



REPORT

Workshop on

Technical feasibility, economic viability and social acceptance of solar powered pumps for irrigation and drinking water supply

Dhaka, Bangladesh
December 15, 2018



Bangladesh Water Partnership (BWP)

December 2018

Final REPORT

On

The Workshop

**Technical feasibility, economic viability and
social acceptance of solar powered pumps for
irrigation and drinking water supply**

Dhaka, Bangladesh

December 15, 2018

Table of Contents

Table of Contents	iii
List of Tables	iv
List of Figures	iv
Executive Summary	v
Abbreviations and Acronyms	vi
1.1 Introduction.....	1
1.2 Objective of the Workshop.....	1
1.3 Date and Venue.....	1
1.4 Preparation for the Workshop	1
1.5 Outline of the Workshop.....	1
1.5.1 Inauguration	2
1.5.2 Technical Session – 1	2
1.5.3 Technical Session – 2	2
1.5.4 Closing Session	2
1.6 Lessons Learned from the Workshop	3
1.6.1 Current Scenario in Irrigation and Drinking Water Supply	3
1.6.2 Models Available / Proposed	3
1.6.3 Solar Power and the Challenges	4
1.6.4 Overcoming the Challenges	4
1.7 Suggestions on the Topic for Future Workshops	4
1.8 Conclusion.....	5
Appendix–I: List of Attendees and Workshop Schedule	6
Appendix–II: Photographs of the Workshop	11

List of Tables

Table A.1: List of Attendees.....	6
Table A.2: Workshop Timestamps and Programme	9

List of Figures

Figure A.1: Inaguration: Recitation of the Holy Quran	12
Figure A.2: Keynote paper presentation, Inaguration Session Chair and Chief Guest	12
Figure A.3: Open session questions and discussions (1)	12
Figure A.4: Open session questions and discussions (2)	12
Figure A.5: Open session questions and discussions (3)	12
Figure A.6: Snapshot of presentation screen of keynote paper.....	12
Figure A.7: Participant’s queries.....	13
Figure A.8: First technical session	13
Figure A.9: Open discussion during first technical session	13
Figure A.10: Technical paper presentation during the first technical session	13
Figure A.11: Technical paper presentation during the second technical session ...	13
Figure A.12: Open discussion during the second technical session.....	13

Executive Summary

Bangladesh Water Partnership (BWP) in collaboration with Global Water Partnership (GWP) – South Asia held a workshop on technical feasibility, economic viability and social acceptance of solar powered pumps for irrigation and drinking water supply on December 15, 2018 at BRAC Centre INN, Mohakhali, Dhaka. The main objective of the workshop was to draw expert opinion and field experience from professionals of various disciplines to address the current challenges of solar powered pumps used for irrigation and drinking water supply in Bangladesh.

This day long workshop was divided into four sessions. The first session namely – the inauguration session included welcome address by Mr. H S Mozaddad Faruque, Vice President, BWP, a keynote paper presentation by Mr. Sheikh Reaz Ahmed, Director, Sustainable Renewable Energy Development Authority (SREDA) on current scenario of solar powered pumps in Bangladesh. In the Keynote paper it was indicated that a new business model solar pumps are being supplied to the users at a subsidized rate through the enlisted service delivery providers of SHREDA and users find this service more attractive than accessing finance through micro credit. The session included an open discussion and concluded with address from the Chief Guest – Mr. Siddique Zobair, Member (EE&C), SREDA & Additional Secretary, Ministry of Power, Energy and Mineral Resources. The Session Chair – Dr. Khondaker Azharul Haq, President, BWP summarized the discussion held during the session.

The second and the third sessions had two technical presentations each. The second session was chaired by Dr. Nilufa Islam, Vice President, BWP and Former Director General of Water Resources Planning Organization (WARPO). The first technical paper was presented by Dr. Md. Ayub Hussain, Chief Scientific Officer, FMPE Division, BARI on the topic “Technical and Economic Status of Solar Pump Irrigation System in Bangladesh”. The second technical paper was presented by Mr. Jalal Ahmed Choudhury, Power Plant Expert, CEGIS on the topic “Solar Power: An Eco Friendly and Cost Effective Power for Irrigation, Drinking Water Supply and Many More Uses in Bangladesh”, prepared under the supervision of Mr. Waji Ullah, Executive Director, CEGIS. Open discussions were held immediately after the presentations and the session was concluded by address from the session chair.

The third session was chaired by Prof. Dr. Umme Kulsum Navera, Professor, BUET. The first technical paper of this session was on the benefits of solar powered pumps on the environment and climate change and presented by Dr. Fazle Rabbi Sadeque Ahmed, Director, PKSf. The final paper of the workshop was presented by Dr. Khondaker Azharul Haq on behalf of Dr. Nilufar Banu, Executive Director/ Mr. Arifur Rahman, Senior Fellow, BUP on the topic “Solar Energy Based Water Solution for Climate Change Vulnerable Coastal Area of Bangladesh: A Pilot Study”. An open discussion followed the presentation of the papers in this session. The session was concluded by address from the session chair.

Important lessons were learned from the keynote paper and the technical papers that followed. Challenges those were faced in solar powered pumps and ways to overcome them had been addressed in the presentations and the subsequent open discussions. The open discussions were enriched by fruitful discussions and constructive arguments. The welcome address, the address of the Chief Guest and addresses from the respective session chairs masterfully summarized the need of the workshop alongside the key findings from the workshop and the main takeaways from it.

The workshop attendees acknowledged the takeaways from the workshop and unanimously agreed upon the benefits of conducting expert further in depth studies as the subject followed by similar workshops in the near future. In short, the workshop provided the foundation to improve the use of solar powered pumps in irrigation and drinking water supply in Bangladesh.

Abbreviations and Acronyms

BARI	Bangladesh Agricultural Research Institute
BRAC	Building Resources Across Communities
BUET	Bangladesh University of Engineering and Technology
BUP	Bangladesh Unnayan Parishad
BWP	Bangladesh Water Partnership
CDMP	Comprehensive Disaster Management Programme
CEGIS	Center for Environmental and Geographic Information Services
FMPE	Farm Machinery and Postharvest Process Engineering Division
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German)
GoB	Government of Bangladesh
GWP	Global Water Partnership
IDCOL	Infrastructure Development Company Limited
PKSF	Palli Karma-Sahayak Foundation
PPP	Public Private Partnership
PSMP	Power System Master Plan
REB	Rural Electrification Board
SDWS	Solar Drinking Water Supply
SIP	Solar Irrigation Pump
SIS	Solar Irrigation System
SREDA	Sustainable and Renewable Energy Development Authority
WARPO	Water Resources Planning Organisation

1.1 Introduction

The Government of Bangladesh (GoB) has envisioned the need to diversify the sources of energy to meet the future demand of power consumption in all the sectors. For such, the GoB has been encouraging the use of renewable energy where possible for quite some time now. Of the renewable energy sources, solar source is the most suitable and Bangladesh is in an advantageous geographical position for solar energy. This has brought the idea of use of solar power into discussions and there have been several success stories in the recent past. For instance, Bangladesh has the largest number of Solar Home Systems (SHS) in the world. However, there are other sectors those can yet become part of such success stories. The use of solar powered pumps in irrigation and drinking water supply are two such sectors. Not that these options have not been ventured yet but there have not been enough growth of solar powered pumps in these two sectors. There are probably multi-faceted socio-economic and/ or technical reasons as to why these two sectors have not been able to take full advantage of solar powered systems.

Thus, a workshop on technical feasibility, economic viability and social acceptance of solar powered pumps for irrigation and drinking water supply was organized by Bangladesh Water Partnership (BWP) in collaboration with Global Water Partnership – South Asia. The main goals of this workshop have been to identify the reasons those could potentially be holding back the expansion of solar powered pumps and the ways forward to change the current rather stalemate scenario.

1.2 Objective of the Workshop

The objective of holding this workshop was to bring on the table the current scenario of solar powered pumps used for irrigation and drinking water supply in Bangladesh for discussion and to share the experience and opinions of the experts.

1.3 Date and Venue

The workshop was organised in the Meeting Room No. 3 of BRAC Centre INN, 75 Mohakhali, Dhaka-1212 on 15 December 2018.

1.4 Preparation for the Workshop

Bangladesh Water Partnership (BWP) and Global Water Partnership – South Asia collaborated to organize this workshop. BWP invited several organization of interest for the topic of concern, i.e. solar powered pumps for irrigation and drinking water supply in Bangladesh, to share their organizational achievements and/ or views on the said topic. The workshop gathered a considerable pool of knowledge in the relative fields to share their expert opinions. The names and the respective organizations of the participants of the workshop has been appended as **Table A.1** in **Appendix-I** with this report. The hosts reserved BRAC Centre INN in Mohakhali, Dhaka. The venue provided a very pleasant workshop environment with all the necessary amenities to make the programme a success.

1.5 Outline of the Workshop

The workshop followed a well-planned out outline. The participants' arrival and subsequent registrations for the workshop were followed by an inauguration session with the keynote paper of the workshop being presented, two technical sessions with four technical papers being presented and finally a closing session with a vote of thanks. The main events of the workshop have been discussed in the following sections. The timestamps of the workshop has been appended as **Table A.2** in **Appendix-I** with this report.

1.5.1 Inauguration

Dr. Khondaker Azharul Haq, President, Bangladesh Water Partnership (BWP), chaired the inauguration session. The session started with the recitation of the Holy Quran. The recitation was followed by a 'Welcome Address' from Mr. H S Mozaddad Faruque, Vice President, BWP.

The keynote paper of the workshop, namely "Sustainable and Renewable Energy Development Authority (SREDA)", was presented during this session. The keynote paper was followed by Mr. Siddique Zobair, Member (EE&C), SREDA & Additional Secretary, Ministry of Power, Energy and Mineral Resources giving his invaluable 'Address of the Chief Guest' as the Chief Guest of Workshop.

Afterwards, the floor was opened to the participants for discussions on the keynote paper. The session was completed Dr. Khondaker Azharul Haq – addressing the session as the session chair. A tea/ refreshment break followed to reinvigorate the participants' attention for the technical sessions.

1.5.2 Technical Session – 1

Dr. Nilufa Islam, Former Director General, WARPO and Vice President, BWP chaired the second session i.e. the first of the two technical sessions. This session covered two technical papers. It is to be mentioned that there had been a quick reshuffling to change the order of technical paper presentation due to one of the presenters being unable to attend the workshop due to unavoidable circumstances.

The first paper (originally scheduled as the fourth technical paper): "Technical and Economic Status of Solar Pump Irrigation System in Bangladesh" was presented by Dr. Md. Ayub Hussain, Chief Scientific Officer, FMPE Division, Bangladesh Agricultural Research Institute (BARI). The paper drew a lot of attention from the audience and it was immediately followed by an open discussion session.

A lunch and prayer break soon followed. The participants returned on time for the presentation of the second technical paper of this season.

Mr. Jalal Ahmed Choudhury, Power Plant Expert, Center For Environmental and Geographic Information Services (CEGIS) presented a highly informative paper, technical paper no. 2, namely – "Solar Power: An Eco Friendly and Cost Effective Power for Irrigation, Drinking Water Supply and Many More Uses in Bangladesh". This second technical paper was prepared under the direct supervision of Engr. Md. Waji Ullah, Executive Director of CEGIS. An open discussion followed the presentation. The session was completed by the address of the session chair.

1.5.3 Technical Session – 2

The third and the final session, i.e. the second of the two technical sessions, was chaired by Prof. Dr. Umme Kulsum Navera, Professor, Water Resources Engineering, BUET & Executive Committee Member, BWP.

The first paper of this session, technical paper no. 3, was presented on the point of view of environment and climate changes by Dr. Fazle Rabbi Sadeque Ahmed, Director (Environment and Climate Change), Palli Karma-Sahayak Foundation (PKSF). This paper touched upon the benefits of solar power from the perspective of environment and climate changes.

The second paper of this session, originally the first technical paper of the workshop, titled: "Solar Energy Based Water Solution for Climate Change Vulnerable Coastal Area of Bangladesh: A Pilot Study" was presented by Dr. Khondaker Azharul Haq on behalf of Dr. Nilufar Banu, Executive Director/ Mr. Arifur Rahman, Senior Fellow, Bangladesh Unnayan Parishad (BUP) who were unable to attend. An open discussion followed the presentation of the papers in this session. The session was completed by the address of the session chair.

1.5.4 Closing Session

The curtain for the workshop was pulled with a Vote of Thanks from the Executive Secretary, BWP. The closing session was wrapped up with light refreshments and tea over informal discussions amongst the guests and the participants of the workshop.

1.6 Lessons Learned from the Workshop

The participants with various backgrounds yet with keen interest on the topic of the workshop got their opportunity through this workshop to learn about different concepts, terminologies, and techniques that are already in place or upcoming in the near future through this extremely informative workshop. The following sections describe the lessons learned from this workshop.

1.6.1 Current Scenario in Irrigation and Drinking Water Supply

The Power System Master Plan (PSMP) 2016 discusses the target of obtaining 15% of the energy source of Bangladesh from renewable sources. This is nowhere near as aggressive as Marcus's target of 100% by 2050 but it would still require significant investment in the renewable energy alternatives as Bangladesh would likely see a tremendous boom in energy consumption in the coming decades. At present, less than 2% of the installed capacity is coming from renewable sources, of which, most is hydro. This, although does not advocate the SHSs of over 5 million homes in Bangladesh, is still significantly low. Currently there is 22MW of Solar based power in Bangladesh. There are room for improvement in the existing scenario and options to add-on in new sectors. Irrigation and drinking water supply have been two of many such sectors where use of solar power can bring socio-economic benefits. The target is to reach 53MW by 2020.

There are currently 1.31 million diesel operated pumps used in irrigation sector of Bangladesh, covering a 3.1 million hectare of land and consumes nearly 1.0 million tons of diesel per year, worth almost 0.9 billion US\$ and almost a third of the figure is subsidized. There are currently 0.31 million electricity operated irrigation pumps, covering 2.2 million hectare of land and consuming 1500MW of electricity, which is almost a fifth of the present generation of the country.

Coastal regions are heavily affected by salinity resulting in severe scarcity of fresh water. Solar powered pumps have been implemented in these regions in test case bases and have been quite successful. The system used in these regions consumes 4.2kW of solar energy to run centrifugal pumps. These pumps have successfully been serving around 1500 people of 300 households in the North Kadamtola of Syamnagar Upazila, Satkhira. These pumps draw around 80,000 litres of deep tube-well water every day. Bangladesh Unnayan Parishad (BUP) is hopeful to provide 200 additional households in the near future, using the same system in place. Introduction of solar powered pumps in drinking water system has saved on average two hours of effort to fetch fresh water mainly by women and to some extent by children of the locality daily. The daily time saved in return has been allowing the households to flourish in other productive activities.

Bangladesh, with a coastal area of 47.2k square kilometers, where more than a quarter of the total population of the country is residing, may provide a huge opportunity to implement more solar powered pumps for drinking water supply like North Kadamtola.

1.6.2 Models Available

A typical 21KWp Solar Irrigation Pump (SIP) based system costs around US\$ 41,500 according to Sustainable and Renewable Energy Development Authority (SREDA); 50% of this amount is from grants and 35% from loan. The remaining 15% is equity.

A typical 5.5KWp SIP costs US\$ 14,000 and capable of drawing 50K litres of water daily. The financial model used is the same as the 21KWp SIP.

Solar Drinking Water Supply (SDWS) has been in contention following the devastations of Sidr, Aila and the likes in recent years when sweeping seawater from the Bay of Bengal left the south-west coastal regions of the country with fresh water crisis. In some regions, people had to walk 2-3 km to collect fresh water. The region saw almost 122 SDWS by GIZ, a German International Organization, in collaboration with Comprehensive Disaster Management Programme (CDMP) of the GoB.

1.6.3 Solar Power and the Challenges

In 2010, SREDA planned for a 100% grant based Solar Irrigation System (SIS) in Dhamrai in collaboration with Raheem Afrooz. However, the project did not succeed due to poor management and non-cooperation from the farmers.

An alternative approach was taken in the following years when a project in Borguna with 10kW system involved farmers group, but then it fell flat immediately after the UP elections, as there had been visible conflict amongst the members of the farmer group.

Additionally, the farmers' groups expressed their unwillingness to pay for the systems. They wanted government funding instead, as they were not ready to invest in unproven systems.

Subsequently, business models were developed using the experience of Infrastructure Development Company Limited (IDCOL). Donors, development partners and experts were involved in the decision making process to come up with the way forward for SIS.

Meanwhile, REB introduced 40 grant based SIS, which did not bode well similar to 2010 approach to enhance the use of solar powered irrigation system in Bangladesh.

The key reasons were identified to be a) the farmers group were uninterested, b) farmers were not ready to invest on largely unproven systems, c) these systems are mainly applicable for low water requirements i.e. cannot be used for paddy, but vegetables mainly, d) improper operation of the systems and e) lack of adept management, which were primarily local.

1.6.4 Overcoming the Challenges

To overcome the aforementioned challenges, business models based on ownership has been considered. The financial systems those have been considered are – a) Entrepreneur based system, b) fee for service, c) farmer ownership as individual or as a group etc.

Expert opinions were gathered on soil condition, area to be covered, crops that can be produced.

In that respect, the tariffs for SIS should always be lower than diesel based systems to encourage farmers. However, tariff would be higher on uneducated farmers because of low return. While this may discourage the farmers, the financial model would actually work and become sustainable. On the other hand, it would encourage farmers to be educated by enrolling in schools for adults or night schools.

The model will then lead to a win-win situation where the entrepreneurs will work to provide maximum service and farmers will provide maximum return, thereby, making the system sustainable.

The involvement of IDCOL is noteworthy as they facilitate the farmers with machines for cultivation, including weeding, harvesting by fees or renting outs. They also suggest farmers on different kind of farming, allowing them to maximize the output from their land by introducing new or simultaneous crops within the crop cycles. Additionally, IDCOL also finance farmers to rent or own transportation, allowing them to enhance their reach in the consumer market without the involvement of third parties i.e. brokers where a large portion of their income is compromised.

1.7 Suggestions on the Topic for Future Workshops

It has been unanimously acknowledged by the participants of the workshop that the event was very successful in its attempt to bridge the gap between organizations those are working relentlessly to address the improvement of the solar scenario on SIS and SDWS. It is widely accepted that more similar workshops such as this one in the future will only benefit the organizations involved. Some of the key decisions taken during the workshop are listed below.

- The approaches and methodologies to invest on solar powered pumps should be further studied in collaboration with organizations from all sectors of interest.

- Financial models should be discussed with more in depth analyses including return of investments and for this, all future workshops should involve experts in financial models through invitations.
- Information circulation should be made effortless. It should be proactive, that is the organizations should reach to the farmers and not the other way around.
- Multi-use of solar powered pumps alongside SIS and SDWS should be discussed in the future workshops.
- Water saving technology should be discussed with solar powered pumps in the future workshops to improve the overall efficiency of the systems.
- Technical discussions should include ways to prolong the life expectancy of solar powered pumps in future workshops.
- Future workshops should consider the ways to enhance the scope of developing solar powered pumps through public private partnership (PPP), and for such prospective entrepreneurs and foreign partners may be invited.

1.8 Conclusion

The workshop was very successful in connection with the sharing of experience and work based opinion through open discussion on the present and future scenarios on use of solar powered pumps for irrigation and drinking water supply. The workshop provided the foundation to build a bridge between organizations with different agendas but with the common goal to build a better Bangladesh.

The participants showed keen interest in learning from experts from various fields. They provided constructive arguments in case of any disagreements with the ideas presented. At the same time, the participants strongly believed that the takeaways from the workshop would help them to reorganize their thoughts and/ or approaches in implementing SIS and SWDS in the near future.

The participants also were very satisfied with BWP's hospitality in collaboration with BRAC Centre INN.

Finally, the workshop has paved the way for further such constructive and informative workshops in the near future.

Appendix–I: List of Attendees and Workshop Schedule

Table A.1: List of Attendees

Sl. No.	Name of the Professionals	Organization
1	Dr. K Azharul Haq	BWP
2	Mr. H S Mozaddad Faruque	BWP
3	Mr. Siddique Zobair	SREDA
4	Dr. Nilufa Islam	BWP
5	Dr. Umme Kulsum Navera	BUET
6	Dr. Fazle Rabbi Sadeque Ahmed	PKSF
7	Mr. Jalal A Chowdhury	CEGIS
8	Mr. Mowaze S Mohsin	CEGIS
9	Ms. Lubaba M Ali	CEGIS
10	Ms. Mashuda Parvin	CEGIS
11	Dr. Md. Ayub Hussain	BARI
12	Mr. Md. Shamsul Huda	BARI
13	Dr. Md. Arshadul Hoque	BARI
14	Dr. AFM Afzal Hossain	IWM
15	Mr. Md. Maurad	ICCCAN
16	Mr. Abul Kalam Azad	BARD, Cumilla
17	Mr. Krishno Sen	SFSA Bangladesh
18	Dr. Md. Hossain Ali	BINA
19	Md. Akramul Haque	DASCOH
20	Dr. A B M Zahid Hossain	BARI
21	Dr. Md. Jahangir Hussain	WB4
22	Dr. M Mizanur Rahman	BARD Cumilla
23	Dr. Biresh Kumar Biswas	BINA
24	Mr. Reaz Ahmed	SREDA
25	Mr. Shah Riazur Rahman	WASA, BRAC
26	Mr. Md. Jahangir Hossain	DAE
27	Dr. Md. Abdul Mueed	DAE
28	Mr. Md. Shahidul Hassan	BWP
29	Mr. Md. Rashedul Alam	SREDA
30	Mr. Md. Tarikul Islam	IWM
31	Mr. Md. Moshir Rahman	BWP
32	Ms. Mukta Akter	BWP
33	Ms. Bipasha Akter	BWP
34	Mr. Waji Ullah	CEGIS
35	Mr. Md. Arifur Rahman	BUP
36	Mr. Md. Toufiqul Islam	Consultant

Registration Sheet

SL.	Name	Designation & Organization	E-mail	Contact no.	Signature
1	Dr. Md. Ayub Hossain	Chief Scientific Officer BARI, Gazipur	mahossain@bari.gov.bd	01716-979034	
2	Md Shamsul Huda	Superintending Engineer	shuda@bmda.gov.bd	01749017769	
3	Dr. Muhammad Arshadul Haque	Senior Scientific Officer BARI, Gazipur	arshadul@bari.gov.bd	01712635503	
4	Dr. AFM Afzal Hossain	DED (P&D), IWM	afzal@iwm.gov.bd	01846130002	
5	Maknoon Mahmud	ICCPAD	maknoon@iccpad.gov.bd	01932491121	
6	Abul Kalam Azad	Director BARO, Comilla	kalamazad12@yahoo.com	01952351479	
7	Mowaze S. Mohsin	CEGIS	shabib@cegisbd.com	01799788842	
8	Krishna Sen	SFSA Bangladesh	krishna.gopal@sfbsa.gov.bd	0171055765	
9	Dr. Md. Hossain Ali	PSO, PINA	haha_bina@yahoo.com	01818-486534	
10	Md. Akramul Haque	CEO, DASCOH	akram@dascoh.org	01714085845	

SL.	Name	Designation & Organization	E-mail	Contact no.	Signature
11	Jalal Ahmed Chowdhury	Powerplant Eng.	jahmed@cegisbd.com	01938242251	
12	Dr. ABM Zahid Hossain	SSO, BRR	abmz_hossain@yahoo.com	0171263359	
13	Dr. Md. Jahangir Hussain	Senior Advisor, 2030 WRG, WRG	mjhussain313@gmail.com	01730311692	
14	Dr. M. Mizanur Rahman	Dir. BARO, Comilla	mizan51@hotmail.com	01708833335	
15	Siddique Zohair	Member, SFEDA	siddique.zohair@gmail.com	01714110610	
16	Dr. Birendra Kumar Ghosh	DC, PINA	gkghosh@gov.bd	01813158197	
17	Dr. Nilufa Islam	Vice President BWP	nilufaislam82@yahoo.com	01552313433	
18	Sec. Raz Ahmed	Director SEED	raz720@gmail.com	01550151179	
19	Shah Riagur Rahman	Senior Manager, WASH BRAC	shah.r@brac.net	01704166264	
20	Dr. Umme Kulsum Navera	Professor, DWRE, BUET	uknavera@gmail.com	01817016153	
21	Dr. Fazle Rabbul Sayyid	Dir. PRSF	fzsa1962@yahoo.co.uk	01552310999	
22	H. S. Moazzad Faruque	BWP	hsmfaruque@gmail.com	01915608789	

SL.	Name	Designation & Organization	E-mail	Contact no.	Signature
23	Md. Jahangir Hossain	Scientific Officer DAE	jahangirhossain@gmail.com	01675751322	
24	Lubaba Mashiat Ali	Research consultant CEGIS	mashiat.lub@gmail.com	01426500803	
25	Dr. Md. ABUL MUJEED	Director (FSW) DAE	mujeebabd61@gmail.com	01716940311	
26	MD. SHAHIDUL HASAN	Former Chief Exec LGED + EC BWP	shahidulhasan@gmail.com	0171523908	
27	Md. Rashedul Alam	Assistant Director SPEDA	rashedul912@gmail.com	01740969271	
28	Md. Tarikul Islam	Senior Specialist, IWM	mtai@iwm-bd.org	01841930014	
29	Md. Mohsinul Rahman	BWP Secretary General	bwp@dhaka.net		
30	Marhuda Parvin.	CEGIS	pmarhuda20@gmail.com	01705066867	
31	K. Azharul Haq	BWP President	Kahar@dhaka.net	01819212970	
32	Mukta Akter	Executive Secretary BWP	bwp@dhaka.net	01760606121	
33	Bipasha Akter	Accounts Assistant BWP	bwp@dhaka.net	01712217933	
34	Md. Wajidullah	CEGIS ED	wajidullahcegis@gmail.com	01715833568	

SL.	Name	Designation & Organization	E-mail	Contact no.	Signature
35	Md. Anisur Rahman	Fellow, BUP	himurjk@yahoo.co	01819660670	
36	Md. Toufiqueul Islam	Consultant	toufiquec@gmail.com	01770199061	
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

Table A.2: Workshop Timestamps and Programme

Timestamps	Programme (Dec 15, 2018)
09:30-10:10	Participant Registration
	Inauguration
	Session Chair: Dr. Khondaker Azharul Haq, President, Bangladesh Water Partnership (BWP)
10:10-10:15	Recitation from the Holy Quran
10:15-10:20	Welcome Address by Mr. H S Mozaddad Faruque, Vice President, BWP
10:20-11:00	Keynote Paper: Mr. Sheikh Reaz Ahmed, Director, SREDA & Joint Secretary, Ministry of Power, Energy and Mineral Resources
11:00-11:15	Address by Chief Guest: Mr. Siddique Zobair, Member (EE&C), SREDA & Additional Secretary, Ministry of Power, Energy and Mineral Resources
11:15-12:20	Open Discussion on Keynote Paper
12:20-12:30	Address by Session Chair
12:30-12:45	Tea Break
	Technical Session – 1
	Session Chair: Dr. Nilufa Islam, Former Director General, WARPO and Vice President, BWP
12:45-13:15	Technical Paper-4: “Technical and Economic Status of Solar Pump Irrigation System in Bangladesh”. Dr. Md. Ayub Hussain, Chief Scientific Officer, FMPE Division, Bangladesh Agricultural Research Institute (BARI), Gazipur
13:15-13:45	Open Discussions on Technical Paper-4
13:45-14:25	Lunch & Prayer Break
14:20-14:35	Technical Paper-2: “Solar Power: An Eco Friendly and Cost Effective Power for Irrigation, Drinking Water Supply and Many More Uses in Bangladesh”. Mr. Jalal Ahmed Choudhury, Power Plant Expert, Center For Environmental and Geographic Information Services (CEGIS)
14:35-14:45	Open Discussions on Technical Paper-2
14:45-14:55	Address by Session Chair
	Technical Session – 2
	Session Chair: Prof. Dr. Umme Kulsum Navera, Professor, Water Resources Engineering, BUET & Executive Committee Member, BWP
14:55-15:15	Technical Paper-3: “Solar Power on Environment and Climate Change”. Dr. Fazle Rabbi Sadeque Ahmed, Director (Environment and Climate Change), Palli Karma-Sahayak Foundation (PKSF)
15:15-15:25	Technical Paper-1: “Solar Energy Based Water Solution for Climate Change Vulnerable Coastal Area of Bangladesh: A Pilot Study”. Dr. Khondaker Azharul Haq on behalf of Dr. Nilufar Banu, Executive Director/ Mr. Arifur Rahman, Senior Fellow, Bangladesh Unnayan Parishad (BUP)
15:25-15:55	Open Discussions on Technical Papers 1 and 3
15:55-16:05	Address by Session Chair
16:05-16:10	Vote of Thanks by Executive Secretary, BWP
16:15	Closing & Tea

“Technical feasibility, economic viability and social acceptance of Solar Powered Pumps for irrigation and drinking water supply”

*Date: 15 December 2018
Venue: Meeting Room-3, BRAC Centre INN
75 Mohakhali, Dhaka-1212*

Programme

09:30-10:00	Participant Registration
	Inauguration
	Session Chair: Dr. Khondaker Azharul Haq, President, Bangladesh Water Partnership
10:00-10:05	Recitation from the Holy Quran
10:05-10:10	Welcome Address by Mr. H S Mozaddad Faruque, Vice President, Bangladesh Water Partnership
10:10-10:55	Keynote Paper: Sustainable and Renewable Energy Development Authority (SREDA)
10:55-11:10	Address by Chief Guest: Mr. Siddique Zobair, Member (EE&C), SREDA, Additional Secretary to the Government, Power Division, Ministry of Power, Energy & Mineral Resources Government of the Peoples' Republic of Bangladesh
11:10-11:25	Open Discussion on Keynote Paper
11:25-11:35	Address by Session Chair
11:35-11:50	Tea Break
	Technical Session – 1
	Session Chair: Dr. Nilufa Islam, Former Director General, WARPO and Vice President, Bangladesh Water Partnership
11:50-12:20	Technical Paper-1: Dr. Nilufar Banu, Executive Director/ Mr. Arifur Rahman, Senior Fellow, Bangladesh Unnayan Parishad (BUP)
12:20-12:50	Technical Paper-2: Center for Environmental and Geographical Information services (CEGIS)
12:50-01:05	Open Discussion
01:05-01:15	Address by Session Chair
01:15-02:00	Lunch & Prayer Break
	Technical Session - 2
	Session Chair: Prof. Dr. Umme Kulsum Navera, Professor, Water Resources Engineering, BUET & Executive Committee Member, Bangladesh Water Partnership
02:00-02:30	Technical Paper-3: Dr. Fazle Rabbi Sadeque Ahmed, Director (environment and climate change), Palli Karma-Sahayak Foundation (PKSF)
02:30-03:00	Technical Paper-4: “Technical and Economic Status of Solar Pump Irrigation System in Bangladesh”. Dr. Md. Ayub Hossain, Chief Scientific Officer, FMPT Division, Bangladesh Agricultural Research Institute (BARI), Gazipur.
03:00-03:15	Open Discussion
03:15-03:30	Address by Session Chair
03:30-03:35	Vote of Thanks by Executive Secretary, Bangladesh Water Partnership
03:35	Closing & Tea

Appendix–II: Photographs of the Workshop



Figure A.1: Inauguration: Recitation of the Holy Quran



Figure A.2: Keynote paper presentation, Inauguration Session Chair and Chief Guest



Figure A.3: Open session questions and discussions (1)



Figure A.4: Open session questions and discussions (2)



Figure A.5: Open session questions and discussions (3)



Figure A.6: Snapshot of presentation screen of keynote paper



Figure A.7: Participant's queries



Figure A.8: First technical session



Figure A.9: Open discussion during first technical session



Figure A.10: Technical paper presentation during the first technical session



Figure A.11: Technical paper presentation during the second technical session



Figure A.12: Open discussion during the second technical session