Concept Note
Drinking water for off grid areas: An institutional Solution

Contextual Background

Bangladesh is one of the most vulnerable countries to the global climate change. Cyclones and tidal surges cause ponds and other surface water bodies to become filled with saline sea-water in the coastal areas. Sub-surface water sources also become contaminated by sea water penetration. As a result, there is severe shortage of safe drinking water in the coastal areas of Bangladesh. People have to collect drinking water from distant sources, spending an average of 4-5 hours a day and often walking 2-3 km. Sometimes, people have no other choice but to drink unsafe water.

The situation became more critical after the two consecutive devastating cyclones, SIDR and AILA, in 2007 and in 2009, respectively. Given this situation, the Government of Bangladesh in cooperation with the German Federal Ministry for Economic Cooperation and Development (BMZ), took initiative to combat the negative impacts of climate change in its southern coastal areas of Bangladesh.

Under the leadership of the Sustainable and Renewable Energy Development Authority of Bangladesh (SREDA), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in Bangladesh started installing Solar Photovoltaic Pumping (PVP) Systems for drinking water supply in 2010. Given the success of the first year's program, further funds were made available in the following years for the construction of more such systems. During the past five years, the project has supported the construction of 122 drinking water pumping and distribution systems for the disaster affected southwestern part of the country. These plants currently supply 1.9 million liters of drinking water every day. SREDA has won the South East Bank Ltd Green Award for the impact on sustainable development and tackling climate change caused by this exemplary project.

Despite the success of this initiative, a lot more is yet to be done; because for a population of over 8.5 million, 122 drinking water inputs are grossly insufficient to meet the suppressed demand for safer drinking water services. To address this dire situation, replication of such self-sustain scalable service models under the leadership of Bangladesh Government is the only longer term solution.

Objective

Both GIZ and SREDA are at present working in close collaboration in order to develop an institutional framework to incorporate these drinking water systems under the appropriate authority of Bangladesh Government. The aim is to bring them under direct leadership of the government who also has the proper prerogative to manage, regulate and ensure access to water services. Once such a suitable operational and institutional mechanism is in place, it can be then further replicated to address the drinking water needs of the greater population of disaster prone southern coastal areas of the country.

Solar Powered Drinking Water Systems

A brief description of SREDA and GIZ's work is given below:

<u>Geographical Location:</u> During the years from 2010 to 2015, GIZ has constructed 122 PV water pumping systems in the coastal areas of Bangladesh. These systems have been installed in 6 districts in the south western part of the country. They are: Satkhira (25 units), Bagerhat (48 units), Borguna (10 units), Pirojpur (3 units), Khulna (35 units) and Gopalgonj (1 unit).

The Infrastructure and System Design: The Photovoltaic water pumping and distribution systems draw water from surface ponds or underground sources and pump it into water tanks mounted on hurricane-proof overhead concrete platforms, from where a number of pipes lead to various water distribution points in the villages. Groundwater sources are being used for 35 plants, surface water sources for 85 plants and saline water source for 2 plants. Overall, about 1 million liters can be drawn from surface water sources and about 0.9 million liters can be drawn from ground water. The PV pumping units for drinking water supply have been constructed using three different technologies. They are Pond Sand Filter (PSF), underground water source and desalination units. PSF has been used in 85 systems, underground water source in 35 systems and desalination technology in 2 systems.

PSF method is used for surface water treatment, such as water from ponds or river. The system has 3 main components, namely, water filtration system, solar pumping system and water distribution system. It is a conventional and popular technology used for the filtration of pond water in coastal belt areas with high efficiency in turbidity and bacterial removal. In the underground systems, filtration is not required as the water is safe and suitable for drinking. In these systems water from deep aquifers is drawn with the help of submersible pumps operated by solar panels. Finally in desalination plants, a battery bank is installed with the solar panel to ensure 24 hours clean drinkable water supply. The solar energy is supported by solar panels to charge the battery and provide power supply to other motor pumps. The saline water is filtered in 2 mechanisms, namely pre-treatment and reverse osmosis (RO) section.

Water Distribution: The installed PV pumping plants have water distribution capacities ranging from 5,000 liters/day to 30,000 liters/day. For each installed plant, on average, 236 households are able to receive drinking water from a total of about 9 dispensers. From each dispenser, an average household is able to receive 7.2 liters of water per day. Using gravity force, the PVC pipes carry the water from the plant site up to a distance of about 2 Km.

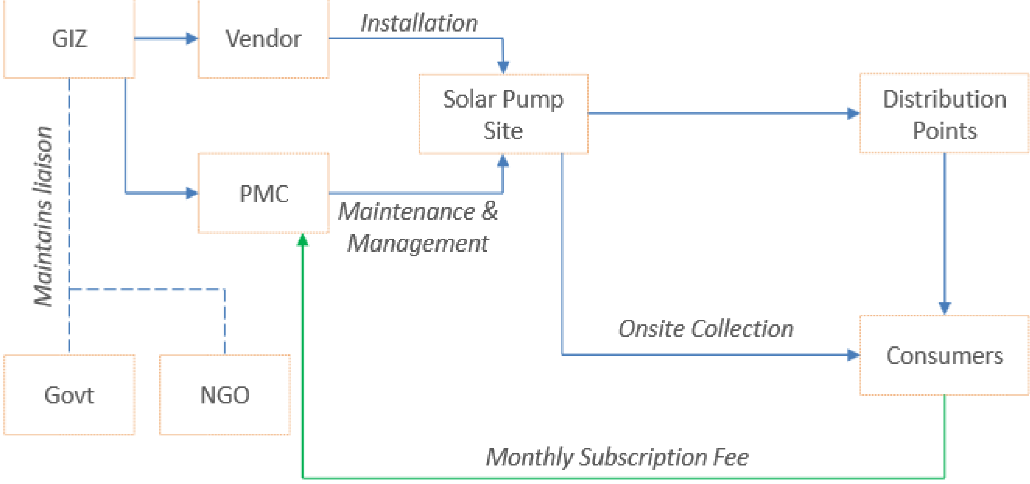
Investment Breakdown: The following figure shows the capital and major expenditures for the 3 technologies over a span of 20 years. 20 years is considered as the project life cycle based on the warranty period of solar panels. The land cost and the operational cost has not been included in the investment breakdown.

	PSF System	Ground Water System	Desalination Plant
Capital Investment	**17,15,000 BDT** **System capacity 5/10/15 K Liter/Day** 5K Lt per day Pond Sand Filter (3-5yrs) 5K Lt Overhead Tank 300W DC Submersible EE Pump (2) (5yrs) 300- 1000W Solar PV system (20yrs) Distribution system of 2Km max radius with 8-10 dispenser points	**20,00,000 BDT** **System capacity 10/20/30 K Liter/Day** 5K/10K Lt. Overhead Tank 300 W DC submersible EE Pump (5yrs) 740 W Solar PV system (20yrs) Distribution system of 2 Km max radius with 8-10 dispenser points	**40,00,000 BDT** **System capacity 10 K Liter/Day** 1/2k lt per hr Desalination Plant (5yrs), RO machine & water treatment filters (5yrs), UV Sterilizer (5yrs), 2K Liter storage Tank, 300-3.7KW DC submersible EE Pump with inverters (3) (5yrs), 12K W Solar PV system (with 100Amp/Hr battery, 5yrs) (20yrs)
Major Replacement	**10,20,000 BDT** Replacement of both DC Pumps every five years . In 20 yrs three times. Replacement of PSF media every three years. In 20 yrs six times.	**4,50,000 BDT** Replacement of DC Pumps every five years . In 20 yrs three times.	**20,00,000 BDT** Replacement of membrane every three years . With five years warranty, in 20 yrs five times. Replacement of Pump with inverter and Battery every five year. In 20 yrs three times.
Major Maintenance	**2,00,000 BDT** Regular maintenance of Dispenser point. Approx. 10,000 BDT each year	**2,00,000 BDT** Regular maintenance of Dispenser point. Approx. 10,000 BDT each year	**4,50,000 BDT** Regular maintenance of filters. Approx. 30,000 BDT each year after five year warranty
	29,35,000 BDT	**26,50,000 BDT**	**64,50,000 BDT**

The Desalination plant is the most expensive technology as it has the highest initial expenditure and major replacement and maintenance cost. Next is the PSF and Ground Water System respectively. In some cases, community contributed in cash and in most cases in labor. However, the community contribution never exceeded more than 10% of the project cost and mostly to develop the distribution system. External contribution is inevitable and these funds have to be incorporated with the institutional framework.

The plants have additional operational costs in the form of caretaker's salary, minor maintenance and repairs. These can be recovered from the revenue generated and won't require external assistance. The price has to be set at a level that is bearable for the beneficiaries and at the same time allows room for economic advancement, ergo make the pumps financially viable.

Present operation and potential/future institutionalization



Current operational mode GIZ maintains a close liaison with local government and NGOs and a plant is constructed upon approval and in collaboration with the locality. A Plant Management Committee (PMC) is formed under the supervision of the local government representative and is responsible for overall management and maintenance of the plants. It appoints a caretaker tasked with the responsibility of ensuring access to water, providing technical supervision, basic servicing, trouble-shooting and generating revenue via subscriptions.

While this caretaker dependent community based approach can work in a scattered micro level, to have a substantial impact on the overall water crisis situation a coordinated institutional and operational mechanism has to be at play.

Institutionalization The Ministry of Local Government, Rural Development and Cooperatives is the responsive agency to the construction and regular maintenance of most of the public infrastructures. Under this ministry the Local Government Division has several autonomous bodies that can be actively involved in the project.

There are the local Government institutions, i.e. City Corporation and the Paurashava; they usually have a direct role in planning, implementation and maintenance of rural water supply and coordinate the activities of public and private sector agencies, NGOs and other stakeholders.

This can be led by the DPHE which is tasked with the responsibility of providing advisory service to the Government of Bangladesh on water supply and sanitation and also provide support to the local government institutions on the development in operation and management of water facilities. The local government division remains the central authority for all these autonomous bodies and their activities. Then there is the National Forum for Water Supply and Sanitation (NFWSS) that can coordinate among different relevant LGD components. Finally there is the Policy Support Unit that provides technical assistance to develop and review sector policy strategies and plans; coordinate and monitor performances and facilitate capacity building in different tiers.