For the future expansion it is planned to target areas were people are already well aware about the arsenic problem in order to reduce implementation costs and risks (see also chapter “Future Prospects”).

On the following pages the six single sites are described and documented in more detail.

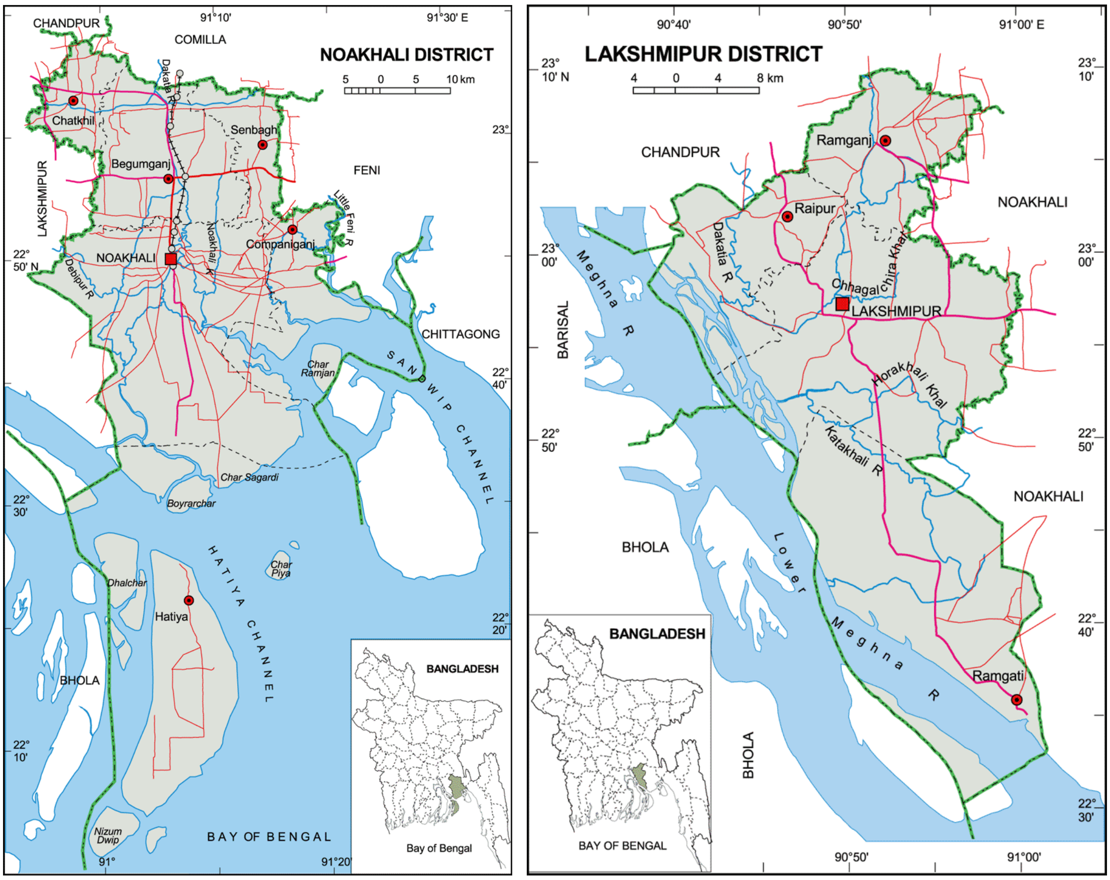


Figure 1: All six projects sites are in rural southern Bangladesh. Two locations are in Noahkali district (see left map) and four sites are in Lakshmipur district (see right map).

Site 1:

Area/Region: Odarhat
Operator: Prism Micro-Credit Branch Office
Consumers: Delivery to restaurants/tea-stalls & surrounding villagers

The system was installed in Odarhat at the branch office from our partner Prism, a micro-credit institution. It is operated and monitored since June 2012 and was the first system to be implemented. The produced water is distributed to around 15 small restaurants and tea-stalls at the nearby bazaar. The buckets of 25 liters are sold for 40-60 Taka (0.5 USD). One external person was engaged to distribute the water in order to develop a market for the supply of water. In addition, the treated water is available to the surrounding households to habituate potential customers to the treated drinking water.

Picture 4: Various pictures of the site at Prism's micro-credit branch office in Odarhat, Noakhali District. This first site is in operation since July 2012.

Site 2:

Area/Region: Chargazi (near Ramgati Bazar), Ramgati, Lakshmipur
Operator: Mojibullah's House (Private Entrepreneur)
Consumers: user-group consisting of 22 families

The system at this site has been successfully installed and set to operation. About 22 families from the surrounding community are taking their drinking water from the SoWaDis-plant. The system is working properly with a production rate of 350 - 550 liters per day. The ownership was given to the owner of the premises, Mr. Mojibullah. He is a private entrepreneur and he is directly operating the system as a service for the community. The community is contributing financially to cover the running costs. The personal motivation for Mr. Mojibullah is that he is appreciating the safe-water for himself, plus he likes to take this leadership-position in the community. Mr. Mojibullah is paying for the flocculation-material and the electricity by himself.

Picture 5: Various pictures from the installed system at Chargazi.

Site 3:

Area/Region: Dhighi, Nasir Samaj, Chargazi, Ramgati, Lakshmipur
Operator: community-based
Consumers: 26 families

The system is installed on a pond embankment. A total of 26 families are the beneficiaries of this site. Up to now the water situation was dramatic for this people, since ground-water was heavily contaminated with arsenic and iron. The families will strongly benefit from the newly installed SoWaDis-system that treats pond-water. The operation of the system is organized by the families that build a community-user group. A manual treadle pump, as seen below in the picture, is installed in the system for lifting of water to the overhead tank, since there is no electricity.
Person living at the plant site, he is given the responsibility by the group. He is not paid for his labour. His motivation is to take .a leadership position in the community.

Picture 6: SoWaDis-system with manual treadle-pump at Dhighi, Nasir Samaj, Chargazi, Ramgati, Lakshmipur

Site 4:

Area/Region: Islamia Zaame Mosque, Uttar Gabtali, Chargazi, Ramgati, Lakshmipur
Operator: Mosque
Consumers: 23 families (user-group), school and mosque.

The system is installed on a pond embankment in front of a mosque. A total of 23 families are served by the system. Also in this case the people will appreciate the access to safe drinking water very much since the situation was dramatic. A primary school and the mosque are also served. The ownership has been given to the mosque authority. A diesel pump was installed in order to lift the water to the overhead tank. The mosque is responsible to cover the running costs of the system and collects the small contributions from the families that are part of the user-cooperative. The operation of the system is done for free by the secretary of the mosque-council. His personal interest is to take the leadership and serve the community in order to strengthen his reputation.

Picture 7: Site number 4 at Islamia Zaame Mosque. 23 families and the nearby school are the consumers of the produced safe drinking water.

Site 5:
Area/Region: Char Matua Madrasha Darul Ulum Madrasha, Char Matua Union, Noakhali
Operator: School
Consumers: Students and surrounding villagers

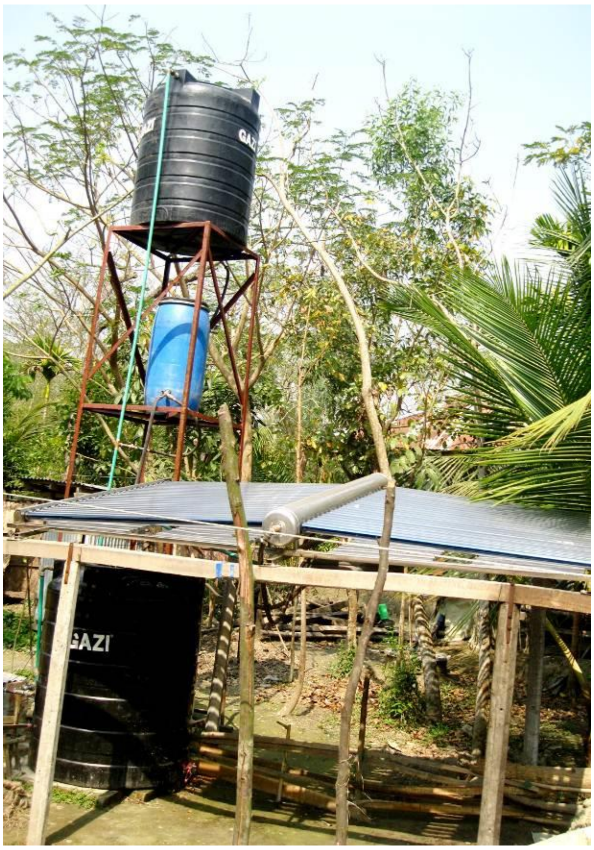
The system is installed on a single storied rooftop of Madrasha Building. The system is treating about 350-500 liters of water per day. The students of the school are the main consumers of the treated water. In addition, surrounding people can also take the water for drinking purposes. An electrical pump is used for lifting the pond water to the overhead tank. The ownership has been given to the mosque authority who is acting as the operator of the system. The operation is financed by the school-fees and the contributions from the surrounding families that are consuming the water.

Picture 8: SoWaDis site number 5 at the school in Char Matua Union, Noakhali, installed on the roof-top of the school. The picture on the bottom right shows the community meeting regarding the introduction of the water-system.

Site 6:

Area/Region: Borokheri Village of Borokheri Union in Ramgati Upazila of Laxmipur District
Operator: Mr. Ahsanullah
Consumers: community group with 18 families

This system is in operation since November 2013. At present, a total of about 18 families of the community are using the system's water for their drinking purpose. Potentially another 6 families will be integrated in the user-group. An electrical pump is used for lifting the pond water to the overhead tank. The ownership has been given to the village leader and local entrepreneur Mr. Ahsanullah. He was trained to operate the water-purification system. He is also responsible to collect the small contributions from the water-cooperative-members. He is not paid for his labour to operate the system, his personal motivation to operate the system is to take a leadership-role in the community.



Picture 9: SoWaDis water-disinfection unit installed in Borokheri Village. The picture on the bottom left shows a community workshop with the women representing the families that are part of the water-cooperative. The workshops helped to build awareness about arsenic contaminated water and to inform the families about the rights and duties regarding the participation in the water-group.

5. Impacts

The six different sites are now all operational and over 2000 people benefit from the project. On the one hand directly by the new safe water-service and on the other hand also by the educational aspects of the project where the community-groups were sensitized about safe-water issues. Especially in the locations where the school is also part of the user- & operation-community, the educational impact is very strong. The project helped to build awareness about the negative impacts of contaminated drinking water and especially showed the communities and schools what alternatives there are.

During the project the SoWaDis-system was technically improved for situations where the feed-water is of low quality. This technical improvement will also be very helpful in other countries, especially Tanzania, where WaterKiosk Foundation has set its current geographical focus.

The innovative project has a strong demonstration effect and will inspire other organizations working in the water sector Bangladesh. The project-video will help to disseminate the results.

6. Future Prospects

Since the project was delayed by various factors the main implementing parties (WaterKiosk Foundation and Prism Bangladesh) have mutually agreed to continue the monitoring of the sites until the end of 2014, at their own cost. It is aimed to gain more insight on the long-term sustainable operation of the systems, covering social and technical aspects[5]. By now, various organizations[6] have shown interest in the project, especially for the zones where groundwater is heavily contaminated with salinity and the use of pond-water is already normal to the people. It is planned to openly share the experiences with these organizations in order to widen the impact of the project.

The extended project-monitoring phase until the end of 2014 will also show how the general political situation in Bangladesh will evolve - for most of the last year it was a very challenging situation to work in Bangladesh as an international NGO. Currently the situation has calmed down and fortunately elections in January 2014 have passed without significant unrest. The future activities of the WaterKiosk Foundation in Bangladesh will strongly depend on the evolvement of the situation. The latest developments give hope that from this year onwards the situation will improve and NGO's can resume their work.

Generally speaking the potential for replication in densely populated Bangladesh is vast, or to put it in other words: the situation about contaminated ground-water in Bangladesh is dramatic. To access this potential in the most effective way, future activities should focus into the following directions:

- New projects should concentrate on project-sites where groundwater is heavily contaminated with high salinity levels and where people already are used to take their drinking water from the ponds. In some areas there was a resistance to change from ground water to surface water because people were not aware about the long-term effects of arsenic. Changing these habits is a major task for a small NGO. Since there is a significant number of areas where people already drink pond water (untreated), it will be the easiest and most efficient to develop these location in the next stage.

- This project covered mainly community-based operational models without direct payment for water (apart from the Odarhat-site, referred to as Nr. 1). The projects are operated sustainably, since people cover running costs and make provisions, but initial investment is not covered. The experiences made show that in rural Bangladesh people are not (yet) used to pay for water. To complement the experiences made with a more commercial approach (water-vendors, water-kiosks etc.) some of the new sites should be located in a more urban/peri-

[5] Some of the systems have been in operation for only a few months. It will be important to monitor and assist the operation of these systems for around 12 months, in order to understand if the community is accepting the system and is able to operate it on its own.

[6] Some of the organizations are: CMES (http://cmesbd.org/) which has staff in the southern region with groundwater that has a very high salt-concentration and people already use surface-water for drinking purposes. The Dhaka-based organization MAWTS was already involved to produce some of the system components locally (http://www.mawts.org/).

urban context. This way further experience can be gained with models that are fully financially sustainable and therefore have higher potential for scaling-up.

7. Conclusions

During the project implementation various challenges had to be faced. This included heavy political unrest and initial technical challenges regarding the water purification process. Despite these challenges it was possible to complete the project successfully by the end of February 2014.

Depending on the evolvement of the political situation WaterKiosk Foundation will plan its future expansion in Bangladesh. The potential for improving the general water-situation in this country is enormous. The next steps for the WaterKiosk Foundation point in the following two directions:

- Focus on areas with high salinity level in groundwater, where people already use pond water for drinking purposes.
- Concentrate on more semi-urban areas, where willingness to pay is higher and commercial operation-models have a high chance to work.

8. References

- To document the project a video was filmed/edited and openly published on youtube. To see the video click on the following link: http://youtu.be/Oqu2mcIuK90

- The project was featured on Geberit's intranet reaching over 6000 employees. Further publications are planned to take place in 2014.

- The project was presented at Repic's workshop on 29.10.2012.

- The project was presented at various speeches held about the WaterKiosk Foundation.

- The project is published on the WaterKiosk Foundation's website http://swisswaterkiosk.org/?page_id=1220

- The project is published on the Repic-Website http://www.repic.ch/repic-de/projekte/laufend/solarthermie/swisswaterkiosk-bangladesch/


Picture 10: A young girl from Noakhali-region is enjoying the safe water from the SoWaDis-plant. She is part of the water-cooperative consisting of around 25 families that is operating the system.

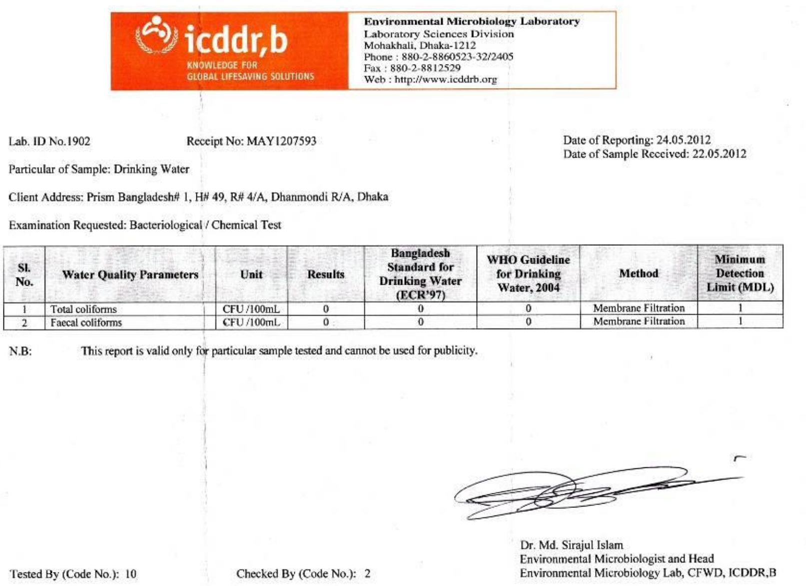

Picture 11: The picture shows one of the many community-workshops that were held before and during the implementation of the water-purification systems. The workshops aimed to build awareness about the arsenic problem and motivate the families to participate in the water-cooperative.

Picture 12: At the site in Odarhat the water-disinfection system supplies private families as well as small entrepreneurs that transport and sell the water to shop-owners at the nearby bazaar.

Picture 13: The project included a water-delivery-service for small street-shops as shown in the picture. The 25 liter bucket is sold to the small shop-owners for around 40-60 Taka (around 0.5 USD). The shop-owner re-sells the water to the end costumers in cups.

Picture 14: The quality of the produced safe drinking water was controlled weekly by our project field staff in order to guarantee the water quality to the end-users.

Picture 15: This picture shows a small hospital in Southern Bangladesh. Many people show symptoms that are related to natural arsenic contamination of the ground-water. Symptoms occur usually many years after consumption. This makes it a challenge to sensitize people.



icddr,b
KNOWLEDGE FOR
GLOBAL LIFESAVING SOLUTIONS

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Web : http://www.icddrb.org

Lab. ID No.1902   Receipt No: MAY1207593   Date of Reporting: 24.05.2012
Date of Sample Received: 22.05.2012

Particular of Sample: Drinking Water

Client Address: Prism Bangladesh# 1, H# 49, R# 4/A, Dhanmondi R/A, Dhaka

Examination Requested: Bacteriological / Chemical Test

Sl. No.	Water Quality Parameters	Unit	Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method	Minimum Detection Limit (MDL)
1	Total coliforms	CFU /100mL	0	0	0	Membrane Filtration	1
2	Faecal coliforms	CFU /100mL	0	0	0	Membrane Filtration	1

N.B: This report is valid only for particular sample tested and cannot be used for publicity.

Dr. Md. Sirajul Islam
Environmental Microbiologist and Head
Environmental Microbiology Lab, CFWD, ICDDR,B

Tested By (Code No.): 10   Checked By (Code No.): 2

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DATE	MITER READING	COMENTS	SIGNATURE
12.10.2013	60258		Shaim
13.10. "	60576		
14.10. "	60870		
15.10. "	61211		
16.10. "	61584		Shaim
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29.10. "	65686		
30.10. "	66041		
01.11.2013	66391		
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03.11. "	67068		
04.11 "	67434		
05.11. "	67819		
06.11. "	68165		
07.11. "	68487		
08.11. "	68870		Shaim
09.11 "	69253		
10.10. "	69634		
11.11. "	70007		

Figure 2:
The left figure shows one of the test-reports on water-quality. The water-quality tests have been conducted weekly in order to assure drinking water quality to the end-users.
The right figure is an extract from the log-book from one of the six project-sites. The reading of the water-meter was done on a daily basis in order to monitor production-rates.