ANNEX: DETAILED PROJECT DESCRIPTION

Component 1: Utility-Scale Solar (US$40 million IDA credit)

1. **Component 1 will finance a series of solar parks to leverage private sector development of solar PV through the use of competitive bidding, starting with an initial 50 MW project that aims to launch the first solicited solar auction in Pakistan.** Solar parks allow governments to strategically identify high-priority sites for development, taking into account such factors as land availability and transmission capacity; help to de-risk project development for the IPP developer; and receive a return on investment in the form of a "solar park fee." Solar auctions, or competitive bidding, ensure a transparent and highly competitive process for awarding tariffs for solar power projects; they have facilitated the major international price reductions of the past few years.[1] Recognizing this, NEPRA announced in 2017 that all future renewable energy projects must be solicited through competitive bidding, but as of February 2018 no solar or wind auction has yet been announced. This Project aims to ensure early implementation of the decision on competitive bidding, and to design and launch a solar auction that incorporates international best practice and attracts foreign direct investment. All else being equal, highly competitive bids can be expected from developers for solar park sites (see Box 1), especially if the auctions include provisions for blended concessional finance. This should also negate any upward pressure on the EPA prices offered under the auction process as a result of adopting international standards and robust qualification criteria, thus ensuring high-quality investments at the lowest possible power prices.

Box 1: Background to Solar Park Auctions

In the last couple of years a new type of "plug & play" auction was developed, the solar park concept. Thanks to a well-structured process and a better risk allocation, the solar park concept recently elicited very low prices in places like Dubai, India, and Zambia. A solar park is a concentrated zone of development of solar power projects. The government identifies, secures, and prepares all the sites up front, obtains necessary permits before the auction, and prepares the necessary evacuation infrastructure. The government recovers its investment through a solar park fee, and a local community fund can be set up focusing on local development. The key advantages of the solar park are that it (a) transforms CAPEX items into operating expense (OPEX) items (e.g., infrastructure and land); (b) optimizes risk allocation by reducing up-front development risks and regulatory hurdles; (c) allows economies of scale through large-scale projects; (d) allows better grid network planning; and (e) facilitates access to lower-cost financing because of lenders' perception of lower risk. By enabling a mix of private and public investments, solar parks reduce the public sector fiscal impact while minimizing the cost of electricity to consumers.

2. **An initial solar auction for 50 MW of capacity will be launched under the Project in 2018.** Preliminary site investigations have already been carried out, and the final selected site, to be developed on land owned by GoS, will be taken forward as a pilot solar auction under the guidance of a professional transaction advisory firm that will be competitively appointed. The up-front costs of developing this initial 50 MW site are relatively low (the candidate site requires no major grid reinforcements and is a short distance from the nearest 132 kV transmission line), and the development may be partially or fully delegated to the winning IPP, rather than being carried out by SED. The aim is to complete the pilot solar auction within the first year of Project implementation, assuming approvals from other agencies are

[1] World Bank. 2017. "What Drives the Prices of Solar Photovoltaic Electricity in Developing Countries?" *https://openknowledge.worldbank.org/handle/10986/26191.*

forthcoming. Power off-take would be arranged with CPPA.

3. **Further solar parks would be developed to support 400 MW of new capacity under the Project.** Additional solar parks would be of 50-200 MW capacity, and would be identified through a comprehensive geospatial and grid constraints analysis, with priority given to sites that are near load centers and/or able to utilize spare transmission capacity—for example, by locating solar near existing or future wind farms. The analysis would build on technical assistance work the WB is already financing in partnership with AEDB, CPPA, NTDC, and the Planning Commission, which aims to facilitate the future integration of variable sources of renewable energy by looking at (a) technical and commercial dispatch constraints; (b) least-cost planning; and (c) potential changes in the energy market. Once identified, solar parks would be developed by the PMU, including land allocation, arranging permits and environmental/social and technical studies, transaction advisory, carrying out of required civil works (roads, fencing, water supply), sourcing of high-quality solar irradiance data, construction of necessary grid connection, and potential grid upgrades as required (e.g., new substation or other enhancements). The solar park assets would be held under a special-purpose vehicle (SPV) owned by SREC, under the full ownership and authority of SED. As the cost of electricity storage continues to fall, the Project may consider solar parks with integrated storage to further improve transmission line utilization and reduce system costs. These costs, which are summarized in Table 1, are more efficiently arranged and covered by the public sector, and can be recovered from the winning private sector IPPs in the form of an annual solar park fee, to be specified in the solar auction.

Table 1: Indicative cost breakdown for Component 1

	Pilot auction	2nd auction round	3rd auction round
MW	50 MW	175 MW	175 MW
Number of sites in solar park	1	2	2
Transaction advisor	$600,000	$400,000	$400,000
Preparation and permits	$200,000	$600,000	$600,000
GoS equity[a]	Up to 30%: $3.7 million	None	None
Solar park infrastructure (transmission lines, substation upgrades, fencing)	$500,000	$14 million, assuming 10 km transmission line and some substation upgrades	$19 million, including transmission line and upgrades, and provision for storage
TOTAL	$5 million	$15 million	$20 million

[a] To be decided following consultation with private sector developers. If this option is exercised, an additional SPV will be needed for the 50 MW project, to be part-owned by GoS.

Component 2: Distributed Solar (US$25 million IDA credit)

4. **Component 2 will finance the installation of distributed solar PV on rooftops and other available space on and around public sector buildings in Sindh.** The objective is to stimulate the growth of the distributed and rooftop solar market while contributing to the reduction in the circular debt problem by installing solar on and around public sector buildings. Distributed solar and other forms of distributed generation offer the benefit of being close to load centers, removing the need for transmission infrastructure and making efficient use of already-developed land. The distributed solar market in Pakistan

is slowly gaining momentum, but has been hampered by the DISCOs' reluctance to facilitate the export of power, in part because the current "net metering" regulations do not provide for any compensation of system costs. Where power export has not been possible, commercial consumers have resorted to sizing the solar system to be below their minimum daytime demand, thereby avoiding the need for a two-way flow of power. IPP-based models for distributed solar, under which rooftop space is leased to solar developers and 100 percent of the power is exported, have not yet taken off in Pakistan. In 2016, the WB commissioned a study[2] to assess the potential for distributed generation in Pakistan, particularly through solar for large public sector buildings. The study assessed 20 large buildings in the city of Karachi, and up to 79 MW of solar PV potential was identified. The installation of solar on/around such buildings can reduce their electricity consumption, and thus their circular debt problem.

5. **The Project will target the installation of 20 MW of distributed solar on and around public buildings in the cities of Karachi and Hyderabad, starting with smaller sites where no power export is required.** With the sharp decline in global and regional prices, the electricity generated from distributed solar in Sindh is expected to cost around $0.06-0.10/kWh,[3] less than the retail tariff charged by utilities. SED will identify portfolios of candidate sites based on predefined criteria,[4] and will liaise with other GoS departments to establish a master leasing agreement at the interdepartmental level (see Figure 1). This arrangement will be a critical element of the project, to ensure a streamlined process before project award. According to the study cited in the previous paragraph, hospitals and universities would be early candidates, along with some high-profile GoS sites such as the Provincial Assembly. Once a portfolio of sites is developed, SED would organize a competitive bidding for detailed building and structural surveys, and construction of the distributed solar plants on an engineering, procurement, and construction (EPC) basis for the capital investment, combined with a long-term, performance-based O&M contract. Bids would be evaluated on the basis of both the capital and the O&M cost. To ensure that the winning bidder meets its contractual obligations, payments will be structured to cover costs up front, while profits will be earned over the lifetime of the contract, initially envisaged as a five-year contract. Construction contracts may include the installation of energy management systems to improve the understanding of energy usage and facilitate future energy efficiency upgrades.

6. **The Project would include larger sites if agreements can be reached with the respective DISCOs for power off-take, through either existing net metering regulations or a negotiated tariff**. Discussions have already taken place with K-Electric, which indicated willingness to purchase solar power output from a publicly owned SPV as long as the costs are competitive and acceptable to NEPRA. If this can be arranged, larger sites where the total peak solar power output is higher than the building's peak daytime load would be selected, and the excess power would be sold to the DISCO. Where there is outstanding GoS debt to the DISCO, the payments for the exported power could be partially offset against this debt, while ensuring some allowance for payments to SED to cover O&M costs. This model provides DISCOs with a potential alternative to net metering, and an attractive way to further reduce the circular debt problem. Longer-term business models with a stronger private sector financing component could also be explored.

---

[2] World Bank. 2016. "Demand for Distributed Renewable Energy Generation." Washington, DC. *http://pubdocs.worldbank.org/en/651451464210676719/Report-Demand-Distributed-Renewable-Energy-Generation-Pakistan-Elan-Partners-World-Bank-Jun2016.pdf.*

[3] Bloomberg New Energy Finance. 2017. Accelerating India's Clean Energy Transition. November 28, 2017. New York.

[4] For example: (a) wholly owned by GoS; (b) free of shading and obstructions; (c) compliant with Building Code; (d) electricity usage on all seven days in the week.

Figure 1: Outline of the structure of Component 2

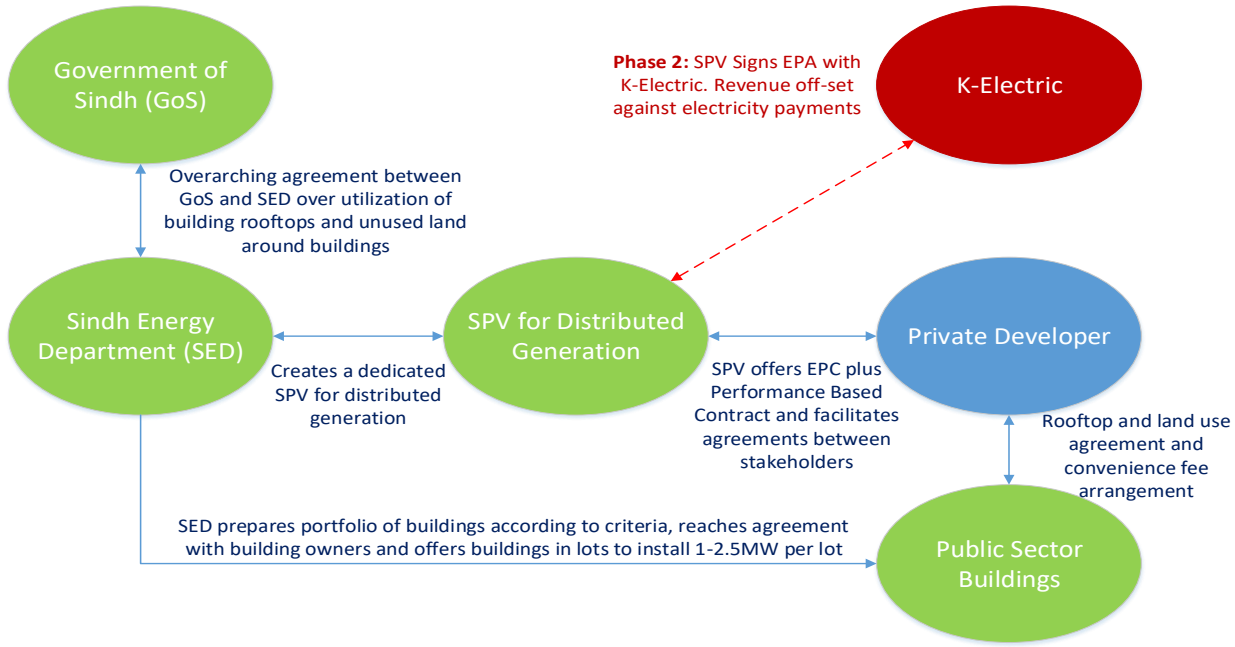

Table 2: Indicative budget for Component 2

Item	Indicative budget
Building identification and mapping, including LIDAR/satellite-based analysis	$500,000
Building analysis and selection	PMU staff time
Leasing agreement between SED and GoS departments (legal fees)	$100,000
Transaction advisory services	$600,000
EPC cost (20 MW)	$19,700,000
O&M for five years (20 MW)	$1,760,000
Building energy management system (15 buildings)	$1,900,000
Contingency	$440,000
Total cost	**$25,000,000**

Component 3: Solar Home Systems (US$30 million of IDA Credit)

7. **Component 3 will provide grants to scale up the provision of SHSs by commercial solar solution providers (SSPs) in areas with low access to electricity, to build the market and enhance long-term sustainability.** International experience shows that SSPs are able to offer electricity services through SHSs that are affordable and scalable, potentially allowing households to become asset owners over time.[5] Because SSP revenues depend on monthly payments, the provision of O&M and product warranties is more assured, with SSPs often establishing a presence in their target markets to be closer to their customers. This contrasts positively with a traditional public sector approach, in which governments procure SHSs and distribute them to households, with limited buy-in or household choice, and often no long-term O&M provision. Building on the progress already made by the IFC Lighting Pakistan program,[6] the Project seeks to attract additional domestic and international SSPs into the Pakistan market to accelerate efforts to ensure universal electricity access in the country.[7] Currently the number of SSPs is low in comparison to other countries with a substantial SHS market, so there is substantial potential to crowd in additional SSPs. However, many of the areas that are most in need of SHSs are remote and poor, so most SSPs in the early stages of development will not focus on such areas because of the high cost of distribution in hard-to-reach areas.

8. **The Project will provide SHSs to 200,000 households in high-priority areas by offering partial grants to SSPs on a competitive basis.** Areas will be prioritized according to two criteria: (a) those with a high number of villages without grid-provided electricity (no nearby transformer/distribution network); and (b) those with a high number of villages with grid-provided electricity but with low levels of reported electricity access. Prequalified SSPs will be invited to participate in a competitive bidding process for each defined area. Bidding will be based on the cost to households of a "starter SHS,"[8] and the SSP with the

[5] In three years (2014-2016) India has achieved both market scale and acceleration, with $32.8 million sales of off-grid devices ($12.5 million in 2016 only), and annual growth of 34% (185% for plug-and-play SHS), reaching 19% of market penetration—in a market where pay-as-you-go SHS are yet to fully scale (because of low penetration of digital payments); if penetration deepens, sales could grow rapidly. WBG. 2018. "Global Off-Grid Market Trends Report: 2018." Washington, DC. *https://www.lightingglobal.org/2018-global-off-grid-solar-market-trends-report/.*

[6] Around 110,000 people have already been provided with electricity access under the program, against a target of 1.5 million people.

[7] Assuming a conducive enabling environment, private-sector-driven off-grid electrification is considered one of the vital elements for achieving universal electricity access. World Bank. 2017. "State of Electricity Access Report 2017." Washington, DC.

[8] Preliminarily defined as 3x lights, 1x fan, and 1x phone charger, inclusive of solar PV, battery, and charge controller, all meeting minimum performance levels to be specified.

lowest-priced system will win the right to service the selected area. SED would provide a fixed grant for each SHS installed, regardless of the system size or features, but potentially differentiated according to the gender composition of households, to be paid directly to the SSP.[9] To help protect consumers, there will be penalties for SSP noncompliance or product standard infractions. During the early stage of implementation, the Project will (a) finalize the detailed design and criteria for the grant scheme, including measures to address identified gender gaps and meet the Project results indicator on FHHs, and put in place the necessary implementation arrangements; (b) carry out piloting in villages/areas already identified by SED as having low electricity access characteristics; and (c) compile a comprehensive database that will enable future prioritization, drawing on existing Government data, studies carried out by development partners, and the household energy survey[10] to be commissioned under Component 4 soon after the Project becomes active. Once early experience is generated and the data are available to support improved prioritization and targeting, the grant scheme will be scaled up slowly to allow the SSPs to expand their operations and financing in a sustainable way.

9. **The grant scheme will be complemented with a major public awareness-raising campaign and SSP engagement.** Awareness-raising through roadshows, media advertisements, and promotional material will help to educate households on the benefits of SHS, introduce them to the SSP operating in their area, communicate the cost of the systems available and the support being provided by GoS, and inform them of grievance redress options. The public awareness-raising activities will be designed to address any gender gaps identified in the detailed design stage, including specific measures to target women and FHHs. Continuous SSP engagement is critical to successful implementation, and the component will be designed to flexibly respond to any bottlenecks identified.

Table 3: Indicative budget for Component 3

Item	Indicative Budget
Citizen awareness and engagement	$3,225,000
Results-based grant Year 1 (3,000 HH)	$437,500
Results-based grant Year 2 (17,000 HH)	$2,187,500
Results-based grant Year 3 (40,000 HH)	$5,000,000
Results-based grant Year 4 (60,000 HH)	$7,500,000
Results-based grant Year 5 (80,000 HH)	$10,000,000
Monitoring & evaluation (7,500 HH surveyed; 97% confidence)	$ 262,500
Contingency	$1,387,500
Total cost	**$30,000,000**

Component 4: Technical Assistance and Capacity Building (US$5 million IDA credit)

Component 4 consists of a range of capacity-building and technical assistance activities to support the design and implementation of the Project and address gender issues. The implementation agency, SED, has no prior experience implementing lending projects financed by the WB or other MDBs, and will need to build up its technical, procedural, and compliance capacity to successfully deliver the Project. The

[9] Preliminary analysis suggests that the grant amount will need to be around 35% of the total system cost, but it will be established during implementation following consultation with the SSPs and once the priority areas are known. A higher grant award may be provided for female-headed households, and part-payment of the grant may be made. These design options will be explored during the detailed design phase.

[10] The household energy survey will be compliant with the MTF, and will therefore provide inputs into the Sustainable Energy for All Global Tracking Framework.

expenditures funded under Component 4 will include activities such as (a) training for SED and other Project stakeholders, including a specific training event targeting women; (b) consultation and engagement with key stakeholders and community groups; (c) data collection, including commissioning of a household energy survey at the start and end of the Project; and (d) specific measures to build SED's capacity in addressing gender, fiduciary, procurement, M&E, and safeguards issues. An indicative cost breakdown is provided in Table 4.

Table 4: Indicative budget for Component 4

Item	**Indicative Budget**
Training for PMU staff on ESMF	$100,000
Training for PMU staff on FM/gender/M&E/procurement issues	$100,000
Study tours for PMU and other GoS and federal staff (x5)	$250,000
Training event for female/disabled persons to support recruitment by SSPs	$50,000
Supplier engagement events x6	$120,000
Community engagement on ESMF and other issues	$80,000
Household energy survey x2	$4,000,000
Satellite/LIDAR data acquisition to identify buildings (C2) and areas with low levels of electricity access (C3)	$300,000
Total cost	**$5,000,000**