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[APPROVAL BY MAIL]: BANGLADESH: POWER SYSTEM EFFICIENCY IMPROVEMENT PROJECT – ADDITIONAL FINANCING- OFF GRID SOLAR PV: SOLAR IRRIGATION (ADB)(SREP)- XSREBD064A

ASIAN DEVELOPMENT BANK RESPONSE TO COMMENTS FROM SWITZERLAND

1. Thank you for providing the efficiency analysis for selected SREP investments. It is important to note that the technologies used and coverage for these projects vary. ADB is aware that some SREP projects are quite large with respect to GHG reductions, e.g., the geothermal projects in East Africa and other utility-scale RE projects (grid-connected projects which may include large numbers of non-lifeline consumers). In Bangladesh, similar utility-scale opportunities are being pursued under the SREP IP by World Bank. The government requested that ADB work on SREP candidate investments with smaller potential for GHG reductions but which still meet all SREP investment criteria. During SREP IP development, solar irrigation and mini-grids ranked with highest priority under off-grid projects. Solar irrigation project has a government internal approval already and a government-prepared Development Project Proposal (DPP) (see footnote 3 of the SREP cover page) which is based on the results of ADB feasibility study.

The proposed solar irrigation pump project is not a climate change mitigation project only. Rather it is a nexus of climate change adaptation, mitigation, and rural livelihood projects. It has the following co-benefits: (i) it will replace fossil fuel utilization directly; (ii) it will support climate change adaptation in rural areas with potential rainfall reductions. Rainfall being reduced, the modern irrigation schemes with pipelines and header tanks will increase water efficiency to enhance coverage from a single pump; (iii) it will add value to food security and could initiate transformational change in the agricultural food production system (please see response to ADB's response to UK's s questions 3 and 4); (iv) it will create local jobs and provide opportunities for the community to diversify their economic and livelihood activities; and (v) it will promote effective participation and involvement of local communities through empowering women and other vulnerable groups. All of these aspects are consistent with SREP objectives.

Farming households in rural off-grid areas will directly benefit from quality, affordable and reliable: (i) irrigation service during irrigation season, and (ii) electricity supply during non-irrigation season. Target results were computed based on conservative assumptions. If the solar PV pump systems operation will be maximized, it will then yield higher results and cost-efficiency.

a. Electricity output: Although the main objective of this project is not electricity generation and there exist no regulatory framework for sale of electricity to Bangladesh Rural Electrification Board / Bangladesh Power Development Board, the DPP assumes that 5 HP and 7.5 HP pumps collectively will generate 5,054 MWh/year. This is only 60% of the total 8,424 MWh per year generation output given some uncertainty on the grid system. (see footnote 6 of the SREP cover sheet).

HP Capacity	No. of pumps	Total est. Gen. (MWh/y)	No. of beneficiaries	60% of the total gen. output (MWh/y)	No. of beneficiaries
5 HP	1000	4,824	30,150	2,894	18,088
7.5 HP	500	3,600	22,500	2,160	13,500
Total		8,424	52,650	5,054	31,588

b. Beneficiaries: The project will establish at least 2,000 pumping systems in rural off-grid Bangladesh directly benefiting poor farming households. The solar pump irrigation system will benefit an estimated 10,000 households or 45,000 individuals; while the 5,054 MWh/y output from the 5 HP and 7 HP will provide electricity to about 7,016 households or 31,588 individuals.

If operation hours and days will be maximized, generation output and number of beneficiaries could still increase.

c. GHG reduction: The 2,000 solar PV irrigation pumps proposed to be installed will eliminate 796,875 liters of diesel every year (678 tons diesel per year). This saves an estimated 2,160 tons of CO2 per year or 43,200 tCO2 over the life of 20 years.

Additional emission savings could be counted from 5,054 MWh/y electricity generation with 5 HP and 7.5 HP systems. This are estimated at 3,791 tCO2 per year or 75,810 tCO2 over the life of 20 years, using a conservative emission factor of 0.75 tCO2 per MWh.

	Annual (tCO2e)	20 years Project lifetime (tCO2e)	$/tCO2e
Solar irrigation	2,160	43,200	514.35
Electricity gen. (5,054 MWh/y)	3,791	75,810	293.10
Total	5,951	119,010	186.71

The SREP cost per ton of avoided CO2 is about $514 if only irrigation is considered. If both irrigation and electricity generation are considered, the cost of avoided CO2 reduces to $186. If black carbon emissions are included, the effective GHG reductions would be larger and cost per ton of CO2e reduced would be lower.

2. The current costs of the systems are based on the existing pumping systems being implemented by IDCOL. As mentioned earlier, a due diligence on project is being conducted including on the pricing of the solar pumping systems. If delivered prices are reduced, the number of pumping systems installed will increase which will result in higher GWh generation.

High price is a derivative of additional civil works and piping systems. The additional civil works and piping systems will ensure:
(i) reduction in water loss due to evaporation and deep percolation (2/3rd of the water is lost due to evaporation and deep percolation in open drain systems). Bangladesh being a hot tropical country with mixed soil compositions, evaporation and deep percolation rates of irrigation water is very high.
(ii) more command area under the same water output, which will ensure better revenue from the systems. Distribution pipelines help reducing these losses and hence increases the command area under each pump (Command area is a crucial success factor for the financial viability of the systems).

Irrigation command area depends on the type of crop. Solar pumping systems in India are of small capacity (2.2 KW- 3KW range) and are used for high value crops only (not for paddy).

Such small pumps cannot be used for flooded irrigation for paddy/maize that requires a lot of water.

Cost comparison with India is not relevant due to the following reasons:
(i) in India, only the areas with shallow water table and very low head are using solar water pumps. Bihar is one of the areas where most solar pumps are installed. Static water head is only 7-10 feet in Bihar. On the other hand, static water head in Bangladesh varies from 20-100 feet. High total dynamic head (TDH) translates to higher system size for the same water output and hence higher unit prices;
(ii) India's solar irradiance is also generally higher than Bangladesh, which results in smaller system size; and
(iii) implementation capacity is more matured in India.

Considering the above, cost difference is actually based on local circumstances and conditions.

3. The ADB project team consults the government to address the issue. The government would like reconfirm its full commitment in promoting RE and taking solar irrigation projects in large scale through implementing measures and setting up aggressive targets, which include:
(i) Tax holiday for the RE companies;
(ii) Zero VAT on RE sales;
(iii) Gradual withdrawal of diesel subsidy;
(iv) IDCOL has a commitment to install 50,000 pumps by 2025;
(v) Bangladesh Agricultural Development Corporation (BADC) has a plan to install 400 pumps in the next 3 years;
(vi) Government's research and pilot agencies (i.e., Barind Multipurpose Development Authority Bangladesh, Rural Development Academy, Bangladesh Academy for Rural Development, etc.) have plans to install 800 pumps in the next 3 years.

The Bangladesh Nationally Determined Contributions (NDC) identifies solar irrigation as a key mitigation measure with investment needs estimated at $0.6 billion for the period of 2011-2030. SREP support stands at 4% of this investment needs. (http://www4.unfccc.int/ndcregistry/PublishedDocuments/Bangladesh%20First/INDC_2015_of_Bangladesh.pdf)

It is expected that SREP support will contribute in scaling up the implementation of solar irrigation systems and eventually transform the country's subsector by fully displacing the existing 1.3 million diesel-based irrigation systems. Through SREP, Bangladesh Rural Electrification Board (BREB), will develop a business model in line with IDCOL, that will be supplementary for all the future solar pump projects in Bangladesh. Moreover, BREB has strong coverage and market reach in the rural areas (100% of the rural areas) and are in a good position to scale up this project in the future.

The project will help demonstrate the competitiveness and economic efficiency of solar irrigation system over diesel-based pumps. Through public awareness and local skills development, it will help catalyze the adoption of solar technology among farmers. The project will offer multi-dimensional impacts such as: (i) new job creation in rural areas; (ii) injection of money flow in rural economy; (iii) facilitation of scientific and mechanized

irrigation systems; (iv) launching of fee for service model, reducing cost per unit of irrigation; (v) creation of enabling environment for modern irrigation practices; (vi) capacity development in rural level; (vii) introduction of new subsidiary investment and new business creation; (viii) in future, with the improvement in technology and reduction of RE costs, systems will be more competitive.

ADB continues to address the issue of subsidies and incentives in its policy dialogue with the government. The government has indicated its interest in pursuing transformation of the irrigation sub-sector, by prioritizing the nascent solar irrigation program over the more mature mini-grids program. The proposed investment in 2000 solar pumping systems is an advanced market commitment on the part of the government, which is fully consistent with SREP guidance. In addition to the policy measures and incentives noted above, the proposed solar irrigation project does include incentives in the form of borrowing from ADB and requesting SREP funds to reduce the cost of financing and help initiate transformation in the irrigation subsector.