

**DEUTSCHE GESELLSCHAFT FUER  
TECHNISCHE ZUSAMMERBEIT (GTZ)**

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**PROMOTION OF THE USE OF RENEWABLE ENERGIES (PURE)**

***EXECUTIVE SUMMARY OF  
FIELD VISITS - REPORT - I***

**IDENTIFICATION & ASSESSMENT OF THE APPLICATION POTENTIAL OF  
OF SOLAR PHOTOVOLTAIC WATER PUMPING INITIATIVE (PVP)  
IN BANGLADESH  
(STAGE-I A)**



20 July 2006

VISIONS

***“Plug your Drinking Water Supply to the Sun”  
“Green Pumping for a Greener Bangladesh”***

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**Dr.-Ing. Khursheed-UI-Islam  
Energy Project Development & Management Consultant  
GTZ-PURE**

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## ANNEXURE

- The Field Visit Questionnaires ('A' & 'B') / Data-collection Format
- Some Selected Photos of Field Visits in Bogra Rural Development Academy (RDA) and the Barind Multipurpose Development Authority (BMDA)
  - Typical Rural Piped Water Supply for Drinking Water and Small scale Irrigation at Bogra (rural backyard vegetable growing)
  - A proud customer shows his Water Tap - the old Hand Tube well is no more used
  - The DTW Pumphouse with Pre-paid Metering System at Barind, Rajshahi
  - The PVP Initiative set up by LGED (under SRE/SEMP Project) at Nachole (a 1.8 kWp PVP Initiative for rural water supply)
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  - Photos showing the key Experts with whom interactions were made by the Consultant at RDA, Bogra and BMDA Rajshahi

## 1.0 BACKGROUND

This Interim Field Report (1) has reference to GTZ-PURE's assignment under Contract No. 83001737 and Project No. 022129100100 - Promotion of the Use of Renewable Energies, whereby the **Stage-1A Works** (Inception/Study Phase) are required to be performed, as per the Terms of Reference (TOR), to identify and assess the potential of **Solar Photovoltaic Pumping (PVP) Initiative in Bangladesh**.

To perform the said Stage 1A tasks, the Approach Methodology of the Proposal on PVP Initiative (Section 7.0 - A and B of the Proposal) included both primary and secondary data/information collection/feedback for situation analysis of both the Piped Safe Drinking Water Supply and Irrigation for Agriculture in rural areas through field visits and interactions with appropriate institutions/individuals/ engaged in application-oriented 'pilot projects' and also large scale sustainable/commercial operation.

## 2.0 RATIONALE BEHIND SELECTION OF BOGRA FOR AS AN AREA OF FIELD VISIT

In partial fulfillment of the requirements of Stage-1 A works, exchange of ideas and experience for feedback and also for primary and secondary data/information collection on irrigation and rural water supply aspects, interactions with water management and irrigation professionals/experts were necessary for which the Bogra and other 'Barind' areas of North Bengal, were selected as the area of major focus. The travel and field visits were conducted from 8<sup>th</sup> and continued uninterrupted up to 13<sup>th</sup> July'06 and covered most of the areas of 'Barind' with bases at two logistically convenient places - the district towns of Bogra and Rajshahi. The total field trip - Dhaka-Bogra-Natore-Rajshahi, field visits to other areas of 'Barind' and back to Dhaka covered a distance of about 1040 km with a field vehicle (Microbus). The 8<sup>th</sup> and 13<sup>th</sup> of July (Saturday) were chosen for (day)travels from Dhaka to Bogra and back from Rajshahi, with a further interaction and site visits.

Bogra and the 'Barind' areas of North Bengal were selected to cover major part of the field visits for this study which has the objective to explore the potentiality for use of PVP for safe rural drinking water supply and irrigation based on the following reasons :

- the Rural Development Academy (RDA), which is a Government-supported (Ministry of Local Government & Rural Development (LGRD) institution conducts Action Research, i.e. sets up 'Flagships' in the field of Irrigation, integrated with Arsenic-free Rural (Piped) Water Supply and also on use of appropriate (renewable) Energy Technologies (presently being involved with Bio-gas).
- RDA is located only about 10 km from Bogra and has set up several integrated Rural Piped Water Supply & Irrigation Projects. They have good potential sites at their disposal with availability of about 30 - 50 acres of land where PVP 'pilots' could be set up, whereby the long experience of RDA with low cost tube-well technology, both for irrigation and rural water supply could be integrated with the proposed GTZ-PURE's PVP Initiative
- RDA is fully authorized to sign MOUs directly with foreign donors, Governments and NGOs for development, promotion and replication of appropriate technologies, without undergoing much bureaucracies through the normal government procedures.

## 2.1 INTERACTIONS WITH RDA, BOGRA

Mr. Matin, Joint Director, RDA Bogra and Centre for Irrigation & Water Management (CIWM), and Mr. Nazrul Islam Khan, Dy. Director, CIWM/RDA, were the key professionals with whom major interactions were made at RDA Bogra, both on the 9<sup>th</sup> of July'06 (whole day) also on way back from Rajshahi (Barind area visit) to Dhaka on the 12<sup>th</sup> of July'06. The interaction with the Director General (DG) was made on way back to Dhaka, i.e. on the 12<sup>th</sup> of July'06.

On being explained the mission of the visit on the PVP Initiative of GTZ-PURE on the 9<sup>th</sup> of July '06, Mr. Matin, Joint Director showed keen interest on the subject, as the electrified DTWs are suffering also from the long power outage problems of REB/PBS Grid for Rural Piped Water Supply and Irrigation. Mr. Matin deputed Dr. M. Hamid, Dy. Director (Education & Training) and Mr. M.A. Mannan, Administrative Officer of RDA for the field visits to sites where integrated irrigation rural water supply and irrigation projects, set up by RDA, were being operated. As much as data/information possible were collected and discussions held on the possibility of the use of PVPs as Pilot for eventual dissemination.

The keen interest to support and work with GTZ-PURE's PVP Initiative, the cooperation and the hospitality extended by all officials of Bogra - especially that by the Executive Director - Mr. Abdul Huq, Mr. Matin, Joint Director, Dr. Hamid, Director (Education & Research), Mr. Nazrul Islam Khan, Dy. Director CIWM/RDA and by Mr. Mannan, Administrative Officer is greatly acknowledged with thanks.

### 2.1.1 HIGHLIGHTS OF THE OUTCOME OF INTERACTIONS WITH RDA/CIWM BOGRA

The following are the **highlights** of the key outcome of the visits and interactions held with RDA, Bogra :

- RDA/CIWM is keenly interested in an action-oriented PVP Initiative for Water Supply and Irrigation/Water Management, as they believe that powered irrigation initiatives are best utilized with better occupancy, i.e. with diversification of the uses of water for drinking, irrigation, aquaculture, horticulture and the like. RDA also implements such 'pilots' with a target to make them financially viable/self-sustainable.
- RDA/CIWM keen to offer their partnerships in the PVP initiative(s) of GTZ-PURE, offered to come forward with specific appropriate sites and their own investments in terms of financing and implementing the water well, the O.H. Tank facilities and water supply network for conducting semi-commercial/commercial oriented field tests of PV Arrays and Inverter or complete pumping systems, if and when provided by GTZ-PURE, with the objective of replication, whereby a proper financial model can be developed for investment and cash flow earnings for its return.
- RDA and CIWM are mandated for "Creation of Additional Employment, Increase in Marginal Productivity of Labour in Rural Economic Activities and Poverty Alleviation through Irrigation and Water Management"
- RDA is fully authorized, as mentioned by the DG of RDA, to sign direct MoUs/Agreements with NGOs, donors and promotional agencies of foreign Governments, without undergoing much bureaucracy, faced by other Government institutions. Matching funds from the Government of Bangladesh are easily allocated to RDA for good replicable 'flagship' projects which converge agriculture and energy as they have earned a good reputation.
- The Rural Piped Water Supply and Irrigation models developed by RDA appear to be commercially interesting models where people are paying for safe drinking water and irrigation. From about 100 households x 4 heads/day x Tk. 1/- per head per day, RDA models are generating about Tk. 11-12,000/- per month (i.e. Tk. 144,000/- per month. (see Annexure for Photograph and details).
- It is interesting to note that the above project visited (at Chandigona site), only a few km from RDA in a rural area is being run and operated by a private association (Chaksatra Krishok Samity). The project cost, including Pump, O.H. Tank (30,000 litre capacity) installed at a height of about 35 feet from ground has been about Tk. 1,800,000/-. Five of the key association members made contributed 10% downpayment, i.e. Tk. 180,000/- and the balance of the money is being paid by them in 10 installments.
- The connectivity (given through 4" dia main 'feeder' PVC pipes) is available for minimum of a further 100 nos of households within about 1 sq. mile of area and the consumer connections are expanding, whereby interested rural household owners are coming forward with the costs of the PVC water distribution lines. The existing 13,000 rft of feeder and water distribution lines has cost about Tk. 500,000/- (included within the initial total investment of Tk. 1,800,000/-) and goes down to various smaller dia. (up to ¾" and ½" for Faucets. At the rural households, the last portion (Standpipe + Faucet) of the installation is made of G.I. pipe for the strength and durability.
- A nearby rural small entrepreneur (a 1000 Bird Poultry operator) and a road side restaurant has also taken water connections and are happy with the water supply system, paying regularly for the water.
- Apart from investing the viability of small sized PVPs in off-grid areas with diesel-driven pumps, RDA/CIWM requested to investigate also the viability of Grid-PVP Hybrid systems would also be interesting to look at, considering the power outage and lower capacity utilization of the 5 kW, 7kW and 10 kW Pumps, which can be used for all purposes of water use, i.e. Safe Rural Drinking Water Supply and Irrigation for growing appropriate agricultural crops.
- Mr. Matin, the Joint Director showed a potential site in close vicinity of the Academy where an office is being constructed with a Water Borehole and a DTW (total dynamic head 25 m) only where a PVP can be installed. An area of about 30 acres is available around this site, where there is also a wholesale vegetable market.

- Mr. Nazrul Islam Khan, Dy. Director showed another site near Mahasthan Gar, Bogra where a grid-connected DTW facility (7.5 kW Motor) with an Overhead Tank Capacity of 20,000 litres can be made available for testing PVP Initiative, either as a separate (Stand-alone PV Pumping or a Grid-PVP hybrid with the existing electric Pump can be set. CIWM has developed and sold this installation to an association of farmers at a cost of about Tk. 840,000/-

The association, headed by a key manager, has to pay back the investment through a separate account with a 10% down payment to CIWM/RDA over a period of 10 years.

Mr. Matin, the joint Director RDA and CIWM and Mr. Nazrul Islam Khan, Dy. Director CIWM/RDA, are both known for their dedicated works in the Irrigation & Water Resources sectors, related to agriculture and rural water supply. They informed that in fact, the RDA models, established through commercially-oriented field tests/'Flagships', have been replicated in large numbers in other areas of Bangladesh, especially in the entire Barind region.

The next destination of the field trip and appraisal had been the 'core' area of 'Barind', with camp at Rajshahi Parjatan Motel (11<sup>th</sup>- 12<sup>th</sup> July'06).

### 3.0 RATIONALE BEHIND SELECTION OF THE 'CORE AREA OF BARIND' FOR THE FIELD VISIT

- the 'Barind' area covers greater Rajshahi, Rangpur, Dinajpur, Bogra and partly also Pabna with a total area of about 7,770 sq. km of land, geographically situated between latitudes 24°20' N to 25°35' N and longitudes 88°20' E to 89°30' E.
- Once about 55% of this area was covered with forest. But due to agricultural activities most of this forest area was destroyed as a result of which in the Seventies **most part of this area became almost a 'desert' (an arid zone)**, with long periods of draughts and extreme climatic conditions (very hot summers and winters, compared to other areas of Bangladesh).
- A number of experts had opined that the quantity of Ground water in the Barind area is so small that it cannot be lifted and there is little hope to turn this area back into a good agricultural land for crop production.
- **With appropriate Ground and also surface water by Powered Irrigation** (both Diesel and Electric) to-day Barind has set a model for a sustainable Irrigation and Water Supply Management in Bangladesh
- **Four large Photovoltaic Pumps** ( 2 x 1.8 kWp + 2 x 1.2 kWp, i.e. **total 4 kWp**) have been installed (initially) **in 4 villages of the Barind** area under the Sustainable Rural Energy (SRE) and Sustainable Energy Management (SEMP) Programmes of LGED to field-test the technical feasibility and social acceptability of the PVPs for Rural Water Supply and Irrigation applications with 4 nos. of DTWs and 4 x 10,000 litres of O.H. Water Supply Storage Tanks. [ details under Section 3.1.1.1]

### 3.1 INTERACTIONS WITH BARIND MULTI-PURPOSE DEVELOPMENT AUTHORITY (BMDA)

Interactions were made with the Barind Multipurpose Development Authority (BMDA) through its Executive Director - Dr. Asad uz Zaman and with Engr. Mannan, Director BMDA both of whom are renowned as very dedicated Deep Tubewell/Irrigation/Water Management professionals.

On being briefed on the mission of the visit - the PVP Initiative, supported by GTZ-PURE, both Dr. Zaman and Engr. Mannan appreciated the mission of the Initiative for Water Supply and Irrigation and expressed their interest to support this initiative by extending all required cooperation in terms of providing with the necessary information data/MIS information and supporting the field visits to the PVP Pumping area (Nachole and the surrounding 'Eco-villages) with an administrative officer - Mr. Mahfuzul Haq.

### 3.1.1 HIGHLIGHTS OF THE OUTCOME / FINDINGS OF INTERACTIONS WITH BMDA, RAJSHAHI

The following are the highlights of key observations/findings of Interactions with BMDA key officials and the field visits in and around the 'core' area of Barind.

Notes on **BMDA's history and its Success Story** in the irrigation and rural water supply sector :

- Disregarding opinions of a number of experts that very little or only non-sustainable Ground water reserves can be found and/lifted, some dedicated experts/professionals, officers and workers of the erstwhile Bangladesh Agricultural Development Corporation (BADC) under leadership of Dr. M. Asad uz Zaman - a renowned Tubewell and Agricultural Irrigation Expert who started his career in BADC since the early days of this institution, founded the BARIND Integrated Area Development Project (BIADP) and took up the challenge for irrigating this area and turn it back into a productive agricultural zone. Under this project about 3000 nos of deep tubewells (DTW) were installed. Before start of the BIADP, only 13% of the cultivable land area was under irrigation and the crop intensity was recorded at about 117%.
- After commissioning the powered irrigation project, about 53% of the cultivable land could be brought under irrigation and the crop intensity almost doubled to about 214.88%.
- Being highly encouraged, inspired and motivated by the enormous success, the then Government of Bangladesh founded the Barind Multipurpose Development Authority (BMDA) on 15<sup>th</sup> January 1992, with its Head Office at Rajshahi.
- To-day, with over 9044 DTWs and also using a significant number of surface water sources for irrigation, such as rehabilitated ponds (70,000 nos) and also a 21 km long canal where about 24 cusec of water flows from the Padma river by installing ten (10) nos of cross-dams and twelve (12) nos. of underground water pipelines, the Barind area has become a success story to practically demonstrate the potential of irrigation.
- To make optimum utilization of the DTWs, the BMDA has also installed 213 nos. of O.H. Storage tank-based safe rural drinking water supply systems (with capacities of 20 - 25,000 litres), using low-cost (PVC) underground network to rural households (about 40 Nos of Stand-pipe Water Faucets in a village of about 150 - 200 people). The ground water of DTWs at Brind is quite safe (tested to be free of arsenic and other contaminations). Such drinking water supply systems have become quite popular in the rural areas, being safe and convenient. Normally, without such facilities the rural women have to pull water, using ropes and buckets, in most cases without pulleys, from 'Kuas' (dug wells) with 40 - 50 m depths, spending much time and energy, which caused physical fatigue. The water from 'Kuas' are also vulnerable to contaminations.

The rural people are paying for the drinking water at about Tk. 1 - 1.5 per head per day, i.e. for a family of 4 about Tk. 120 - 160 per month per household, which means for Tk. 24,000 - 32,000/- per month for a village with 200 households or about Tk. 262,000/- to Tk. 384,000/- per year

- The Farmers are paying also for the Irrigation water at about Tk. 85/- per hour and a pre-paid card metering systems has been introduced which has made the payment system very transparent and convenient (see Annexure)
- A Pre-paid metering systems has now been introduced by the Barind Authority, which when inserted into a DTW Pump house Meter turns on the Irrigation Water. The Payment Rate is about Tk. 85/hr. for Irrigation Water and Tk. 85/hr. + 10% per hour for drinking water.

### 3.1.1.1 VISIT OF THE FIRST PVP ‘PILOT’ IN BARIND & SOME OBSERVATIONS ON SAME

The Barind Authorities success in integrating the rural drinking water supply and irrigation/other diversified economic use of the PV pump, such as for aquaculture inspired LGED, under its Sustainable Rural Energy (SRE) and Sustainable Environment Management Programmes (SEMP), funded by UNDP, to ‘pilot test’ 4 nos. of Solar PVPs in 4 Villages at Barind, which were also visited. The installations have been handed over by LGED/SRE/SEMP to BMDA last year

The following are the details of the PVP Initiative at Barind :

Overhead Storage Tank Capacity of all PVP DTWs = 10,000 litres

Location	PV Array Capacity	Tot. dyn. Head(m)	Water Lift Litres/day	Cost (Tk in lacs)
1) Nachole	1.8 kWp	50m	26,000	7.3
2) Shapahar	1.8 kWp	50m	26,000	7.3
3) Porsha	1.2 kWp	50m	13,000	5.7
4) Patnitala	1.2 kWp	50m	13,000	5.7

The initial tests with these PVP are very close to the objectives of the proposed Stage-1 A of GTZ-PURE’s PVP initiative,

- i.e to provide safe rural drinking water
- to replace small high maintenance and recurring imported fuel cost based Diesel Pumps
- to test and replicate their application in irrigation

However, the GTZ-PURE Objective is to start the PVP initiative with a Feasibility Study (Stage-1 A) to analyze the various PVP Options and Recommendations with the ultimate objective to implement an a PVP Initiative in Bangladesh, if found viable, start ‘Flagships’ and replicate same with an appropriate financial mechanism.

### SOME OBSERVATIONS ON THE PVP INITIATIVES INSTALLED IN THE BARIND AREA

LGED/SRE/SEMP effort is appreciated in terms of putting up the first 4 nos of PVPs of mentionable capacities (total 6 kWp). The SPV Panels were found to be well installed. However, the following observations need to be made on the overall project design and set up, to improve the initiative :

- (i) The access road to the project site becomes very muddy and slippery when it rains. Since it had been raining during the time of the site visit (which had been continuing since about three days before the site visit), the sloping approach could be crossed and the Pump installation reached only with great difficulty, because of the wet slippery clay. This fact was also being complained by the beneficiaries (about 30 households, living the project area).

A Pilot or a ‘Flagship’ project area must have a good access, as it is often visited by many including International donors. The accompanying official of the BMDA, who also literally fell down in the slippery mud, has taken a note of this being made aware by the Consultant. The dwellers were suggested to grow grass at the site and also put coarse gravels/’khoa’.

- (ii) The O.H. went dry, as tested at the Stand pipe faucets, during three days of rain, the reason being lack of sunshine, since the PV pumping did not function due to the rains. The Overhead Storage Tank of 10,000 litres capacity appears to be under-designed, as admitted by the BMDA. At least 20,000 (preferably 30,000 litres) capacity tanks should have been built, as otherwise the objective of the piped water supply system will be lost, creating frustration of the beneficiaries on the reliability of the system who in spite of being poor, are paying for water. Under present circumstances, an arrangement for rain water harvesting on the Tank top (with a sloping C.I. roof and half-cylindrical large dia. PVC pipes) may be set up to compensate for the capacity gap during continuous rains.

- (iii) The 30 households in the project are paying quite nominal charges (Tk. 1/- per head per day). The poverty level of the PVP initiative, set up a Nachole and other Barind areas is high, the average income per month being less than Tk. 1,500/- per family. From experience in dissemination of RE technologies, even if targeted eventually for poverty reduction it is difficult to bring a 'Flagship' project to success, as the ability of the beneficiaries to pay would be lacking. Water supply to the rural middle class households should be targeted to make rural PVP initiatives viable from earnings of safe drinking water and irrigation.
- (iv) However, as Dr. Asad us Zaman, addressing the issue of popularizing rural water supply observed that if with first 6 months of operation of piped water supply when the house wives under the comfort and convenience of piped water, they will persuade their husbands in nearby households to take connection and pay the cost of water. They have plans to slowly increase the rural water supply charges with an 'induction period' of sales for a 'new' technology, in marketing terms.

#### **4.0 SOME PRELIMINARY THOUGHTS ON A PV-GRID HYBRID DTW PUMPING SYSTEM**

Electric motor-driven DTWs (15 kW avg. motor ratings) of BMDA are facing significant problems due acute power outages and/or low voltage problems from REB/PBS grid, especially during the irrigation seasons (December - April).- a period when the sun shine is strongest. BMDA irrigation engineer - Mr. Mannan requested, therefore, to investigate the possibility of operating pumps with large (7.5 kW - 20 kW) capacities with large PV Panel-Inverter systems, with switch to change-over from Grid to PV and vice versa. Mr. Matin and Nazrul Islam Khan of RDA has made the same observations, as mentioned. The reason for such observation is obvious. The Chapai-Nawabganj incident in the Barind area is the best example how bad it can be when there is no electricity, or only 2-3 hrs. of electricity for the Pumps. War-like situation developed, as reported by the press and people died in riots with police, as they were being deprived of the irrigation water due to lack of electricity for their irrigation pumps from REB/PBS lines.

Considering the special Bangladesh situation, they requested that apart from evaluating the competitive advantages of PVPs with Diesel Engines in the small capacity ranges (500 Wp - 4 kWp), the techno-economic feasibility of switching over from grid A.C. power for to large PV Panel-Inverter systems (7.5 kWp, 10kWp and 15 kWp) could be interesting to analyze and test on a pilot basis, as it is almost certain that the situation for sustainable power supply would not be available from all practical consideration.

Since investments in DTWs (with Mono-submersible Pumps) have already been made by BMDA (each 15 kW or 20 H.P. system costing about Tk. 2,500,000- per DTW to BMDA (equivalent to about US\$ 30,000.-) for an irrigation plus O.H. Drinking Water Supply system, the differential investment for such a hybrid system, if a techno-economic evaluation turns out to be positive, would be for large PV-Panels & Inverters only, which, in spite of their high initial (capital) costs, may turn out to give a reasonable pay-back period due to the much better revenues, attainable through maximum utilization of the pumps water capacity. Presently, due to electricity outages and low voltage problems, the pumps are highly under-utilized with an average operating period of only 1050 hours per year per DTW !

Apart from making investments in the BMDA has to make their own investments, both for the water well, as well in constructing their own long Power Transmission (33/11 kV) & Distribution(440/380 V) and once they are completed by BMDA REB/PBS energize them after inspection. One sees miles after miles of such transmission and distribution lines just to connect a few DTWs. The cost of long Transmission & Distribution lines, which BMDA is investing are, on the average about US\$ 30,000.- per mile of 33 kV, US\$ 20,000/mile for 11kV and Us S\$ 10-12,000 per mile of construction. These do not include the additional cost of substations, in which also BMDA has to invest heavily.

#### **AN INTIAL 'BRAINSTORMING' ON THE POSSIBILITY OF IMPROVING THE ENERGY EFFICIENCY AND ENHANCING THE SYSTEM RELIABILITY BY USING PV-GRID HYBRID DTW**

Being explained by the Consultant to BMDA that the Panel-sizing and Inverter for such (10 kWp) would be quite large and expensive, although theoretically there are no technical upper limits to the power ratings of PV Panels + Inverter systems, the cost of a 10-15 kWp Array (of PV Panels + Inverter only) would be in the range of than US\$ 40,000.- 60,000.- (Tk. 28 - 42 lacs). However an economic and financial analysis of this option, considering the macro and micro-economic/financial benefits, would be interesting to look at, considering the special difficulties encountered in operating grid-connected pumps during day-time in Bangladesh, being a country which suffers from both an acute shortage of power and also imported diesel.

The acute power crisis being an unique situation in the context of Bangladesh, which is not expected to improve in near future, the suggestions of both RDA and/ or BMDA deserve to be analyzed both from macro and micro-economic considerations, which will be the determining factors for decisions to try such large PVP-Grid hybrid systems with change-over facilities as 'Pilots'. It could be very similar to the present Grid-connected roof top PV Systems which are typically built for 3.0, 4.0 5.0 kWp and also 10 kWp and higher ranges with A.C Inverters and a metering system. The Inverters produces quality A.C. electricity, with a 'Net-Metering' arrangement with the utility grid.

With a Net Metering System, there can be an arrangement that during the 6 hours of day time when the grid fails to provide power, which it mostly does, the E-Motor, as load will seek power from the PV Array-Inverter, that may be installed on the Pump-house roof-top or installed as several separate arrays to make an easy sun-tracking. These PV-Inverters will supply electricity to the DTWs through a Meter. On dry winter days the daily electricity output of a 10 kWp Panel would be about 60 kWh (avg. 6 hours of Sunshine/day), which, at the REB/PBS sales rate of electricity for irrigation (about Tk. 3/kWh, would mean about Tk. 180/day or Tk. 68,800/- year At night when there is no sunshine, the DTW Pump will draw electricity from the grid through the same Meter, turning it in reverse direction. Having got almost continuous 6 hrs. electricity from the large PV Array only a few hours of operation from Grid may be necessary. Preliminary estimates indicate that even with an investment of US\$ 30,000.- for the DTW + US\$ 40,000 = US\$ 70,000.- per DTW, there can be a reasonable pay-back on such a hybrid system, whereby the RDA/BMDA will buy the Systems and sell it to the 'farmers associations', say, groups of 100, who may pay it back over a period of 10 years from the savings on REB/PBS electricity bills, Even in absence of a Net Metering Policy which is yet to be introduced by the Bangladesh Government (India has also already introduced it), the same can be achieved with a simple manual **change-over switch**, the kind used for switching over to emergency generators. No sophisticated protection circuits are needed

## 5.0 DATA / INFORMATION ALREADY COLLECTED

The following basic data / information have already collected from BMDA

- (i) Total Number of operating DTW Power Pumps (Diesel + E-driven)
- (ii) Historical growth of DTWs in the Barind area and trends of Electrification of Diesel Pumps
- (iii) Data on sustainable Financial Operation of Barind through earnings from Irrigation
- (iv) and Water Supply Revenue (Earnings, O & M Costs & Other Expenditures and Operating Surplus)
- (v) Typical maintenance costs of Diesel Pumps
- (vi) Ideal hours of operation of E-driven Power Pumps hours available due to power outages and low voltages when E-Motors do not operate
- (vii) Total Earnings of the BMDA from Water Sales (Irrigation + Water Supply)
- (viii) Total Electricity Bills paid by BMDA to REB/PBS
- (ix) Total Number of beneficiary Farmer families
- (x) Total Area under Irrigation
- (xi) Crop Production
- (xii) Estimated Value of the Crop produced
- (xiii) Data on sustainable O & M coverage with net surplus (Water Revenues less the Electricity Cost + Other Costs and Net Operating Surplus after covering all Expenses.

While the details of above are presently under evaluation and are expected to be presented in the Main Report on Stage-1A it is interesting to note the following **KEY IMPACTS** of BMDA's powered irrigation, in technical, financial and also socio-economic terms :

Year	Nos. of DTW	Nos. of Farmer Families benefited Nos.	Irrigated Area hectares	The estimated Value of Crops produced (Billion Taka)
2004				
/2005	9,044	1.104	337,406	<b>15.30</b>

### **FINANCIAL OPERATING PERFORMANCE**

Year	Income (million Tk)	Electric Bills paid (million Tk.)	O & M and all Costs (mill. Tk)	Oper. Surplus (mill.Tk)
2004				
/2005	<b>478.74</b>	225.94	458.93	<b>196.38</b>

The above performance is indicative of BMDA's good operational and financial management.

## **5.0 FURTHER PROGRAMME FOR COMPLETION OF STAGE-1 A WORKS**

Based on the field visits already made, it is felt necessary that about 3 - 4 more Interactions with the following institutions may be required, to start the full-blown desk work for evaluation to prepare and complete the techno-economic feasibility of the PVP Initiative :

- (i) Interaction with Bangladesh Rice Research Institute (BRRI), Gazipur
- (ii) Interactions with Bangladesh Agricultural Research Institute (BARI), Gazipur
- (iii) Interaction with Bangladesh Agricultural Research Council (BARC)

With the above interactions done by the end of this month, the Stage-1A field visits/data/information/feedback collection is expected to be completed and the desk work/evaluation started to complete and submit the Draft Final Report within the schedule, as stipulated in the contract.

## **ANNEXURE**

( Some Selected Photographs from Field Visits)

**RURAL SAFE (PIPED) DRINKING WATER SUPPLY PROJECT  
BEING REPLICATED AT INITIATIVES OF RDA, BOGRA**



PICTURE SHOWS 30,000 LITRE CAPACITY O.H. DRINKING WATER TANK

[DEVELOPED AS A FINANCIALLY SUSTAINABLE PROJECT  
WITH INVESTMENT AND MANAGEMENT  
BY PRIVATE SAMITY]

KEY TECHNICAL & FINANCIAL DATA OF PROJECT  
IN FOLLOWING PAGE

## RURAL PIPED WATER SUPPLY PROJECT AT BOGRA



Mr. M. A. Mannan, Admin. Officer, RDA (left), Dr. M. Hamid and the Association Leader (right) looks on as a Consumer proudly demonstrates the water flow at his faucet  
The old Hand Tube Well is out of commission

### PROJECT HIGHLIGHTS

PROJECT SITE	:	CHANDAIGONA (REB GRID AVAILABLE AT THIS PILOT SITE)
PROJECT DESIGN BY	:	RDA, BOGRA
INVESTMENT COST	:	ABOUT TK. 1,800,000/- (including a Water Treatment Plant, which is necessary for DTWs in a few places only, based on Water Analysis)
MANAGED & OPERATED BY CHAKSATRA KRISHAK SAM ITY (ASSOCIATION)	:	THE SAMITY MADE 10% DOWN PAYMENT FOR THIS DRINKING WATER PLANT (Tk. 1,800,000/-). THE BALANCE OF INVESTMENT WILL BE PAID IN 10 INSTALLMENTS TO RDA.
RURAL CONSUMERS CONNECTED	:	115 Nos and expanding (4" Dia. Feeder Pipes) through Consumers' Interests and contributions.
MONTHLY WATER BILL PAID BY CONSUMERS	:	Tk 1/- per Head per day for an Unit of 4-Head Family : Tk. 460/- day Per 4 Head Family Unit. Typically, the collection is average Tk. 12,000/- per month (Tk. 144,000/- per Year).

Note : The Barind Development Authority has replicated about 213 of such integrated Rural Water Supply and Irrigation Systems, using DTWs and the near term target is to reach over 3

## THE FIRST PHOTOVOLTAIC PUMPING PILOT INSTALLATION AT NACHOLE, BARIND AREA, RAJSHAHI

DESIGNED & INSTALLED BY LGED UNDER SRE/SEMP PROGRAMME OF UNDP  
AND HANDED OVER TO BARIND MULTIPURPOSE AUTHORITY

(A TOTAL OF 4 SUCH INSTALLATIONS HAVE BEEN MADE IN 4 VILLAGES)



### PROJECT HIGHLIGHTS OF THE FIRST PVP BASED WATER SUPPLY 'PILOT' AT BARIND

PV Solar Panel Array Capacity	:	1,800 Wp
Overhead Water Tank Capacity	:	10,000 litres (for Rural Water Supply)
Water lifting Capacity	:	26,000 litres on a clear sunny day
Total Dynamic Head	:	50 m
Number of Beneficiaries	:	About 30 Households (120 heads)
Cost of the PVP Installation	:	Tk. 730,000/

**THE PRE-PAID WATER METERING SYSTEMS  
FOR INTEGRATED IRRIGATION & RURAL DRINKING WATER SUPPLY  
FROM DEEP TUBE WELLS AT BARIND, RAJSHAHI**



PHOTO SHOWS THE PUMP HOUSE, THE PREPAID CARD-BASED WATER METER  
AND ALSO THE OVERHEAD DRINKING WATER STORAGE TANK  
WHICH USES THE SAME DTW USED FOR IRRIGATION

WATER FLOWS TO THE OVER IRRIGATION FIELD & OH DRINKING WATER SUPPLY TANK  
ONLY ON INSERTION OF THE PRE-PAID CARD IN THE METER

## THE IRRIGATION & WATER MANAGEMENT EXPERT TEAM AT RDA, BOGRA



Mr. Matin, Joint Director, RDA/CIWM, Bogra  
- a highly dedicated Irrigation & Water Management Expert at work



Mr. Nazrul Islam Khan, Dy. Director, Centre for Irrigation & Water Management, Bogra  
an Irrigation & Water Management Expert who also showed keen interests on PVP

THE MAN BEHIND BARIND'S SUCCESS STORY IN ITS IRRIGATION EFFORTS  
USING POWERED IRRIGATION DEEP TUBE WELLS

**DR. ASAD UZ ZAMAN, EXECUTIVE DIRECTOR, BMDA**



Dr. Asad uz Zaman also showed keen interest the PVP Initiative of GTZ-PURE  
and extended every support during Author's visit of the Barind area

THE AUTHOR WITH THE EXECUTIVE DIRECTOR, RDA, BOGRA  
MR. ABDUL HUQ



THE AUTHOR WITH **MR. MANNAN** (AT RIGHT), DIRECTOR, BMDA

A Very devoted Irrigation & Water Management Expert  
who is behind the materialization of Dr. Asad uz Zaman's Vision



MR. MANNAN SHOWED KEEN INTEREST IN PVP INITIATIVE OF GTZ-PURE  
HE ALSO INSPIRED TO LOOK INTO LARGER PVP SYSTEMS

**MD. SALAH UDDIN AL BITAR, GENERAL MANAGER, NATORE PALLI BIDYUT SAMITY-1**



THE GENERAL MANAGER, PBS, NATORE INFORMED OF A LARGE DIESEL BASED IRRIGATION PUMP ACTIVITY  
ACTIVITY IN HIS AREA AND SHOWED KEEN INTEREST AT GTZ-PURE'S PVP INITIATIVE