June 14, 2017

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. Project description and rationale:

(1.a) The Power System Efficiency Improvement Project includes the Ashuganj supply side efficiency upgrade and solar power development investment. The addition of solar irrigation is fully consistent with the original objectives of the project, and as agreed between the government and ADB, a minor change in scope of the ongoing project was approved by ADB. The solar irrigation component and SREP cofinancing are "dropped in" to the ongoing project as a way to minimize transaction cost compared to developing a new stand-alone project.

The ongoing ADB Loan 2769 and the new output for solar irrigation are noted in the IP Appendix B at footnote 77 and again on page 117.

(1.b) The total project cost $53.91 million covers both capital and operational expenditures. The capital expenditures include: all costs related to machinery and project management up to installation and commission, as well as price contingencies. The operational expenditures include: all costs related to manpower for the project life time, cost of interest, depreciation cost, and considered replacement cost in 11th year.

The capital expenditures/cost is estimated at $46.42 million. Below shows the unit cost of a system according to capacity. For 5 HP and 7.5 HP systems, an estimated average budget of about $1,634 (1.3 lakh taka) per system has been considered for permanent evacuation line. Revised SREP cover sheet includes a new Table 7 to specify system cost per unit.

(1.c) The BREB will be the executing agency, as noted in the IP Appendix B. Under BREB, a project management consultant (PMC) will be mobilized for managing the project and will largely be responsible for site selection, fostering cooperative relationships with farmers, procurement, and other project implementation activities.

BREB will ensure the quality of the supply items through following ADB standard procurement procedures. BREB, PMC and Palli Bidyut Samity (PBSs), which is the Bengali name for Rural Electric Society, will identity farmers who can make equity contributions and acquire solar irrigation pumps.

The financing structure is tentatively designed as follows: 7.5% equity from the farmers/sponsor, 42% ADB loan and 50.5% SREP grant. The detailed business model will be developed during the project due diligence from June-September 2017. [Although the project is at an advanced stage of readiness in the government system, the due diligence is an internal ADB requirement to be completed after the SREP cofinancing is approved and before ADB Management approves the Additional Financing].

(1.d) There are various options for integration with mini-grids, including:

(i) project will take advantage of existing mini-grids, where such installations can benefit from adding solar pumping systems which can also provide electricity in the non-crop season; and/or
(ii) mini-grids will be either established via parallel investment programs in coordination by BREB and other agencies;

Details of the agreement with mini-grid operators will be finalized during the project due diligence.

2. Project financing

(2.a) As noted in Footnote 2 of the SREP cover sheet, the proposed SREP amount has been adjusted downward due to the shortage of SREP funds for projects in the "sealed pipeline."

ADB and government agreed to identify other grant resources to accommodate a reduction in SREP amount.

(2.b) See above. ADB and the government are not proposing to reinstate the $1.78 million grant from SREP.

(2.c) The government counterpart financing normally covers taxes and duties, which typically are about 15% of the base cost. The amount of $0.075 Million was an entry error and this has been corrected to the original $6.6 Million. Cost estimates will be further refined as additional due diligence is conducted prior to ADB Management approval of the Additional Financing.

(2.d) The discussion leading to including the solar irrigation project in the IP did in fact envision a possible equity contribution, which is noted in Box 5.3 on page 92 of the IP.

As noted above, farmers are expected to bring some equity as a way of minimizing the need for grant funding and moving the solar irrigation program to a commercial basis over the medium to long term.

3. Expected results:

(3.a) Table 9.1 of the IP shows results indicators. The 43 GWh from off-grid source includes energy output from 2 separate projects: (i) the solar mini-grids project and (ii) the solar irrigation project.

The total capacity of the proposed 2,000 pumps is 13.2 MW as shown in SREP cover sheet Table 6. Assuming 4 hours per day 365 days per year output at rated capacity, the total annual output would be 19.2 GWh/year. However, for purposes of feasibility assessment, it is assumed that irrigation pumps only run for 180 days per year, so the adjusted output would be: 13.2 MW x 4 hours/day x 180 days = 9.5 GWh/year.

The 5 GWh/year is the amount of surplus electricity which is expected to be exported, which is about 50% of the total potential generation based on 180 days of output.

(3.b) The GHG reductions are modest, and are typical of almost every SREP project in the global portfolio. Bangladesh's total GHG emissions are less than 1% of the global total; again, this is comparable to other SREP pilot countries which account for very small amounts of global GHG emissions both individually and on an aggregate basis. The 678 tons of diesel per year is based on the following assumptions used in the feasibility study:

Capacity of PV irrigation pump	1.5 HP	3 HP	5 HP	7.5 HP
Total no. of pump	250	250	1,000	500
Total Operation hr / year per pump	250	250	250	250
Ave. fuel consumption of equivalent diesel pump /ltr/hr	1	1.25	1.5	2.25
Total diesel consumption/ltr/hr	62,500	78,125	375,000	281,250

Total fuel consumption is estimated at around 796, 875 liters of diesel / year or 678 tons diesel per year. Diesel is 86% carbon and carbon converts to CO2 at a ratio of 44/12, so the CO2 from 678 tons of diesel is 678 x 0.86 x 44/12 = 2138 tons CO2e/year (tCO2e/y). Assuming 20 year lifetime the project would result in avoided emissions of 42, 759 tCO2e. If black carbon emissions are considered the avoided CO2e would be much higher.

Other estimates of CO2 emission reduction are shown below.

Pro-rated fuel consumption
About 1 million tons of diesel/year is used to run 1.3 million pumps. Diesel is 86% carbon and carbon converts to CO2 at a ratio of 44/12, so the CO2 from 1 million tons diesel is:

1 million x 0.86 x 44/12 = 3.15 Million tCO2e

Per pump:
3.15 M tCO2e / 1.3 Million pumps = 2.42 tCO2e / pump / year

2000 pumps x 2.42 tCO2e/y/pump = 4,846 tCO2e/y

20 year lifetime: 4846 x 20 = 96,923 tCO2e for the project lifetime
With $22 million SREP, cost-effectiveness is $226 / tCO2e

Avoided Diesel generation of electricity
Total PV is 13.2 MW Assume 4 hours/day 365 days/year
13.2 MW x 4 h/d x 365 d/y = 19,272 MWh / year
If this displaces diesel generation of electricity, assume 0.8 tCO2e/MWh diesel

19,272 MWh/y x 0.8 tCO2e/MWh = 15,417 tCO2e /year

If the solar pumps actually run 180 days per year and about 50% of output is exported to non-pumping uses, then the estimated reduction would be about 25% of 15,360 tCO2e/y = 3,854 tCO2e/y

(3.c) The direct leverage ratio for the irrigation subproject alone is 1 : 2.43, computed as $53.91 / $22.22. However, if the total solar energy investment component of the project is considered, the leverage ratio is about $142.59 / 22.22 = 6.42.

(3.d) As noted above, most of the projects in the global SREP portfolio result in modest GHG reductions, and as such carbon reduction is not an over-riding objective of SREP. The solar irrigation project is fully aligned with the SREP objectives of developing renewable energy,

increasing RE output and productive end uses of RE. The proposed project is not being presented as a carbon reduction project.

As noted above, there are different ways to estimate GHG reductions which result in different estimated unit cost, e.g., $226/tCO2e with low GHG estimate and $71/tCO2e with the higher GHG estimate. This relatively high unit cost reflects the fact that the there is a capital cost barrier to broader adoption of solar irrigation pump systems (see item 4. c. below).

4. Financial and economic viability:

(4.a) The sponsors/farmers will be the beneficiaries of this revenue. For solar irrigation, based on the feasibility study done by ADB, it shows that the average minimum revenue generation for the sponsors must be equal or higher than $37.71/bigha/year (3000 taka / bigha/ year). In reference to the unit cost per system (see response to question 1b and Table 8 of the revised SREP cover sheet) and with project lifetime considered as 20 years, this justifies concessional funds (grant) to the project to be technically feasible and financially sustainable.

(4.b) Although these indicators appear high, this is not unusual for projects of this nature and for other SREP projects. E.g., EIRRs are normally high when diesel generation is being displaced by RE. Although this FIRR appears attractive, there is limited or no commercial financing available for solar irrigation. SREP is needed because there is a capital cost barrier to the end users.

The EIRR and FIRR noted are taken from the preliminary project proposal developed by BREB following government guidelines. The EIRR and FIRR are high because (i) the grant portion comprising almost half of the capital cost is considered as zero capital cost. (ii) The tariff assumption (10.14 taka/kwh) is higher than the current tariff for agricultural pumping (3.82 taka/kwh). (iii) A 5% annual revenue escalation factor is assumed (which is overoptimistic).

The EIRR and FIRR calculated following ADB guidance will be lower, e.g., because the grant portion is not considered as zero capital cost and revenue escalation factor will be lower. The EIRR and FIRR are subject to revisions going forward as due diligence is conducted by ADB.

(4.c) As noted above, there is a capital cost barrier for broader deployment of solar irrigation.

The Government of Bangladesh proceeded with IP preparation with the clear understanding that all SREP funds would be in the form of grants.

(4.d) The project may not go forward in the absence of grant financing (otherwise, the project could already have been implemented). This is the case for almost all other projects in the global SREP portfolio.