



National Solar Parks Program

Country / Region: **Cambodia** | Project Id: **XSREKH077A** | Fund Name: **SREP** |

MDB : **Asian Development Bank**

Comment Type	Commenter Name	Commenter Profile	Comment	Date
Comment 1	Simon Ratcliffe	United Kingdom	<p>Apologies for the delay sending you our questions. Members of our team have been off ill over the last two weeks.</p> <p>We have the following questions related to this proposal. These are:</p> <p>Question 1: Given that the recent 10MW plant has already provided a demonstrational effect and that the price of solar energy at auction was below the cost of other sources of electricity, does this proposal provide justification for the need for concessional SREP resources (including the \$3 million grant) and could it already proceed commercially?</p> <p>Question 2: This project describes Solar power as a new comer to the Cambodian market, (10MW commissioned in 2017) this proposal also suggests that it will be completed in 2 phases with between 30 MW and 50 MW in phase 1 and the remainder in Phase 2, how long is the expected gap between phase 1 and phase 2? Is this long enough to prove the first phase a success and therefore mean less concessional financing is needed for packages in the 2nd phase? If not, why not?</p> <p>Question 3: Further given the success of the 10MW plant at auction (see excerpt.... "Early engagement of ADB PSOD ensured that bidders had the opportunity to optimize their proposals by leveraging the involvement of international financial institutions. This tendering process resulted in a competitive and sustainable tariff of \$0.091 per kWh, which is below EDC's average cost of supply (which was \$0.095 per kWh in 2015).") was this not the demonstration effect needed to prove that this solution was viable to the market? Could more rationale be provided as to why concessional SREP resources are needed to create the necessary change within the market and why this project couldn't be taken up commercially in its current form without SREP financing?</p> <p>Question 4: It is unclear whether the private sector would be involved in Phase 1 of the project, "The development of the 30–50 MW plant will be financed by the private sector through private sector equity and commercial debt." This conflicts with discussion of the breakdown of the costs for the first part of the project totalling \$36.5m with funding provided from SREP the ADB and the government. If they are involved, could more detail be provided on how the public finance mentioned here will leverage them in? I also notice in the cover note this is referred to as indirect private finance, why is this the case?</p>	Mar 07, 2018
Response 1	Sugar Gonzales	ADB	<ol style="list-style-type: none"> The 10 MW solar plant was a small individual project which provided a limited demonstration effect of solar PV technology in Cambodia. ADB's involvement and grant funding were crucial in ensuring financial closure. The current effort takes the next step and aims to demonstrate a programmatic approach for a large-scale solar park model, which would have a material impact on the electricity sector of Cambodia. It allocates risk efficiently between public sector and private sector wherein the public sector uses concessional funding to derisk projects by procuring and building common infrastructure ("the park") and the transmission evacuation infrastructure. At the same time, it uses a structured PPP-based tendering approach to procure private sector participation for power generation assets, which is expected to lead to deep reductions in tariff, and a model that can be scaled up through successive solar parks. By investing upfront in common park infrastructure (e.g. roads, fencing, drainage, water supply, control room and other facilities) that will be developed concurrently with Phase 1 of the generation assets and used for both phases of generation assets, the public sector is in effect derisking all phases of the project. No concessional financing is expected to be required for subsequent phases. The expected gap between Phase 1 and 2 is about 9 months. Bidding for Phase 2 can start right after Phase 1 reaches financial closure. Experience in other developing countries shows that public sector intervention should be maintained until a critical mass of projects have been completed. Even in 	Mar 15, 2018



large developed markets such as the middle east, sovereign-backed funding and access to land and transmission infrastructure is considered an integral pre-requisite to assure low prices. Also see response to question 1 above for further information as the 10 MW plant was a small project with limited demonstrational effect.

4. The solar park model is a form of public-private partnership wherein the public sector leads development of the common park infrastructure and grid interconnection, with public sector financing. The generation assets (the solar plants) are then tendered out to, and subsequently financed by, the private sector. The SREP funds will cover some of the public sector investment which enables private sector participation. The SREP funds will not flow directly to the private sector (in Phase 1 or Phase 2), hence it is "indirect" support.

Table 1 is presenting 36.5 million USD in public sector infrastructure to be financed by ADB, SREP and the government. The quantum of private sector investment (\$100 million) is presented in section 15 and this would support generation plants under Phase 1 and 2.

Response 2 Simon Ratcliffe United Kingdom

Thank you the responses to our questions. There are still some issues we seek to clarify. These are: Mar 19, 2018

A couple of things though that were not clear to us. These are:

- 1) The Government is receiving the concessional funds and grants and presumably passing these onto the utility which is developing the solar park. It was not clear whether the benefits of this concessional funding are being passed through to consumers.
- 2) If the concessional funding is passed through, how is this reflected in the tender process to secure lower prices?
- 3) If the objective is the demonstration effect, then, whilst it can be understood that de-risking is valuable in providing a predictable environment for the private sector, why are concessional funds needed for this?
- 4) Are we not in danger of creating tenders with artificially low prices reliant upon public subsidy that then create an artificially low price cap that cannot be replicated in the absence of ever more subsidy?

Response 3 Sugar Gonzales ADB

1. That is correct. The government will pass on the funds to EDC, the public utility which will be the user of SREP and ADB funding. An overarching objective of the solar parks program is to buy down the wholesale cost of supply, and pass those cost savings onto consumers. The benefits from the solar park will be passed on to consumers via future reductions in retail tariffs as adjudicated by the national electricity regulator. Mar 22, 2018

2. The effective application of concessional funds will help ensure that the park infrastructure and transmission connections are constructed in a timely manner at a low cost. This will translate into reductions in the tendered price of power from the private sector and a lower cost of delivered power to consumers. The experience with the solar parks model in other countries is that concessional funding is not needed for the generation assets if the overall park infrastructure development is de-risked. Risk reduction and competition are the key elements to secure lower PPA prices.

3. Concessional funds will be leveraged to support the park infrastructure and grid connections which -- unlike large-scale solar PV plants -- do not have inherent economy of scale and demonstrable learning rates. This will crowd in private sector investment, as intended in the SREP design and guidance documents.

4. In this PPP project, we are supporting the public sector to procure the land, and build common infrastructure. This de-risks the project, creates a level-playing field and foster transparency and competition, all of which in turn will lead the private sector to bid at very competitive prices. It epitomizes a model PPP project. The SREP funds are being used as precision-guided subsidies where concessional funds are needed the most: to support the solar parks infrastructure and grid connections. This is international best practice established in other countries such as India, the middle-east and several African countries, which are implementing the solar parks business model. The proposed investments and use of concessional funds are fully consistent with SREP guidance to crowd in private sector participation and facilitate the transformation from fossil and other unsustainable energy systems to sustainable renewable energy systems.

Response 4 Simon Ratcliffe United Kingdom

Thank you for the responses to the queries we have raised. We have a number of additional questions. These are: Apr 04, 2018

1. Is there any evidence that can be provided that indicates that concessional funding is needed to make power generated through this project will be competitive with other energy sources?
2. If concessional finance is needed to reduce the cost of power in order to be competitive with conventional non-renewable alternatives, can this be demonstrated?



Thank you.

Response 5 Sugar Gonzales ADB

Apr 06, 2018

1. As solar power does not have any fuel cost, the cost and price of solar electricity varies with the cost of financing. The offtake price of \$0.091/kWh for the 10 MW Bavet project was possible in part because some concessional funds were blended with market-rate funds. As described in the Revised IP of 2017, a combination of factors are needed to drive down the cost of solar energy including:

- (a) advanced market commitment, i.e., the government's commitment to develop a 100 MW solar park; and
- (b) risk reduction via government leading the early development of the solar park.

The solar park model, including use of concessional funds has been instrumental in making solar energy competitive with conventional energy supplies as documented in the report by World Bank (Dobrotkova, Zuzana. 2016. Price of Solar PV Electricity in Developing Countries. The World Bank Group).

2. Yes, as noted in reply to question 1 above, and as shown on the 10 MW Bavet project. The pre-feasibility study conducted for the 100 MW solar park also demonstrated that concessional finance would be instrumental in bringing the cost of solar energy below that of the earlier 10 MW project.

In India, which pioneered the solar parks model, CTF has cofinanced two ADB projects: (i) the Rajasthan Solar Transmission project with CTF \$200 Million (CTF TFC and ADB Board approvals in 2013), and (ii) the Solar Transmission Sector Project with CTF \$50 Million (CTF TFC approval in 2016 and ADB Board approval in 2017). After India began developing large scale solar parks in the early part of this decade, solar power purchase agreements (PPA) reached grid parity by 2015 and some PPAs were below the cost of coal by 2017. Partly based on these developments, India's BAU scenario for coal-fired capacity growth have declined from 250 GW by 2030 to 50 GW by 2022 after which no major coal capacity growth is expected. Based largely on India's experience (including the support from CTF), other developing countries have since adopted the solar parks model as international best practice to drive down the cost of solar energy (as documented in the 2016 World Bank report noted above).

Comment 2 Daniel Menebhi Switzerland

Mar 26, 2018

Thank you for circulating this project proposal.

We apologize for coming in late with these questions, which is due to our initial decision not to comment it, given the rather small size of the requested SREP grant and our limited resources and other priorities, also regarding the CIFs/SREP. In the meantime we have had the time to study the project proposal and are taking the opportunity that the window is still open to submit the following questions (Q) and comments (C):

1. In our understanding of the project document, the SREP funding, along with ADB loans and government resources (i.e. a total of USD 36.5 million) is used to set-up (a) solar park(s), including land acquisition and common infrastructure, as well as its/their connection (transmission infrastructure) to the national (EDC) grid. Private developers are then invited to tender for up to 100 MW of solar PV generating capacity, representing investments of USD 100 million, to be installed inside the solar park(s):

- a. (Q) Is our understanding correct?
- b. (Q) Is the project focusing on just one solar park with a capacity of up to 100 MW near Phnom Penh or on several solar parks (locations, land sizes, capacities)?
- c. (C) Please detail the budget of (USD 36.5 million) with regards notably to land acquisition (size and price), common infrastructure, transmission infrastructure (length of power lines, capacity of substations and transformers, other equipment) and other (detailed as far as possible).
- d. (C) Please detail in particular what the SREP loans and grants will be used for.
- e. (Q) In what form is the contribution of the Government of Cambodia and what will be financed with it?
- f. (Q) Does the expected investment from the private sector (USD 100 million) cover the entire solar PV generating capacity of 100 MW?

2. It is stated that the project will minimize imports of fossil fuels and displace other sources of power and that avoided costs range between 0 (for hydro), \$0.039 /kWh (for coal) and \$0.139 /kWh (for diesel, with imports ranging from \$0.11-0.12 /kWh.

- a. (Q) Why is the avoided price for hydro power 0? Is this because no hydro-power will be displaced?
- b. (Q) What is the energy mix of the imported power from Thailand and Vietnam?
- c. (C) Please detail the calculation of avoided or reduced CO2 emissions.
- d. (Q) Taking into account that EDC has power purchase agreements with private suppliers on a take-or-pay basis, what incentive does EDC have to substitute coal generated power (costed at \$0.039 /kWh) with solar generated power (costed at



\$0.091 /kWh)?
Looking forward to your answers
Thank you and best regards

Response 1 Sugar Gonzales ADB

Apr 04, 2018

1a. Correct
1b. The immediate investment is for one park to host 100 MW of generation. This first park is a replicable prototype for several more parks.
1c. Please see detailed cost estimate in table below.
Content Cost
1. Transmission Line (42 kms) \$ 9.5 million
2. Upgrades to Grid Substation \$ 2.0 million
3. Solar Park Substation (22 kV O&M building \$10.0 million & equipment housing, 2x 22/115 100 MVA transformers (N+1 redundancy), switchgear, protective equipment, SCADA, fencing)
4. Land Acquisition Costs (for 250 ha) \$12.5 million
5. Tax and duties exemptions \$ 2.5 million
Total \$36.5 million

1d. As detailed above SREP funds (loans and grants) will be used for the public infrastructure in the park, the pooling substation, and the transmission line. This may be further leveraged with a ADB-supported political risk guarantee, and potential ADB private sector funding that would be offered to the power plant developer.

1e. Government's contribution will include tax and duties exemptions.
1f. Yes

2a. Hydropower has no associated fuel costs and for purposes of assessment is taken at zero cost.

2b. Thailand and Vietnam both have a mix of coal, gas, hydro, solar and wind. The grid emissions factors for Thailand is 0.5661 tCO₂e/MWh (combined margin for solar and wind projects), and for Vietnam is 0.8154 tCO₂e/MWh (combined margin) [Source: <https://pub.iges.or.jp/pub/iges-list-grid-emission-factors>.]

2c. Since in the short-term, the project is expected to displace power imports from Viet Nam, an effective grid emissions factor of 0.83 tCO₂e/MWh is used to calculate avoided emissions. [This is the average of the IGES build and combined margins for Vietnam.]

Phase I: 60,000 MWh / year X 0.83 tCO₂e/MWh = 49,800 tCO₂e/year (rounded off to 50,000 tons)

Phase II: 140,000 MWh / year X 0.83 tCO₂e/MWh = 116,200 tCO₂e/year (rounded off to 115,000 tons)

TOTAL: 166,000 tCO₂e/year (rounded off to 165,000 tons CO₂e/year)

2d. For clarity, the coal generation cost shown in the question represents the expected fuel cost rather than the total cost of coal generation. The analysis assumes that in the short term, the relatively small quantities of solar power injected from the solar park would not be sufficient to prevent EDC meeting its take-or-pay obligations under existing PPAs with coal generator and therefore impacts on total coal-fired generation levels would be small. In the near-term, solar generation will complement hydropower by helping to meet daytime peak demand and improving hydropower storage performance during the dry season, reduce reliance on power imports, and displace some coal and diesel-fired power. And we expect the off-take tariff for the solar park to be substantially below the \$0.091, by virtue of the de-risking that has been described above. In the longer-term, a like-for-like comparison for new investment would be between the total cost of coal-fired generation and that of solar power. The levelised cost of coal generation has been estimated at \$0.073/kWh at a delivered coal price of \$80 (coal prices have risen significantly since this estimate). This compares to a projected levelized cost of around \$0.07/kWh for the solar park, and thus solar would over time be cost competitive with coal-fired power. Solar is the most promising domestic energy resource with respect to future cost reductions, while the cost of coal fired power is not going to decrease.

Response 2 Daniel Menebhi Switzerland

Apr 05, 2018

Thank you for responding to our questions and comments.
Switzerland is happy to support the approval of the proposed SREP contributions to this project.