SOLAR PHOTOVOLTAIC COMPONENT

System: Design and Installation

A. INTRODUCTION

1. **Background.** The 2015 earthquake in Nepal caused extensive damage to the country's school infrastructure rendering more than 80 per cent of the 35,000 schools completely destroyed or severely damaged.

2. The Asian Development Bank (ADB) has been requested by the Government of Nepal (GON) to finance part of the school reconstruction program and ADB is considering support of $148.86 million from its concessional ordinary capital resources (COL) and a grant of $10.00 million from the Asian Development Fund (ADF). The total cost of proposed Disaster Resilience of Schools (DRSP) amounts to $198.86 million, of which $35.00 million is Government counterpart resources. The financing will help further finance reconstruction and retrofitting to earthquake-proof standard buildings of the approximately 174 damaged public secondary and feeder/basic schools remaining outside the already financed school reconstruction program. The three expected project outputs are: (i) heavily damaged schools reconstructed and improved; (ii) unsafe schools retrofitted and disaster risk reduced; and (iii) institutional capacity for disaster resilience strengthened.

3. An ADB administered grant of $5.00 million financed by the Clean Energy Fund (CEF)[1] under the Clean Energy Financing Partnership Facility has been approved and will be attached as a grant component to the proposed DRSP. The grant will be implemented as an integral part of the overall investment operation.

4. **Rationale and Objectives.** The 2016-2023 School Sector Development Plan (SSDP) has identified school safety as an explicit prerequisite for the development of human capital, assisted by the establishment of a modern learning environment and tools including the use of ICT learning techniques. The grant operation has been introduced to fill an existing gap at schools not having access to sufficient power supply to run basic ICT education at the school premises. The grant would complement the general reconstruction work being undertaken and financed under the ADB DRSP loan.

5. The grant project aims at developing a model to introduce modern climate friendly power systems to the most vulnerable earthquake affected schools in a sustainable manner. The Project will aim at having fully functioning and reliable power supply systems operating in about 130 of the DRSP target schools at the completion of the project. The specific objectives of the grant are to (i) design and take into use of solar PV power most suitable to each school; (ii) have adequate systems maintenance arrangements in place at schools; (iii) enable schools to create new income generation opportunities, techniques and sources together with the local community involving women, youth and local entrepreneurs; (iv) improve the schools' and stakeholders' understanding and capacity for the efficient use of local renewable power sources in a financially sustainable manner; and (v) share the knowledge with stakeholders in results-based financing and project implementation processes.

6. **Benefits.** As a result, the Project will enable schools to provide better education using various techniques and tools including ICT, extend its working hours, provide office services such

[1] Financing partners: the governments of Australia, Norway, Spain, Sweden and the United Kingdom.

as printing and photocopying and have a more proactive role serving their respective communities. It will provide the communities with ancillary services and the small enterprises with new employment opportunities through the renting out by the schools of the extra power generated. The schools will be able to create a new income source to cover future maintenance and replacement of equipment. The grant will help eliminate a major financial obstacle by enabling to cover the high up-front investment costs of power equipment outside the regular school budgets or financial resources.

B. PROJECT APPROACH

7. **Lessons Learned from Solar PV Installation in Nepal.** Nepal has experienced during the last ten years a rapid growth in solar PV systems commercial market for household use with the help of the public extensive subsidy schemes. Solar PV systems have also been introduced to selected public services such as hospitals and schools through international donor financial support (e.g. by the European Union) and via public subsidies. The schemes and pilot projects in Nepal have utilized a variety of modalities and mechanisms.

8. The following problem areas, *inter alia*, have emerged from these operations: (i) ***Vendor driven market***. The subsidy schemes have helped the emergence of a large vendor industry in Nepal. The combination of inexperience of institutional customers, the lack of installation standards, mismatched power capacity to actual requirements, and insufficient monitoring and maintenance has resulted in sub-optimal operating systems. (ii) ***Lack of self-financing*****.** Public schools have had insufficient budgets or tuition fee income to raise the 25-35 percent self-financing portion expected for the public AEPC subsidy and to cover maintenance costs. (iii) ***Diverse ICT equipment*****.** The subsidy and door schemes have not provided for the purchasing of ICT or office equipment. Thus, the schools have been obliged to either finance the purchase themselves or to rely on NGOs or donor grants, often resulting in utilization of sub-optimal high energy consuming equipment. (iv) ***Community driven approach.*** Donors and development partners have favored outsourcing and ownership of energy services to local community groups resulting in long processing delays, insufficient maintenance and conflicts of interest.

9. The Output Based Aid (OBA) grant operation has been designed to build upon past experiences and lessons in the following three respects: (i) The NRA will also provide the schools with a basic kit of energy-efficient lap-top computers and copiers/printers to match with the school's minimum pedagogical requirements and the power system capacity; (ii) The OBA structure will ensure functioning solar PV systems installed and commissioned by the service provider, including sufficient warranty period. The outsourced co-user of the power supply has strong business interest in day-to-day operations and maintenance of the power system, thus, relieving schools from system up-keep. (iii) The capacity of the solar PV system is sufficient for evening and weekend use. The rental income will ensure not only maintenance, but is also accrued towards future battery and inverter replacement costs and thus providing more sustainable power supply in the longer term.

10. **OBA:** OBA is a widely-used aid delivery mechanism used by international donors and financiers in reaching out public services to the poor and disadvantaged beneficiaries not affording the high up-front access costs involved. The aid, normally in the form of grants, will be reimbursed to the service providers upon achievement of predetermined outputs. The main attention in the project implementation will thus be directed to desired results (impacts and outputs) achieved instead of focus being put on the inputs used to achieve those results.

11. The key elements required for a successful OBA operation and adapted to this purpose include the following: *(i)* ***Targeting****.* OBA to fill the "affordability gap", i.e. helping to establish infrastructure service access to client groups not affording to pay the initial up-front costs*.* The schools pre-selected for receiving the solar PV systems will be qualifying under a set of criteria ensuring the maximum development impact to students and communities. (ii) ***Selection of Service Provider.*** The selection of the most effective channel to deliver energy access will ensure cost-effective delivery. In this operation the service provider will be contracted to deliver a functioning power system. (iii) ***Design of Mechanism****.* The OBA schemes have to be tailored to the actual needs in terms of e.g. coverage, definition of output and form of subsidy. The basis for reimbursement is normally unit cost of the output achieved through a competitive process. The schools will receive the solar PV systems on a 100% grant basis. The service providers selected through competitive bidding will be reimbursed on the basis of unit costs only after fully operational systems have been commissioned and test run. (iv) ***Verification.*** The attainment of outputs has to be verified by independent verification agents (IVA) before disbursements can be released, normally in batches*.* The IVA consultant will verify to ADB and central level project implementation unit (CLPIU)-education the fully functioning power/ICT systems at target schools before payments to service providers are being released.

C. PROJECT SCOPE

12. **Selection of target schools for OBA solar component.** Solar PV systems will be installed in about 130 schools[2] qualifying under pre-set selection criteria. These schools will be amongst the approximately 300 pre-selected secondary and feeder/basic schools to be reconstructed or retrofitted in 14 districts under the project unless otherwise agreed between GON and ADB. The key school selection criteria are:

(i) Status of *access to and use of power*: The schools with no grid connection and proven power supply needs are the highest priority beneficiaries with availability of space to capture adequate solar radiation. Two eligible target groups selected from the basic population are:[3]

- Off-grid schools with no power supply; and
- Off grid schools with insufficient solar, mini-hydro etc. power supply.

(ii) Preparedness and willingness of schools to maintain PV systems and engage in generating income and providing business opportunities within community.

13. The selection based on the above two criteria would inherently bring about the following features in participating schools: (i) schools are normally located in areas where grid connection will not be imminently available; (ii) communities have higher average poverty level and low affordability; (iii) additional power supply will have positive spill-over impacts to communities via added entrepreneurial services.

14. Final selection will be made by NRA and ADB at project inception with proper coordination and consultation with Alternative Energy Promotion Center. The selection process will be carried

[2] The final number of schools will be defined on the basis of the unit cost of the systems based on open competitive bidding.

[3] Selection of schools from the group with connection to the national grid may be possible on exceptional basis, provided that they have serious power shortages adversely affecting their ability to provide ICT education. Approval from ADB is required in these cases.

out by the CLPIU assisted by the OBA Implementation Team. The proposed methodology and steps are:

(i) Schools pre-selected to the reconstruction/retrofit program will be screened in relation to their initial eligibility under the above two school categories;
(ii) Schools to be informed about the opportunity and invited to justify their power supply needs, and present their plans on ICT education, community outreach and income generation;
(iii) An on-site validation of the provided information will be made by the OBA implementation consultant team, including definition of power needs and initial designs as well as confirmation of availability of space suitable for solar generation;
(iv) Selection will be made by NRA/MOEST based on eligibility criteria and schools are allocated into the alternative standard PV system categories.

15. **Solar PV systems.** The OBA grant will finance the installation of alternative standard PV power system packages based on the estimations on the level of current and future power supply needed as proposed by the schools and verified by the OBA Implementation Consultant. The power capacity of the standard packages will be designed to cover the needs of the different school sizes and power needs, and should also allow for the commercial usage after school hours. The sizing of the alternative packages will be confirmed during the school selection process based on verified demand structure of the participating schools.

16. The solar PV system packages financed from the OBA grant will include the solar panels, batteries, inverters and basic lighting, wiring, outlets and related accessories delivered to site, installed and test run by the service provider. The schools will also be furnished by NRA with energy-efficient laptop computers and printer/copiers to help reach the school's ICT education targets and to optimize the use of the limited power supply available.

17. **Technical Support.** The grant will provide for technical support to assist CLPIU with grant implementation, output verification and providing capacity building to stakeholders in solar PV systems as well as in OBA project implementation. A resident national OBA consultant team will provide altogether 110 person-months (p-m) of specialist inputs assisting CLPIU in grant implementation over the 34-month implementation period. The team will be comprised of the Team Leader and Solar PV Systems Expert (34 person-months), Procurement Expert (24 p-m), Institutional and Community Development Expert (28 p-m) and Capacity Building Expert (24 p-m). The team will provide CLPIU hands-on support in all technical, procurement, contractual and logistical issues including project documentation and guidance material required for project implementation. In addition the team will carry out awareness creation among schools and communities and provide training to stakeholders. The grant will also finance the services of a national IVA for monitoring and inspection of the PV systems installation in the schools. IVA will work independently on behalf of NRA and ADB as required by the OBA approach.[4] The consultant team will travel extensively to the target districts in order to provide tailored support to schools.

18. **Income Generation.** Experience from earlier interventions show that public institutions have had limited budgets or financial means to maintain the equipment at the end of their life cycle leading to depleted PV systems. The power capacity under the project has been designed to enable schools to earn income from renting the surplus power to community private entrepreneur users outside regular class hours. Such services not readily available at the community may include e.g. printing and copying, commercial computer training, internet-based services, international money transfers, renting space for functions, small business and support

[4] The draft terms of reference of the consultants is in Appendix 1.

services to community. The schools will identify potential uses, select and contract "tenants" on a competitive basis, assisted by OBA consultants. The tenant will also be responsible for day-to-day maintenance of the PV power system. The net rental income will accrue towards replacement of power equipment and will be retained in escrow managed by the school. The rental income, other fee income, standard school budget as well as public subsidies would together enable sustainable use of solar PV power in the long term.

D. PROJECT COSTS

19. The total solar PV systems cost amounts to about US$ 4.1 million (Table 1). Financing will be extended to beneficiaries on a 100 per cent grant basis. US$ 0.7 million will be allocated to an extensive technical assistance component providing implementation support and capacity building to the agencies and schools.[5]

Table 1. Project Cost Estimate (US$)[6]

OBA Grant proceeds	Unit cost	Total
PV systems by category		
Category A – 40 schools	30,000	1,200,000
Category B– 60 schools	40,000	2,400,000
Category C- 30 schools	18,000	540,000
Technical Assistance		700,000
Contingency		160,000
Total Grant		5,000,000

E. GRANT IMPLEMENTATION

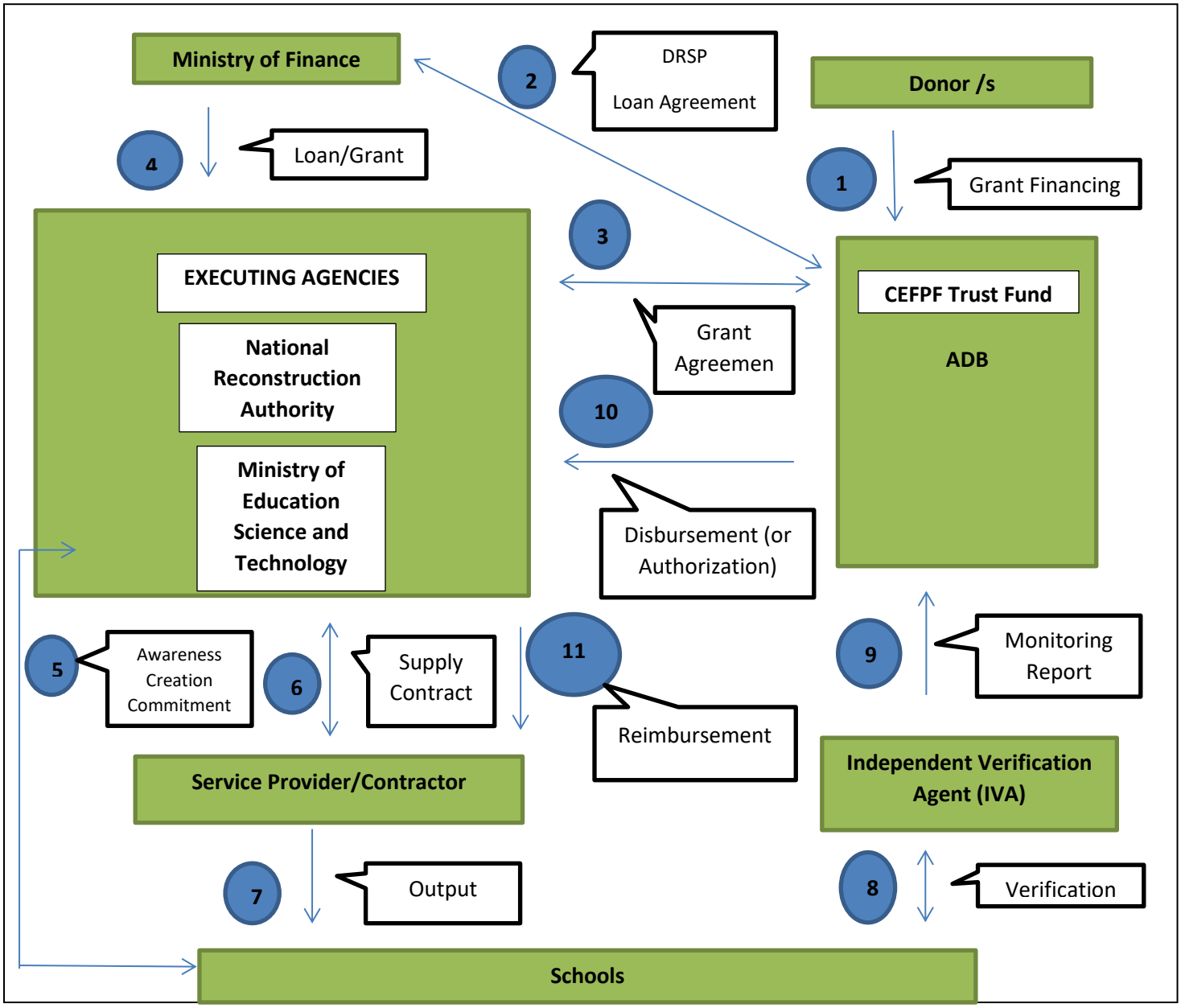
20. **OBA Mechanism.** The OBA structure and process will follow the standard OBA requirements, but have been adapted to match the specific needs of the clients, market, the services covered and outputs delivered. Figure 1 presents the OBA mechanism and the sequence of key action among the stakeholders.

[5] The schools will be also furnished with necessary numbers of energy efficient laptop computers and copiers/printers by MOE, as separately agreed with ADB.

[6] Costing is based on the provision of three standard PV system packages (A:8 kWp; B:10kWp; C:5kWp). The cost estimates are made on the following basis (US$): PV system equipment (on turnkey/commissioning basis) US $ 3,300 /kWp; lighting, fixtures and accessories US$ 2,000 per school, construction/civil works of technical space US$ 300/m2. Actual number of beneficiary schools will be defined after completion of the final selection and bidding process. On this basis, the total installed capacity of solar PV power in the schools would amount to about 1 MWp of capacity generating annually 1,500 MWh of electricity. The ensuing CO2 reduction would amount to about 1,200 tCO2eq/year considering diesel emission factor of 0.8tCO2/1 MWh using small-scale renewable energy projects methodology.

Figure 1

The Indicative OBA Grant Delivery Structure and Process



21. The numbered steps involved in OBA implementation are: 1. Bilateral donors have contributed grant funds to the ADB administered CEF under the CEFPF trust fund. A grant of $5.00 million has been approved to support this OBA operation and technical assistance. 2. ADB and MOF sign DRSP loan agreement. 3. ADB will sign a Grant Agreement with NRA on solar component. 4. Ministry of Finance will pass on ADB DRSP loan proceeds to NRA/MOEST to implement the reconstruction and retrofitting program. 5. CLPIU will implement awareness creation among schools and communities on the solar PV component and income generation. 6. CLPIU will procure and contract selected service providers to deliver and commission solar PV systems on OBA basis. 7. Service Provider delivers, installs, commissions and will test-run the PV systems. 8. The IVA carries out periodic monitoring, inspection and verification at schools. 9. IVA reports to CLPIU and ADB of the completed systems confirming successful outputs delivered. 10. ADB disburses grant in batches upon receipt of Withdrawal Requests from NRA/CLPIU[7]. 11. NRA/CLPIU reimburses Service Provider against batches of outputs at agreed PV system unit cost.

22**.** **Implementation Schedule.** The grant operation will be implemented over a period of 34 months and will be aligned with the DRSP reconstruction and retrofitting construction schedules at the target schools as outlined in Figure 2. The detailed timing and milestones for project activities will be defined at project inception.

Figure 2. Indicative OBA Grant Implementation Schedule

	2018				2019				2020				2021			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Consultant selection																
Implementation plans																
Demand assessment, school selection																
Preparation of tender documents																
Procurement																
Systems delivery/installation																
Implementation consultant																
Verification/disbursement							*		*		*		*			
Capacity Building																
Community outreach																
Monitoring/reporting			IR	*	*	*	*	*	*	*	*	*	DFR	FR		

23. **Implementation Arrangements.** The overall responsibility for the grant operation falls within the National Reconstruction Authority (Executing Agency) and CLPIU. The grant will be implemented by CLPIU as guided by the DRSP Project Administration Manual (PAM) and OBA Operational Manual. CLPIU will be supported by the OBA consulting team in project implementation and in energy related technical aspects related to the grant operation. The OBA and DRSP teams will work in close co-ordination and will complement each other's work program.

24. **Project Organization.** The project organization is merged with that of DRSP program organization for overall management and oversight. Implementation of the solar PV systems introduction will take place in close operational co-operation and liaison with the AEPC, the national focal agency for renewable energy support, financing and co-ordination. Sufficient

[7] Sequence of steps 10. And 11. is subject to agreement between ADB and GON (may also be inverse)

arrangements will be put in place among participating agencies and ADB to ensure appropriate oversight of grant implementation. The OBA implementation consulting team will work under the responsibility and management of CLPIU Project Director, working in parallel with the DRSP consulting team.

25. **Procurement.** All procurement of goods and works will be undertaken in accordance with ADB *Procurement Policy* (2017, as amended from time to time) and ADB *Procurement Regulations* (2017, as amended from time to time). The grant will finance procurement of goods, services and consultants, as defined in the Procurement Plan of DRSP Project Administration Manual (PAM). The principal procurement method to be used is Open Competitive Bidding (OCB) for the supply, installation and commissioning of the solar PV power systems through international or national advertising. Following the requirements of the output-based grant delivery approach, contracting will be made on a lumpsum turnkey contract basis including systems commissioning and initial operation as condition of payment to the contractor. The computer and office equipment financed from the ADB loan proceeds will be procured under OCB method under separate contracting. The consultants will be selected under QCBS method and will be contracted by NRA.[8] The IVA consultant will be contracted separately in order to ensure independence for the verification.

26. **Fund Flow and Disbursement.** The OBA grant funds administered by ADB will be channeled according to the actual progress made following the output-based reimbursement principles and as defined in the Grant Agreement between ADB and NRA. The OBA grant disbursement process follows ADB's *Loan Disbursement Handbook* (2017, as amended from time to time) and as defined in the DRSP PAM. The foreign currency grant funds will be channeled through the project US dollars Imprest Account managed by the CLPIU under a separate grant sub-account for the disbursement to the PV systems suppliers (Service Provider) and OBA implementation consultant. The funds for local currency expenditure will be disbursed by the NRA District Treasury Controller Office (DTCO) to local training and reimbursable costs and will be reimbursed by ADB through a Withdrawal Application procedure.

27. The grant funds will be managed separately from the ADB loan and GON counterpart funds. The ADB will advance and replenish the OBA grant Imprest sub-account based on actual and expected expenditure and along with ADB's guidelines governing advance accounts. Disbursements will be made by ADB to NRA/CLPIU against periodic Withdrawal Applications supported by documentation to enable timely disbursements to contractors and consultants. Reimbursement to the service providers will be made according to actual outputs (i.e. functioning solar OV systems) as verified by the OBA IVA inspection and on the basis of pre-agreed unit costs of the systems, and can partially be made in instalments against progress and agreed milestones. Payments to the Implementation consultant will be made as contracted by NRA. CLPIU will retain supporting documentation available for inspection by ADB.

28. **Accounting and Audits.** The CLPIU will maintain separate project sub-accounts for the OBA grant. The financial statements will be made in accordance with Nepal Public Sector Accounting Standard and government's accounting laws and regulations consistent with international accounting principles and practices. The accounting and audit procedures follow those laid out in the DRSP PAM.

[8] The QCBS selection method without price consideration is justified, as the required consultant inputs focus on tailored, qualitative advisory and knowledge sharing activities with a variety of beneficiaries with strong local experience in similar solar PV operations and good knowledge sharing skills, in contrast to standard routine technical tasks.

29. **Monitoring and Reporting.** NRA and ADB will monitor grant implementation through the DRSP Steering Committee, through Quarterly Progress Reports by the OBA Implementation Consultant and through the periodic output verification and progress reports by the OBA IVA. The OBA consulting team will be in charge of day-to-day monitoring of progress and outputs including operational support to schools and agencies. Reporting to NRA and ADB includes Inception Report(s), quarterly progress reports, IVA verification reports, Draft Final and Final Reports, and technical reports as requested.

Appendices

1. Terms of Reference for Consultants

Appendix 1

TERMS OF REFERENCE

OBA Implementation Support Team

(National Consultant – 110 person months)

Objective/Purpose of the Assignment

The Asian Development Bank (ADB) and the Government of Nepal (GON) financed project to support the Disaster Resilience of Schools Project (DRSP) in Nepal that will reconstruct and retrofit the secondary and feeder/basic schools affected by the 2015 Gorkha earthquake. The financing totalling $198.86 million that includes $5.00 million grant financing from the Clean Energy Fund (CEF) under the Clean Energy Financing Partnership Facility, administered by ADB. The grant implemented under an output-based aid (OBA) modality, will also support the Ministry of Education, Science and Technology's (MOEST) most recent and comprehensive 2016-2023 School Sector Development Plan (SSDP) and in particular, its objective for disaster risk reduction (DRR) and safe schools.

The target schools have either no connection to the electricity grid or are suffering from damaged and unreliable power supply and as a result not able to fulfil their objective of providing new or complementary source of uninterrupted power for a better learning environment to the students. As such, the $5.00 million grant from CEF will help furnish about 130 affected schools with solar PV systems and provide technical assistance and support to schools and agencies through an OBA mechanism. The preselected schools will be provided with standard packages of solar PV power systems and computer and office equipment by Service Provider(s) selected by Nepal Reconstruction Authority (NRA) through a competitive bidding process. The contract comprising site specific design, supply, installation and commissioning of the systems and their test-running for 30 days will be reimbursed to the Service Provider once the agreed outputs have been independently verified.

The main objectives of the ADB grant component are: (i) to undertake mapping and selection of the target schools for energy systems; (ii) to procure and install new or back-up solar PV systems to around 130 schools; (iii) to provide training and outreach programs to use and maintain solar PV systems in schools involving youth, women and communities, including entrepreneurship oriented training; and (iv) to pilot income generation activities in selected school communities involving women, youth and local entrepreneurs.

The grant will be implemented through the Central Level Project Implementation Unit (CLPIU)-Education under NRA and will be supported by a team of experienced solar power and OBA consultants. The solar PV power grant component will be implemented in close collaboration with the Alternative Energy Promotion Center (AEPC) of the Ministry of Energy, Water Resources and Irrigation.

Scope of Work

ADB wishes to engage an OBA Implementation Support Team (the Team) of national consultants specializing in solar PV system markets and installation, and community entrepreneurial mobilization in Nepal and/or similar environments. The Team will provide the CLPIU operational support in all phases of implementation of the project as well as capacity building to NRA, CLPIU, schools and local communities to enhance sustainable utilization of the power systems at participating schools.

The team will consist of:

Team Leader and Solar PV systems Expert;

Technical Expert (Procurement) Expert;
Institutional and Community Support Expert; and
Capacity Building and Training Expert.

The Team will support the NRA/CLPIU in all key aspects of the grant project. Based on the conceptual design and implementation plan already prepared by CLPIU and ADB, the consultant would perform the following key tasks:

(i) Final selection of the target schools in collaboration with CLPIU/NRA;
(ii) Finalization of baseline surveys, solar PV packages design and technical specifications;
(iii) Preparation of detailed roll-out plans in coordination with general reconstruction work undertaken;
(iv) Provision of assistance to CLPIU in preparation of the bidding documents on solar PV and ICT systems;
(v) Provision of support to CLPIU in the procurement of the solar PV and ICT systems;
(vi) Support to schools in PV systems installation and operations planning;
(vil) Support to schools in community and entrepreneur mobilization and selection;
(viil) Monitor the progress in systems installation and provision of technical side support to schools;
(ix) Provide capacity building and training to participating agencies and schools in solar PV systems and OBA process;
(x) Provide support to the schools and communities in piloting income generating activities: and
(xi) Carry out any other activities that may be required to effectively and efficiently implement the TA and ADB's energy access activities.

Detailed Tasks

The Team will have the following responsibilities:

Team Leader and Solar PV Systems Expert (34 person-months):

(i) Overall team leadership, planning and management of the grant operation, including detailed roll-out and work plans;
(ii) Take the lead and coordinate with CLPIU in the final selection of the target schools;
(iii) Provide management and technical inputs to solar PV systems final design, technical specifications, and installation;
(iv) Manage and coordinate solar PV component procurement process in coordination with CLPIU;
(v) Manage the PV systems roll-out process;
(vi) Coordinate and liaise with NRA, CLPIU, AEPC and ADB in all aspects of grant component implementation;
(vii) Set up remote monitoring system and take the lead in progress and performance monitoring and trouble-shooting;
(viii) Coordinate and monitor the Independent Verification Agent;
(ix) Provide progress and financial reporting to CLPIU and ADB; and
(x) Carry out any other activities that may be required to effectively and efficiently implement the TA and ADB's energy access activities.

Qualifications: Advanced university degree or equivalent in engineering, science or other related fields with specialization in the field of energy and renewable energy. At least 10 years of experience in implementation of similar solar PV and renewable energy programs and projects in Nepal. Experience and ability in project management and team leadership of projects financed by multilateral or international development banks or donors. Excellent co-ordination and team work. Fluent in English with good writing and reporting skills. Familiarity with ADB processes in an advantage.

Technical Experts (Procurement) expert (24 person-months)

(i) Assist CLPIU in final selection of target schools for solar PV systems;
(ii) Review and finalization of solar PV and ICT standard systems package design and technical specifications;
(iii) Prepare bid documentation related to the grant equipment in coordination with CLPIU;
(iv) Assist CLPIU on all aspects of the solar PV systems procurement process;
(v) Provide technical support to participating schools in detailed systems planning and installation;
(vi) Provide support to CLPIU in the systems roll-out and logistics;
(vii) Monitor school-level progress and performance and provision of technical side support;
(viii) Provide technical/procurement inputs to capacity building activities and reporting; and
(ix) Carry out any other activities that may be required to effectively and efficiently implement the TA and ADB's energy access activities.

Qualifications: Bachelor's degree in engineering and science. At least 8 years of experience in the design of renewable energy and solar PV systems in Nepal and implementation of infrastructure and energy projects. Extensive experience in public infrastructure procurement policies and processes in Nepal, familiarity with ADB procurement policies an advantage. Technical familiarity with solar PV systems.

Institutional and Community Support Expert (28 person-months)

(i) Assist CLPIU in the final selection of target schools for solar PV systems;
(ii) Design of community mobilization plan for income generation opportunities for schools, including awareness creation on solar PV power system utilization opportunities;
(iii) Draw up the framework models for outsourcing of system O&M and power capacity/premises;
(iv) Preparation of guidance material and contracting models available to schools for the attraction of entrepreneurs;
(v) Provision of institutional hands-on support to participating agencies and schools during roll-out of systems; and
(vi) Carry out any other activities that may be required to effectively and efficiently implement the TA and ADB's energy access activities.

Qualifications: Bachelor's degree in business, engineering, economics or similar fields. At least 5 years of experience in engaging in the establishment in Nepal of community based income generating activities and schemes together with the private sector involving households,

schools, women's groups and similar stakeholders, and in arranging community based awareness and business promotion activities. Fluent in English with good writing and reporting skills.

Capacity Building and Training Expert (24 person-months)

(i) Identify training needs among agencies and schools in solar PV power systems and output-based implementation processes;
(ii) Prepare capacity building plan including workshops, on-the job training and tailored mentoring;
(iii) Organize sub-regional training events and prepare material specific to PV systems operation and community entrepreneurship outreach support;
(iv) Prepare guidance and reference material for schools in management, fiduciary aspects and administration of services outsourcing;
(v) Coordinate with NRA and other GON agencies on the availability of trainer's training for school staff; and
(vi) Carry out any other activities that may be required to effectively and efficiently implement the technical support and ADB's energy access activities.

Qualifications: Bachelor's degree in human resources, institutional development, or related fields. At least 5 years of experience in planning and implementing training programs in Nepal for public institutions in the fields of project implementation and management, renewable energy systems deployment and private sector development/entrepreneurship. Basic technical knowledge and familiarity with solar PV systems and results-based project approach are considered an asset. Fluent in English with good writing and reporting skills.

Work and Output/Reporting Requirements

The assignment will largely be the provision of day-to-day hands-on support services and advice to the CLPIU, agencies, local districts, schools and local communities, with specific reference to the procurement and introduction of solar PV power facilities to the schools, in introducing income generating opportunities for schools and implementation of output-based grant delivery operations.

The services will focus on three levels: (i) Government and district participating agencies and local project management; (ii) target schools and their management/staff; and (iii) local communities and entrepreneurs.

The main reporting deliverables include:

(i) **Inception Report** (2 months after start-up), covering:
a. Understanding of the assignment and comments to the TOR;
b. Recommendation for the selection of target schools against agreed criteria;
c. Review of draft technical specifications and design of standard solar power and ICT packages and recommendations for revisions, related specific minimum requirements for construction and security;
d. Review and summary recommendations for the incorporation of the solar PV component into the school reconstruction and layout plans;

e. Review and revision (if required) of solar power and ICT systems procurement plan;
f. Preparation the PV systems roll-out and implementation plan in consultation with CLPIU and ADB;
g. Definition of organization plan and capacity building needs at NRA, school and community levels;
h. Preparation of selection criteria for service providers;
i. Capacity building and training needs analysis and initial plan;
j. Detailed work plan; and
k. Other implementation issues

(ii) **Quarterly Progress Reports** (starting month 6)
(iii) **Guidance and training material in OBA processes, solar PV systems, income generation**
(iv) **Technical Reports**, as required by CLPIU and ADB (including conceptual standard solar PV system designs and drawings, technical and performance specifications, solar and ICT components for the tender documents)
(v) **Draft Final Report** (month 32)
(vi) **Final Report, including Scaling-up Program Plan** (month 34)

Requirements and Implementation Arrangements

The assignment will require services from experienced locally based consultant/consulting firm or non-governmental organization with hands-on experience in introducing PV solar power systems for public institutions or private customers in the region, preferably in Nepal. Experience in implementation of internationally financed developmental and solar power/renewable energy investments and operations in considered an advantage. The consultants need to have proven experience in establishing sustainable operational and maintenance arrangements in local communities and providing ancillary capacity building and awareness creation services.

The services require a total of 110 person-months of national expert inputs over the 34-month implementation period. The OBA Implementation Support Team will work under the auspices and offices of the NRA and CLPIU in close collaboration with the resident DRSP project team. The team will report to the National Project Director and ADB.

Deliverables	**Estimated Submission Date**	**Type**
Inception Report		Report
Quarterly Progress Reports		Reports
Guidance and training material on OBA Processes, solar PV systems, income generation		Training Materials
Technical Reports		Reports
Draft Final Report		Report
Final Report (including Scaling-up Program Plan		Final Report

Schedule and Places of Assignment (chronological and inclusive of travel)
Intermittent work in Kathmandu and other project districts over the 34-month implementation period, starting September 2018, as per project roll-out plan.

TERMS OF REFERENCE

Independent Verification Agent (IVA)

(National Consultant – 18 months)

Objective/Purpose of the Assignment

The Asian Development Bank (ADB) and the Government of Nepal (GON) financed project to support the Disaster Resilience of Schools Project (DRSP) in Nepal that will reconstruct and retrofit secondary and feeder/basic schools affected by the 2015 Gorkha earthquake. The financing totalling $198.86 million that includes $5.00 million grant financing from the Clean Energy Fund (CEF) under the Clean Energy Financing Partnership Facility, administered by ADB. The grant implemented under an output-based aid (OBA) modality, will also support the Ministry of Education, Science an Technology's (MOEST) most recent and comprehensive 2016-2023 School Sector Development Plan (SSDP) and in particular, its objective for disaster risk reduction (DRR) and safe schools.

The target schools have either no connection to the electricity grid or are suffering from damaged and unreliable power supply and as a result not able to fulfil their objective of providing new or complementary source of uninterrupted power for a better learning environment to the students. As such, the $5.00 million grant from CEF will help furnish about 130 affected schools with solar PV systems and provide technical assistance and support to schools and agencies through an OBA mechanism. The grant will be implemented through the Central Level Project Implementation Unit (CLPIU)- Education under the National Reconstruction Authority (NRA) and will be supported by a team of experienced solar power and OBA consultants. The solar PV power grant component will be implemented in close collaboration with the Alternative Energy Promotion Center (AEPC) of the Ministry of Energy, Water Resources and Irrigation.

The preselected schools will be provided with standard packages of solar PV power systems and computer and office equipment by Service Provider(s) selected by NRA/CLPIU through a competitive bidding process. The contract comprising site specific design, supply, installation and commissioning of the systems and their test-running for 30 days will be reimbursed to the Service Provider once the agreed outputs have been independently verified.

Scope of Work

ADB wishes to engage an Independent Verification Agent (IVA) to assist the CLPIU and ADB to reimburse the Service Provider in accordance with the delivery of the agreed outputs. The assignment helps, in particular, to (i) provide an independent verification to the CLPIU and ADB to ensure that the schools have been equipped with the specified solar power packages in accordance with the technical and performance specifications and that those systems are operational; (ii) recommend reimbursement of OBA subsidy by the CLPIU to the service provider; and (iii) verify and collect project monitoring data.

Detailed Tasks

The IVA will have the following responsibilities:

(i) **Output verification:** The IVA will carry out verification of the delivery and installation of the systems combining the methods of verification of the appropriate documentation as provided by the Service Provider. In addition, the IVA will carry out systematic or random on-the spot inspections, as deemed necessary, physically possible and efficient and as agreed with the CLPIU and ADB. Depending on the final roll-out plan and geographical considerations, it is

expected that the number of output batches (and reimbursement claims) for verification will range from 2-5 per Service Provider.

(ii) **Documentation review:** In order to validate subsidy claim submitted by the Service Provider, the IVA will verify all pre-agreed indicators as evidence of the achievement of the outputs claimed, through an exhaustive desk review of the Service Provider and executing agency records. Specifically, this review is intended to certify that (i) the schools belong to the beneficiary list; (ii) verified results claimed are consistent with the output definition; and (iii) claimed output reimbursement is consistent with agreed reimbursement unit pricing.

Documentation review may include the following:

i. **Technical documentation**: Roll-out plan, technical and performance specifications, school identification database, reconstruction and power system plans and architectural drawings, Service Provider contract, grant agreement, bid documents, and other relevant project documentation.;
ii. **Power Company documentation:** School connection and power delivery information when applicable and required

For field verification, the sampling methodology proposed by the IVA will have to be acceptable to the CLPIU and ADB. Possible sampling of beneficiaries may be done randomly (i.e. any output in the project areas), or in two stages (i.e. random selection of specific areas followed by the verification of all OBA outputs in the selected areas). Each verification batch plan will require prior clearance with CLPIU.

(iii) **Physical Verification**: Verify reality and quality of outputs claimed. The IVA will carry out on-site random physical verification in at least 20% of target schools for which payment is requested by the Service Provider. For each output, the IVA will inspect and certify that it is properly installed and functioning according to the required standards and minimum performance level, and will verify the associated delivery records of the Service Provider. In addition, the IVA will launch for follow-up and monitoring purposes a short school questionnaire among main users, including service quality, energy uses, benefits, shortcomings and gender aspects. The inspection will take place a minimum of 30 days after the school has taken the power system into use.

The detailed tasks for the on-site verification include but are not limited to the following:

i. Verification of equipment fulfilling the required technical and operational specifications
ii. Physical verification of completion and functionality of installations;
iii. Test /verification of conformity of installations, effective operation of the service (e.g. appropriate power supply), and existence of satisfactory maintenance plan;
iv. Photograph of each verified installation
v. GPS positioning of school; and
vi. Questionnaire to beneficiary school, including satisfaction on service, energy usage for cooking/non cooking purposes, number of women in the schools, effects in quality of education after connection.

(iv) Carry out any other activities that may be required to effectively and efficiently implement the TA and ADB's energy access activities.

Work and Output/Reporting Requirements

The OVA will be responsible for the following output and deliverables:

Inception Report (IR): The IVA will submit an IR to the CLPIU and ADB for comments and approval within one month from start of services.

- Review and comments to roll-out plan and design documentation
- Suggested detailed description of verification process, methodology, outputs and indicators, documentation and report
- Implementation and work plan including indicative, sequence and schedule of verification process.
- Update the school database structure (including pictures, GPS coordinates, and other details); and
- Propose a sampling methodology for physical verifications, if required.

Output Verification Reports: These reports will contain a summary of baseline conditions along with a detailed description of the post-OBA situation in each district, including a detailed description of

- each new system installed,
- their conformity to technical specification and standards,
- sufficient standards followed in installation and ancillary construction
- proof of satisfactory operations for at least two (2) months (each report will be delivered to the CLPIU and ADB 15 working days after the Service Provider submits its disbursement request for the batch delivered).

The report should also specify minimum improvements required to installations in each case where the solar systems have been inadequately installed and are not operating at or above minimum performance standards. After the IVA report has been received, the CLPIU will process the official disbursement request within 10 working days for payment to Service Provider.

Final Report: After all solar PV and associated systems have been installed and taken into use, the IVA will submit a short final report containing a description of the assignment (e.g. activities developed), the database used during the project, as well as an analysis of the progress of OBA implementation, problems found during the assignment and recommendations for improvement.

Requirements and Implementation Arrangements

The IVA as an individual expert will work under the overall guidance of the ADB Project Manager and reports to the CLPIU and ADB. He/she will work closely with the CLPIU, their consultants, contractors and local authorities throughout the assignment. However, the IVA will maintain full independence and impartiality as required in relation to the output verification process.

The assignment will require inputs of 100 working days within a period of 18 months, expected to commence in early 2019. The work will require extensive travel in Nepal to the project sites.

The IVA with a minimum Bachelor's degree in engineering, energy, science or related fields should have experience in technical engineering, familiarity with installation of decentralized renewable energy and especially solar PV systems, performance and output based project implementation and contracting. The specialist should have at least 8 years in technical design, implementation and management of infrastructure clean energy and energy projects in Nepal or

similar environments with specific experience in monitoring, technical inspection and audit functions. Familiarity with ADB processes is considered an advantage.

Minimum General Experience	10	Years
Minimum Specific Experience (relevant to assignment)	8	Years
Regional/Country Experience	Required	

Deliverables	**Estimated Submission Date**	**Type**
Inception Report		Report
Output Verification Reports		Reports
Final Report		Final Report

Schedule and Places of Assignment (chronological and inclusive of travel)
Intermittent work in Kathmandu and 12 project districts over a period of 18 months, starting in early 2019, as per project roll-out plan.